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NATURAL HISTORY

OR

Second Division of "The English Cyclopædia."

CONDUCTED BY

CHARLES KNIGHT.

VOLUME IV.

LONDON:

BRADBURY, EVANS, & CO., 11, BOUVERIE ST., FLEET ST., E.C.

SCRIBNER, WELFORD, & CO., 654, BROADWAY, NEW YORK.

1867.

LONDON:
BRADBURY, EVANS, AND CO., PRINTERS, WHITEFRIARS.

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NATURAL HISTORY.

VOLUME IV.

NERITIDÆ, a family of Holostomatous *Gasteropoda*, having the following characters:—Shell thick, semiglobose; spire very small; cavity simple from the absorption of the internal portion of the whorls; aperture semi-lunate; columellar side expanded and flattened; outer lip acute; operculum shelly, sub-spiral, articulated. At the end of the columella there is an oblong muscular impression, connected on the outer side by a ridge on which the operculum rests; within this ridge the inner layers of the shell are absorbed. Animal with a broad short muzzle, and long slender tentacles; foot oblong, triangular; teeth 7, uncini very numerous. This family includes the genera *Nerita*, *Pileolus*, *Neritina*, and *Navicella*.

Linnæus placed the genus *Nerita* between *Helix* and *Haliotis*, and he divided the genus into the following sections:—

* Umbilicata.

Species: *N. canrena*, *N. glaucina*, *N. vitellus*, *N. albumen*, *N. mammillata*.

** Imperforate, with a toothless lip.

Species: *N. corona*, *N. radula*, *N. cornea*, *N. fluviatilis*, *N. littoralis*, and *N. lacustris*.

*** Imperforate, with a toothed lip.

Species: *N. pulligera*, *N. pupa*, *N. bidens*, *N. viridis*, *N. Virginea*, *N. polita*, *N. peloronta*, *N. albicila*, *N. histrio*, *N. plicata*, *N. grossa*, *N. Chamæleon*, *N. undata*, and *N. exuvia*.

We find then, that, in the 'Systema Naturæ,' Linnæus made no marked distinction between the marine and freshwater Nerits.

The *Neritaceæ* of Lamarck comprise the genera *Navicella*, *Neritina* (Freshwater Nerits), *Nerita* (Marine Nerits), *Natica* and *Janthina*.

Cuvier makes the Nerites (*Nerita*, Linn.) immediately follow *Janthina*, and includes under them *Natica*, Lam.; the Nerita, properly so called (*Nerita*, Lam.; *Peloronta*, Oken); *Velates*, Montf. (*Nerita perversa*, Gmel., a large fossil species); *Neritina*, Lam. and *Clithon*, Montf. (the Crowned Neritines).

M. De Blainville's *Hemicyclostomata*, equivalent to *Nerita*, Linn., comprise the genera *Natica*, *Nerita*, and *Navicella*, or, as he terms it, *Septaria*.

Nerita he divides into the following sections:—

* Right lip toothed. (Genus *Nerita*, Lam.)

A. Species with a single median tooth on the left lip. (Genus *Peloronta*, Oken.) Ex. *Nerita peloronta*.

B. Species with two teeth. Ex. *N. exuvia*.

C. Species with three or four teeth. Ex. *N. lineata*.

** The right lip not toothed. (Genus *Neritina*, Lam.)

D. Species less thick, with the right lip trenchant, and the operculum very oblique. (Genus *Neritina*, Lam.) Ex. *Neritina fluviatilis*.

E. Species whose columellar lip is toothed, and which are provided with spines. Ex. *Nerita canora*.

F. Species with the columellar lip toothed; the two extremities of the right lip prolonged much beyond the aperture, and forming, with the callosity which covers the columellar lip, a sort of auricle produced by the tentacular lobe of the animal. Ex. *N. auriculata*.

G. Calyptroid species, with the upper summit vertical and spired; the last whorl forming the whole base of the shell, and occupied below by a large callosity, which sometimes covers the whole spire. (Genus *Velates*, Montf.) Ex. *N. perversa*.

H. Patelloid species, which are elongated, non-symmetrical, with a dorsal summit, and not spired. (Genus *Pileolus*, Sow.) Ex. *N. altavillensis*.

M. De Blainville observes that this genus is formed of marine and fluviatile species, which led Lamarck to subdivide it into two genera, according to the thickness of the shell, which is greatest in the first, and the denticles on the right lip, which are entirely null in the second. M. De Blainville's observations lead him to the conclusion that the species are still more easily distinguished by the sculpture (guillochis) of the external surface of the operculum than by any other character. He remarks that Lamarck enumerates 17 species of Marine Nerits, which are all from the equatorial and southern seas, and 21 River Nerits, or *Neritinæ*, two of which only are European, and the others belonging to America and Asia.

M. De Blainville states that only two fossil Nerits are known and two *Pileoli*. But immediately afterwards he says that Defrance reckons five species of fossil Nerits, two of which are analogues (Italy) according to Brocchi; and five species of *Neritinæ*, two from the same country, and four *Pileoli*.

M. Rang adopts the arrangement of M. De Blainville, and condemns Lamarck for generically separating the marine and freshwater Nerits. M. Rang says that there are many species of fossil Nerits.

Mr. Swainson places the family *Naticidæ* between his *Turbidæ* and *Trochidæ*, making it consist of the following sub-families and genera. His arrangement is, he says, founded on the shells only, from ignorance of the animals of the major part:—

Sub-Family 1. *Naticinæ*. Sea-Snails.

Genera: *Natica*, Lam. (with the sub-genera *Naticella*, *Globularia*, *Mamillaria*, *Sigaretus*, *Naticaria*, *Lacuna*, *Leucotis*).

Sub-Family (?) *Neritinæ*. Nerits.

Genera: *Nerita*, Linn. (with the sub-genus *Neritopsis*, Gray); *Neritina*, Lam. (with the sub-genera *Clithon*, *Velotes* (*Velates*), *Pileolus*, and *Navicella*). ('Malacology.')

Dr. J. E. Gray makes the *Neritidæ* the sixth family of his *Podophthalma*, and places it between the *Fissurellidæ* and the *Ampullariadæ*. Dr. Gray's *Neritidæ* comprise the following genera:—*Nerita*, *Pileolus*, *Culana*, *Neritina*, *Clithon*, *Dostia*, *Velates*, and *Navicella*.

Adanson appears to have been the first to make known the animal of a *Nerita*, and Cuvier afterwards, in his 'Anatomie Comparée,' gave an outline of it. M. De Blainville has added some further details in the zoology of the *Uranie*, from individuals brought home by Messrs. Quoy and Gaimard, who, in the 'Zoology of the Astrolabe,' thus follow out those details.

The Nerits are marine or freshwater animals, a modification of habit which Messrs. Quoy and Gaimard think sufficient for establishing a simple division between these molluscs, which Lamarck erroneously in their opinion separated into two genera—*Nerita* and *Neritina*; for their organisation is entirely similar. Thus the *Neritæ*, with a comparatively thick shell, which is very rarely furnished with an epidermis, are always found in the sea; and the *Neritinæ* of Lamarck, whose shell is more delicate and almost constantly covered with an epidermis,

are always inhabitants of fresh water: a single instance of one of these *Neritinæ* having wandered into the sea, they may, they say, perhaps have had to cite. The Nerits have a particular and distinctive appearance: they pass a part of their life out of the water without ever removing to a distance from it. Those which haunt streams or marshes may adhere to the leaves of trees, but without going on land. Those which are found on land are carried there by *Paguri* or by some accident. Marine Nerits are also seen at the mouth of rivers; and Messrs. Quoy and Gaimard remark that these are transitions which nearly all the molluscs undergo without suffering much.

The genus *Nerita* is described separately. [NERITA.]

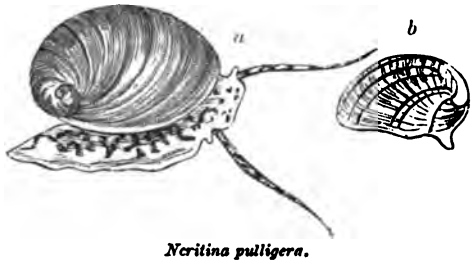
Neritina has the shell rather thick at the aperture, but extensively absorbed inside; outer lip acute, inner straight, denticulated; operculum shelly, with a flexible border, slightly toothed on its straight edge.

N. pulligera has the shell ovate, slightly striated, blackish-brown; the outer lip dilated, thin, white within, the margin acute, the inner border yellowish; the inner lip toothed. (Lam.)

This fine species is uniform chestnut, with the striæ of growth strongly marked; these converge on the spire, which is covered by the right lip.

The animal has long delicate tentacles, which are yellowish soiled with brown. The head and sides of the foot are yellow, spotted with brown and black. The under part of the foot is reddish.

The operculum is large, of an apple-green colour, with black transverse bands proceeding to converge towards the spire: its contour has a reddish line. ('Astrolabe.')



Neritina pulligera.

a, shell and animal; *b*, operculum.

The drawing from which Messrs. Quoy and Gaimard have figured this species was made at Umata in the island of Guam. They state that there are also *Neritæ pulligeræ* at Vanikoro. They found on the trees dead shells whose spire was always corroded, and they inquire whether they had been brought there, or whether the animal had died after having ascended the trees. They state as a remarkable fact, that in a great number of individuals of this species they found in the liver a small knot of worms, some of which were not less than 17 lines in length. They were pointed at both ends, like *Lumbrici*, or Round Worms.

Pileolus has the shell limpet-like above, with a subcentral apex; concave beneath, with a small semilunar aperture, and a columellar disc, surrounded by a broad continuous peristome. The species are only known as fossil.

Upwards of 100 recent species of *Nerita* and 70 species of *Neritina* have been described. The fossil species of *Nerita* amount to 60, and of *Neritina* to 20. *Nerita* is found in the Lias, and *Neritina* in the Eocene Formation.

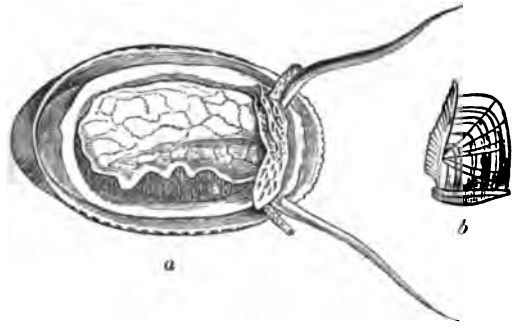
Navicella.—With the exception of the disposition of its operculum and of the muscles of attachment to the shell, the animal may be said to be nearly similar to that of *Nerita*. Its head is large, convex, notched, a little auriculated anteriorly, carrying two long and very pointed tentacles, having the eyes at their base, on a rather elongated pedicle. The foot is regularly oval, and does not overborder the shell; at its union with the mantle, near its root, it presents a remarkable bourrelet, which is due to the internal disposition of the operculum. It is pale-yellow below, deeper upon the sides, with spots of deep-brown, as is the case with the head and the ocular peduncles; only the tentacles have a smoked colour, with black and very delicate longitudinal striæ. Mantle light yellow.

The form, and especially the position, of the operculum of *Navicella*, are so abnormal, that it may be said that it is not a true operculum, and that it is situated in the foot. But it is an evident operculum, and its place is, as in all the Cephalous Molluscs which are provided with that organ, above the foot. Its form is subquadrilateral; it is adherent throughout its lower surface, free on its upper surface, and terminated behind by a cartilaginous part, by means of which it increases. It is carried, as in the *Naticæ*, by a very small appendage of the foot, which overborders it a little behind. But that which renders it so abnormal is, that the foot, which is really subtrachelian, that is, only attached below to the body, is united, nearly throughout the rest of its length, to the visceral mass by the continuation of the skin which envelopes it; whence it results that the operculum seems to be contained in a sort of pouch situated between the foot and the viscera, and whose aperture, in the form of a transversal slit, is at the posterior extremity of the body. This disposition of the operculum

of the *Navicella*, says M. De Blainville, prevents it from really serving the ordinary purpose of one.

N. elliptica. Shell ovate, elliptical; sub-epidermis greenish-brown, smooth, shining, squamously spotted with white and cærulean; the apex recurved, subprominulate beyond the margin. (Lam.)

The number of species of *Navicella* (all recent) recorded is 20.



Navicella elliptica.

a, animal in the shell, seen from below; *b*, operculum.

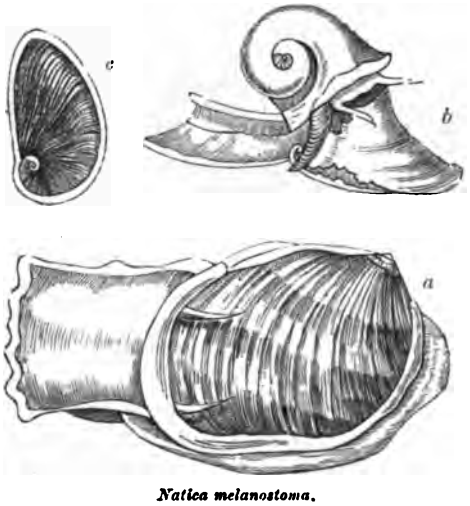
The genus *Natica*, sometimes made the type of a family (*Naticidæ*), has been included with the *Neritidæ*.

Messrs. Quoy and Gaimard remark, that the *Naticæ* are animals to which their foot gives a remarkable aspect. It is a long oval lamella, ordinarily squared in front, oval behind, and doubled; anteriorly, where it is widest, it is a thick escutcheon, a little auriculated, which ascends on the front of the shell, which it covers, at the same time that it hides all the head of the animal, of which ordinarily nothing but the tentacles appear; a groove on each side indicates the two parts of the foot.

The posterior escutcheon, which is less considerable, supports the operculum, which it overborders in order to cover the left lip and the extremity of the shell. There are individuals in which it has the same size as the foot, from which it is distinguished by a circular groove. Thus, observe these zoologists, throughout their development the *Naticæ* resemble a mass of flesh, on the summit of which one perceives a part of the shell. The operculum, although very large, is not apparent; placed transversely, it is hidden by the extremity of the shell, which contains the mass of viscera. A very small muscle binds all this development of flesh to a rather slight columella. The rest of the animal, which is but slightly spiral, offers nothing remarkable.

N. melanostoma has the shell oval, ventricose, convex-depressed thin, white, zoned with yellow; spire somewhat prominent; lip blackish-brown, umbilicus semi-closed. (Lam.) Length 15 lines; breadth 11¼ lines.

Operculum membranous; paucispiral on the left border; the rest of its lamellæ obliquely transverse. Colour deep chestnut-brown; lighter on the edge.



Natica melanostoma.

a, shell with animal seen from above; *b*, animal out of the shell; *c*, operculum.

It has been found at Tonga, the Moluccas, and many other places.

Found by Messrs. Quoy and Gaimard some fathoms deep. Species of the genus have been captured creeping on the shore like the Nerits on rocks and sea-weed, and from the surface to the depth of 40 fathoms on mud and sandy mud, in estuaries and in tidal rivers.

Dr. J. E. Gray makes the *Naticidæ* the first family of his second section, *Eriophthalma* (*Edriopthalma* ?), of his second order *Phytophaga*. Under the *Naticidæ* he comprises the following genera:—*Natica, Neverita, Nacca, Cepatia, Polinices, Mammilla, Cernina, Globulus, Naticina, Cryptostoma, Stylina* (?), *Radula* (?), and *Neritopsis*.

In Woodward's 'Manual of the Mollusca' the *Naticidæ* include the genera *Natica, Sigaretus, Lamellaria, Narica*, and *Velutina*.

Ninety recent species of *Natica* have been recorded. They are inhabitants of the Arctic Seas, Great Britain, the Mediterranean and Caspian Seas, India, Australia, China, Panama, and the West Indies. The fossil species amount to 260.

Sigaretus has 26 recent and 10 fossil species.

Lamellaria has 5 recent and 2 fossil species.

Narica has 6 recent and 4 fossil species.

Velutina has 4 recent and 3 fossil species.

In Forbes and Hanley's 'British Mollusca' the following species of *Neritidæ* and *Naticidæ* are enumerated as British:—*Neritina fluviatilis, Natica monilifera, N. nitida, N. sordida, N. Montagui, N. Helicoides, N. pusilla*, and *N. Kingii*.

NERIUM (from *νηρός*, humid, the habitat of the species), a genus of Plants belonging to the natural order *Apocynaceæ*. It has a hypocrateriform corolla, the orifice surmounted by lacerated multifid processes; segments of the limb contorted; the filaments are inserted into the middle of the tube; the anthers sagittate, adhering by the middle to the stigma; it has two ovaries, a filiform style dilated at the apex, and an obtuse stigma.

N. odoratum has linear-lanceolate leaves, three in a whorl; the segments of the calyx erect; appendages of the corolla filamentous; the anthers bearded at the point. The flowers red or white, with an agreeable musky scent. The bark of the root and the sweet-smelling leaves are supposed by native Indian doctors to act as powerful repellants applied externally. The root, taken internally, acts as a poison.

N. Oleander, Common Oleander, has lanceolate leaves, three in a whorl being beneath, the segments of the corona trifid. It is a native of the Indies, in humid places, but has now become wild in the south of Europe, by the side of streams and the sea-coast. The flowers are rather large and of a bright-red colour. This species contains a great quantity of gallic acid, and a decoction of the leaves or bark forms an acrid stimulating wash, much employed by the poor people in the south of France to cure cutaneous disorders. The peasants in the neighbourhood of Nice use the powdered bark and wood of the Oleander to poison rats. Several cases are also recorded of death from having eaten meat roasted on a spit of Oleander wood.

All the species of Oleander are very showy when in blossom. They thrive well in a light rich soil; and cuttings strike root freely in a moist situation. All of them require a good deal of heat to flower well in this country.

(Don, *Dichlamydeous Plants;* Lindley, *Flora Medica;* Burnett, *Outlines of Botany.*)

NERVOUS SYSTEM. This system constitutes one of the most essential and characteristic parts of the animal frame. It consists of two portions, the Cerebro-Spinal and the Sympathetic, or Ganglionic, each of which, although possessing many things in common, is distinguished by many peculiarities of structure and function.

The Cerebro-Spinal system includes the brain, spinal chord, and the nerves proceeding from these organs. It is through the medium of this part of the nervous system that the functions of mind, sensation, and volition are performed. This part was called by Bichat the Nervous System of Animal Life. The Sympathetic, or Ganglionic, portion was named by Bichat the Nervous System of Organic Life. These names however involve theories which are not confirmed by recent researches. The sympathetic system consists essentially of a chain of ganglia connected by nervous chords, which extends from the cranium to the pelvis along each side of the vertebral column, and from which nerves pass to the abdominal, thoracic, and pelvic viscera.

When examined under the microscope the tissue of which the whole nervous system is composed, may be separated into two elements, the Vesicular and the Fibrous. The vesicular nervous matter is gray or cineritious in colour and granular in its texture, containing nucleated nerve-vesicles, and is largely supplied with blood. The fibrous nervous matter is, on the other hand, usually white, and composed of tubular fibres, although in some parts it is gray, and consists of solid fibres; it is also less vascular than the preceding. The former is more immediately associated with the mind, and is the originating seat of the force manifested in nervous actions; while the latter is simply the propagator of impressions made on it. The union of these two kinds of matter constitutes a Nervous Centre, and the threads of fibrous matter which pass to or from it are called Nerves. The smaller nervous centres are termed Ganglia; the larger ones are the Brain and Spinal Chord.

The Tubular Fibre is a tube composed externally of a fine transparent homogeneous membrane, very much resembling the sarcolemma of muscle. Nucleated cells may however be occasionally seen in it, as in *fig.* 1, which represents a portion of the sciatic nerve of a frog. This may be termed the tubular membrane of nerve. The contents of this tube consist of a soft, semi-fluid, whitish, pulpy substance, which is readily pressed out of its cut extremity. This is termed by

Fig. 1.

Schwann the white substance, *Fig.* 2 is a nerve, that is, a sheath containing a number of nervous filaments branching and receiving branches from another adjacent to it. *Fig.* 3 is a portion of nerve in which the sheath has been removed and the fibres and smaller fasciculi of filaments separated from each other.

Fig. 3.

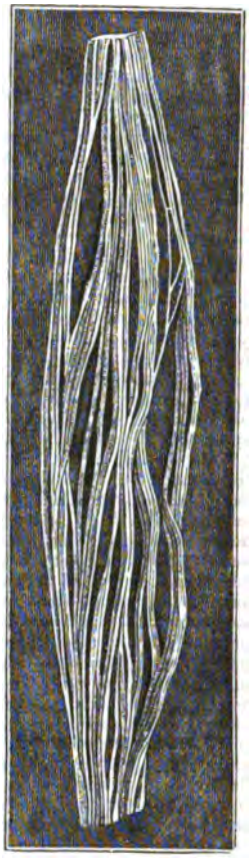
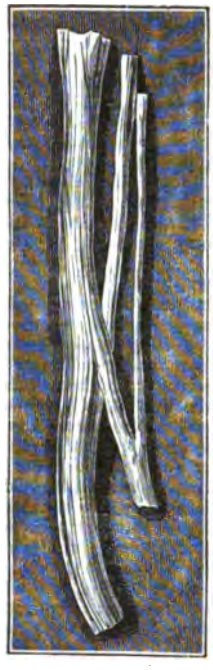


Fig. 2.



The researches of Kölliker on the intimate structure of the nervous tissue are the most recent, and we subjoin his general account of the nerve-fibres as given in the translation of his 'Histology' by Messrs. Busk and Huxley:—

"The Nerve-Tubes, or Fibres, also termed primitive tubes, or primitive fibres of the nerves, are soft, fine, cylindrical filaments, having a diameter of 0·0005‴—0·01‴; they constitute the principal part of the nerves and of the white substance of the central organs, although they are not wanting in the greater part of the gray substance of the latter and in the ganglia. When examined in the recent state and by transmitted light, they appear as clear as water, transparent, and with simple dark contours; by reflected light—glistening, opaline, like fat, in larger quantities together, white, and for the most part their appearance does not indicate that they are composed of different constituent parts. But it is readily seen upon the application of various methods, that they consist of three entirely distinct component structures, viz. of a delicate coat, and a viscid fluid, in the centre of which is a soft but elastic fibre.

"The Coat, or Sheath, of the Nerve-Fibres (Limitary Membrane, Valentin) is an excessively delicate, flexible but elastic, perfectly structureless, and transparent membrane, which, in quite unaltered nerve-fibres, except in certain situations, is altogether invisible. But on the application of suitable reagents, at least in the thicker fibres of the nerves and of the central organs, it comes readily into view, corresponding, in its chemical characters, in all essential particulars, with the sarcolemma of the muscular fibres. In the finest fibres of the peripheral as well as of the central nervous system, the existence of this membrane has not yet been demonstrated, and it must consequently, for the present, be left undecided whether these fibres possess sheaths or not.

"Within the structureless sheath lies the Nerve-Medulla, or Pulp (Medullary Sheath of Rosenthal and Purkinje; White Substance of

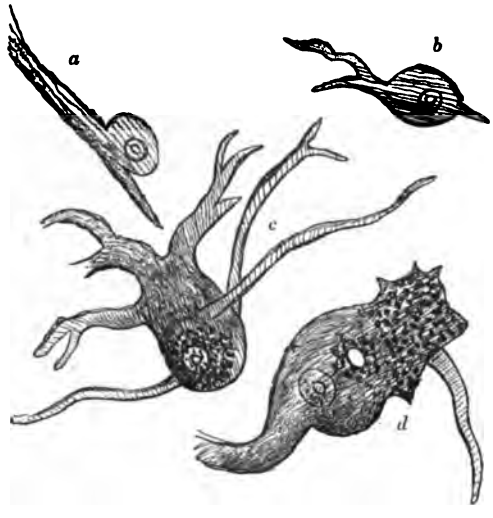
Schwann), in the form of a cylindrical tube, closely and exactly surrounding the central fibre. In the recent nerve-fibre this substance is perfectly homogeneous, fluid, but viscid like a thick oil, and, according to the light by which it may be viewed, transparent and clear, or whitish and pearly, and it is obviously to it that the peculiar glistening appearance of the nerves is due. The nerve-pulp is rapidly and invariably altered by the application of cold water, of most acids, and of many other re-agents; the change consisting principally in a coagulation of it, which takes place gradually from without to within, sometimes involving the entire thickness, sometimes only its outermost layer. In the latter case are produced the well-known nerve-fibres with double contour lines, or in which the medullary sheath is externally coagulated to a greater or less extent, remaining fluid internally—in the former case with the contents apparently wholly grumous and opaque. The coagulated nerve-medulla in fact seldom appears homogeneous, but most generally grumous, granular, and as if composed of separate irregular larger and smaller masses; and, upon the application of acetic acid, as if formed of minute, separate, or reticularly-united rods. The nerve-pulp is also altered very readily by pressure. It sometimes escapes from the ends of the tubes, or from hernial protrusions or ruptures of the sheath, forming larger or smaller drops of every imaginable shape—regularly spherical, clavate, fusiform, cylindrical, filamentary, or of the most bizarre figures—which likewise coagulate, either on the surface merely or throughout, and thence, like the nerves, appear with a double contour, or half or wholly grumous. But within the fibres also its structural conditions alter, for instead of being continued through them as before—as a cylinder of uniform size—it accumulates in places into larger masses. In this way are produced the frequently-described varicose nerve-fibres, in which the medullary sheath presents sometimes minute moniliform enlargements; sometimes various-sized irregularly-distributed nodosities, or even, in places, complete interruptions. All these forms, in which the sheath frequently participates, but in which the central fibre takes no part, arise artificially, and are developed most readily in the finer fibres with more delicate sheaths, such as are found in the central organs.

"The Central or Axis-Fibre of the nerve-tubes (Primitive Band, Remak; Cylinder Axis, Purkinje) is a cylindrical or slightly-flattened filament, which in entire and unaltered nerve-fibres is as little recognisable as the sheath, being surrounded by the pulp, and possessing the same refractive power; whilst it comes readily into view when the fibre is torn or treated with various re-agents; and it may thus be recognised as a constant structure, sometimes in the interior of the fibre and sometimes isolated. Under natural circumstances it is pale; most generally homogeneous; more rarely finely granular or striated, bordered by straight or occasionally by irregular pale contour lines; and it is generally everywhere of uniform thickness. It is distinguished from the medullary sheath especially by the circumstance that although soft and flexible, it is still not fluid and viscous, but elastic and solid, something like coagulated albumen, with which it also appears to agree in most of its chemical characters. This axis-cylinder exists in all nerve-fibres without exception, even in the finest, and invariably presents the same characters, except only that it is sometimes thicker, sometimes more slender, according to the size of the fibre itself.

"The Nerve-Fibres in which the three structures above described can be distinguished, and which we would designate as the Medullated, or Dark-Bordered, constitute, it is true, the greater proportion of those existing in the body; but besides these there are still some forms requiring more particular description. These are the nerve-fibres in which there exists no trace of a medullary sheath, whilst they have an outer sheath and contents, sometimes identical with the axis-fibre of the other kind of nerves, sometimes similar but more clear. These non-medullated nerve-tubes occur, in the first place, as continuations to the other sort, where the latter are in connection with nerve-cells; and also as more elongated independent fibres, representing the so-termed processes of the nerve-cells of authors; and, lastly, at the terminations of the dark-bordered nerves. They may again be arranged in several subdivisions, distinguished respectively by their having, or not having, nuclei, and more or less transparent, more or less consistent contents. It must also be added that the dark-bordered fibres differ extremely—partly in respect of the delicacy or firmness of their structure, and partly in their diameter, which varies from 0·0005‴ to 0·01‴ or more, so that they may be distinguished into fine and coarse, delicate, or firm fibres; from which it is evident that the nerve-fibres, notwithstanding their general tubular character, still differ pretty widely from each other in various respects.

"The Nerve-Cells (Accessory Corpuscles, Belegungkörper, Nerve-Corpuscles, Valentin) are nucleated cells, occurring in great numbers in the gray or coloured substance of the central organs, in the ganglia, and occasionally also in the trunks and peripheral expansions of the nerves (retina, cochlea, vestibule). The nerve-cells are covered externally by a delicate structureless membrane, which in the cells of the ganglia (ganglion-cells, -globules, -corpuscles) may be demonstrated easily, but with great difficulty in those of the central organs; the application of re-agents however will suffice to show pretty distinctly that the membrane exists around the larger cells even in these situations, whilst in the smallest, just as in the finest nerve-fibres, no membrane has yet been observed, although one probably exists. The contents of the nerve-cells are a soft but tenacious elastic substance, which, besides the nucleus, consists of two elements; firstly, of a clear homogeneous light-yellowish or colourless matrix, upon which the physical properties of the contents depend, and which is a protein-compound; and, secondly, of minute granules of different kinds. In the colourless nerve-cells these present the form of uniform, roundish, for the most part minute and pale, more rarely darker and larger corpuscles, dispersed throughout the entire contents of the cell, and imbedded in the tenacious matrix; whilst in the coloured cells, instead of these granules, more or less yellowish, brown, or blackish corpuscles occur. The latter are most usually of a larger size, and are placed, closely aggregated, in a mass near the nucleus; in other instances, they nearly fill the entire cell, giving it the aspect, in all respects, of a brown or blackish pigment-cell. In the midst of these contents lies the nucleus, for the most part as a very clear spherical vessel with distinct walls, perfectly transparent contents, and one, or more, rarely several, large opaque nucleoli, which occasionally exhibit a cavity.

Fig. 4.

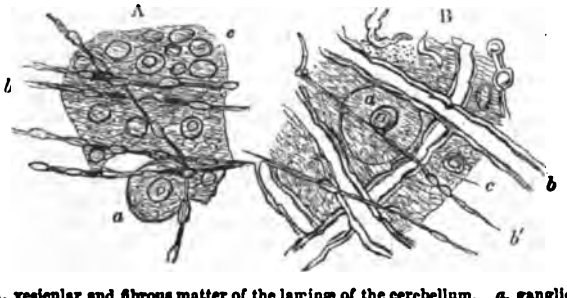


Ganglion-Globules, with their processes, nuclei, and nucleoli.

a, from the deeper part of the gray matter of the convolutions of the cerebellum. The larger process is directed towards the surface of the organ; *b*, another from the cerebellum; *c*, *d*, others from the posterior horn of gray matter of the dorsal region of the chord. These contain pigment which surrounds the nucleus in *c*. In all these specimens the processes are more or less broken. Magnified 200 diameters. (From Todd and Bowman.)

"The size of the nerve-cells varies very much; like the fibres, they occur as large, small, and middle-sized. The extreme dimensions of the cells are 0·002‴—0·003‴ and 0·05‴—0·06‴. The nuclei, which for the most part are in proportion to the cells, measure from 0·0015‴—0·008‴; the nucleoli 0·0005‴—0·003‴. The nerve-cells, moreover, are distinguished according as they are: 1, thin- or thick-walled, of which the former are found almost wholly in the spinal chord and brain; and 2, as they are independent cells, or are furnished with pale processes, of which they may have one, two, or several (uni-

Fig. 5.



A, vesicular and fibrous matter of the lamina of the cerebellum. *a*, ganglion-globule; *b*, very minute nerve-tubes traversing a finely granular matrix, in which are numerous rounded nuclei, *c*.

B, blending of the vesicular and fibrous nervous matter in the dentate body of the cerebellum. *a*, ganglion-globule, with its nucleus and nucleolus; *b*, nerve-tube, slightly varicose, in close contact with the ganglion-globule; *b'*, a smaller nerve-tube. These parts all lie in a finely granular matrix interspersed with nuclei, *c*. (From Todd and Bowman.)

bi- multi-polar cells), and which are frequently ramified, and the former, in many situations, continuous with dark-bordered nerve-fibres, and even having the nature of non-medullated nerve-fibres. Besides the nerve-cells, there also exist in the gray substance of the higher central organs, as constant constituents, a finely granular pale substance, which has the greatest resemblance to the contents of the cells, and besides this, in places, large accumulations of free cell-nuclei. Similar elements are contained in the retina, and according to Wagner and Robin in the ganglia of the *Plagiostomata*."

The arrangement of these fundamental elements of the nervous system present an almost countless diversity in the various parts of the spinal chord and of the brain. [BRAIN.] The student of anatomy will find the fullest account of these arrangements in Kölliker's 'Manual of Human Histology.'

The nervous matter has been submitted to chemical analysis, but no very important result has hitherto been obtained. The following compounds have been observed from the fatty matters of the brain, which amount to about 5 per cent.:—1, Cerebric Acid, a white substance in the form of crystalline grains, abounding in carbon, and containing a minute proportion of phosphorus; 2, Cholesterin; 3, Oleo-Phosphoric acid, a peculiar fatty acid containing about 2 per cent. of phosphorus in the form of phosphoric acid; and 4, traces of olein, margarin, and fatty acids. The following table has been drawn up by L'Heritier from his own researches. The numbers in each instance represent the mean of six analyses:—

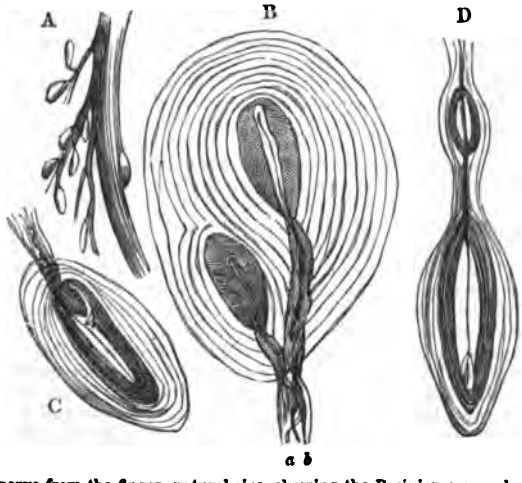
	Infants.	Youths.	Adults.	Aged Persons.	Idiots.
Water . . .	82·79	74·26	72·51	73·85	70·93
Albumen . . .	7·00	10·20	9·40	8·65	8·40
Fat	3·45	5·30	6·10	4·32	5·00
Osmazome and Salts .	5·96	8·59	10·19	12·18	14·82
Phosphorus . .	0·80	1·65	1·80	1·00	0·85

The varying amount of phosphorus has been supposed to stand in some connection with the mental powers. This view must however at present be deemed merely hypothetical. The nerves, according to L'Heritier, contain more albumen, less solid and more soft fat, than the brain.

Lehmann, in the third volume of his 'Physiological Chemistry,' is obliged to admit that at present our knowledge of the chemical composition of nervous matter throws no light upon the functions of this system. This may serve as a rebuke to those who so readily attribute nervous function to the action of physical and chemical causes. "But however forcibly," says Lehmann, "we may be compelled to admit the incapacity of chemical assistance to explain the actions of the nervous system, chemists will not suffer themselves on that account to be deterred from further investigations; for they must be well aware that, without a careful examination of the chemical phenomena presenting themselves in the nervous system, they can never succeed in tracing nervous actions to definite physical laws."

The nerve-fibres proceed uninterruptedly from their origin in the nervous centres—the ganglia—to their destination. In the whole of their course there is no branching, or anastomosis, or union with the substance of any other fibres. The nerves seem to terminate at their peripheral extremities in different ways. Those which have been

Fig. 6.



A, nerve from the finger, natural size, showing the Pacinian corpuscles.

B, unusual form from the mesentery of the cat, showing two included in a common envelope; *a*, *b*, are the two nerve-tubes belonging to them.

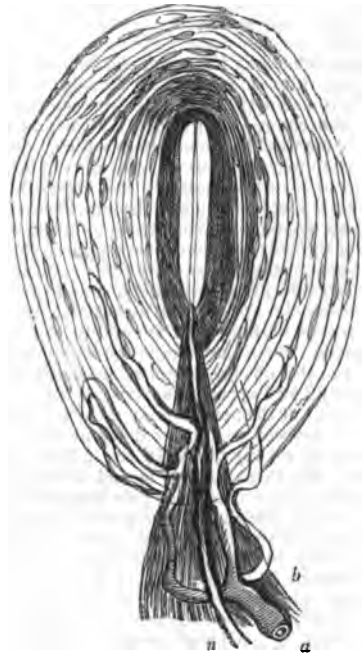
C, another from the same, showing an offset from the central cavity, containing a branch of the nerve.

D, rare form from the mesentery of the cat, showing two corpuscles placed in succession on a single stalk, and furnished with the same nerve-tube, which resumes its white substance in the interval between them. (From Todd and Bowman.)

noticed are as follows:—1, In loops. In this case each fibre, after supplying the tissue on which it is found, turns back, and probably pursues its way to a nervous centre. This mode of termination has been observed in the internal ear, in the papillæ of the tongue, in the pulp of the tooth, and in other parts. 2, In plexuses. It has been stated by many observers that nerves terminate in this way on the serous membranes. 3, In free ends. This seems to be the case in the retina. [EYE.] It has also been observed in the Pacinian corpuscles. These bodies, so called from Pacini their discoverer, are found in the human subject in great numbers in connection with the nerves of the hand and foot, but they also exist sparingly on other spinal nerves and on the plexuses of the sympathetic, though never on the nerves of motion. In the mesentery of the cat they may be almost always detected by the naked eye, being pellucid oval grains rather smaller than hemp-seeds.

A (*fig.* 6) gives a correct idea of their relation to the nerves in the palm and sole. In the human subject they vary from the 10th to the 20th of an inch. The structure of these bodies is highly singular. They consist, first, of a series of membraneous capsules, from thirty to sixty or more in number, inclosed one within the other; and, secondly, of a single nervous tubular fibre inclosed in the stalk, and advancing to the central capsule, which it traverses from end to end.

Fig. 7.



Pacinian corpuscle from the mesentery of a cat; intended to show the general construction of these bodies. The stalk and body, the outer and inner system of capsules, with the central cavity, are seen.

a, arterial twig, ending in capillaries, which form loops in some of the intercapsular spaces, and one penetrates to the central capsule; *b*, the fibrous tissue of the stalk, prolonged from the neurilemma; *n*, nerve-tube advancing to the central capsule, there losing its white substance, and stretching along the axis to the opposite end, where it is fixed by a tubercular enlargement. (Todd and Bowman.)

In the above figure (7), which exhibits the general structure, the ten or fifteen innermost capsules may be observed to be in contact with one another, while the rest are separated by a clear space containing fluid.

Respecting the function or use of these corpuscles much has been written. Pacini himself regarded them as connected with the function of animal magnetism. Mr. Huxley, in a Paper in the second volume of the 'Quarterly Journal of Microscopical Science,' suggests that they are homologous with certain bodies described by Savi in the *Torpedo*, and with the ampullæ or muciparous canals of Rays and Sharks. He says, "We have only to conceive a single hair developed in one of these ampullæ, and taking the place of the clear gelatinous matter, to have a vibrissa, such as is met with in almost all the *Mammalia* about the lip and eyebrow; and I conceive that the vibrissæ are in fact the most complex and fully-developed forms of this series of cutaneous organs. Now the vibrissæ are without doubt delicate organs of touch, and the mucous canals of fishes appear to be very probably of the same nature; but when we come to the Savian and Pacinian bodies, and to the corpuscula tactus, two possibilities arise—either they may be still the instruments of a modified sense of touch, or they may be merely rudimentary representatives of the more completely formed organs." In a note, he adds, "The auditory labyrinth is constructed on precisely the same plan as the muciparous canals of fishes, and the eye

on that of a vibrissa, as might readily be demonstrated; so that all the organs of sense are to be regarded as modifications of one and the same plan."

The development of the elements of the nervous system has been observed by Kölliker. The nerve-cells, wherever they may occur, are nothing else than transformations of the so-called embryonic-cells; some of which simply enlarge, whilst others throw out a varying number of processes, and are, at all events in part, connected with nerve-fibres.

"Many nerve-cells also appear, at a subsequent period, to increase by division; at all events, I do not know how otherwise to explain the frequent occurrence of two nuclei in the nerve-cells of young animals, especially in the ganglia; and the cells connected by communicating filaments, which have been noticed by various observers.

"The peripheral nerve-fibres all originate on the spot, but their subsequent development proceeds in such a way that the central extremities always precede the peripheral. With the exception of the extremities of the nerves, they are developed from fusiform nucleated cells, which are nothing else than modifications of the primordial formative cells of the embryo, and are conjoined into pale, flattened, elongated, nucleated tubules or fibres 0·001'''—0·003''' broad. Now, at first the nerves consist only of fibres of this kind, and of the rudiment of the neurilemma, being gray or dull white, like the sympathetic filaments; subsequently, in the human embryo at the fourth or fifth month, they always assume a whiter colour, and the proper white or medullary substance continues to be more and more developed in them. Of the three possible modes of development of this substance propounded by Schwann, one only in the present state of things can come into question, that namely, as to whether the medullary sheath is a structure deposited between the membrane and the contents of the embryonic nucleated fibres; in which case the contents of the latter would become the axis-fibre. But besides this, the medullary sheath may originate in what did not occur to Schwann, namely, a chemical metamorphosis of the external portion of the contents of the embryonic-fibres; and the axis-fibre may be only the remainder of those contents which has not undergone a fatty metamorphosis. It is difficult to determine which of these two views is correct. Direct observation shows only this much, that the contents of the pale embryonic fibres invariably, by degrees obtain dark contours, and ultimately present the aspect of a true dark-bordered fibre, whilst it teaches nothing with respect to the proper origin of the white substance. Since however it can be proved that the fibres, whilst they undergo this change, do not alter in size, the supposition I have expressed would still appear the more correct.

"The development of the terminations of the nerves, which appears in some respects to present conditions different from those exhibited in the trunks, may be readily traced in the tails of the larvæ of the naked *Amphibia*. We there find, as is mentioned by Schwann, the primary rudiments of the nerves to be pale branched fibres, measuring 0·001'''—0·002''', which here and there anastomose, all finally terminating in free fibrils of the finest kind, measuring 0·002·'''—0·004.''' There is no difficulty in showing that these fibres arise from the coalescence of fusiform or stellate cells, for, in the first place, such cells may be seen, in part still in close opposition with but independent of them; in part more or less connected by means of their processes; and, secondly, cell-nuclei occur at the divisions of the fibres, which are there somewhat dilated; and, at all events in young larvæ, with them are associated the well-known angular vitelline corpuscles, with which, at first, all the cells of the embryo are filled. At first the number of pale embryonic nerves is very small, and limited to a few short trunks closely applied to the muscular structures in the tail; but they are gradually developed in the direction from the centre towards the periphery, further into the transparent portion of the tail, new cells being continually added in connection with the existing trunks, whilst the latter themselves, almost in the same manner as the capillaries of these larvæ, unite directly by delicate offsets."

On the general question of the functions of the elementary parts which have been described, Kölliker makes the following observations:—

"As regards the two elementary portions of the nervous system, anatomical investigation shows, that all its divisions which preside over the higher functions, contain gray substance in greater or less quantity, as in the sympathetic, the ganglia of the spinal and cerebral nerves, and in the spinal chord and brain; whilst the nerves which act only as a conducting apparatus contain nothing but nerve-fibres. This being admitted to be the attribute of the gray substance, it may further be inquired whether it presents differences in its structure, as it does in its functions. With respect to this I would remark as follows: The largest nerve-cells are met with in situations from which motory effects proceed, as in the anterior horns of the spinal chord, amongst the fibres of the anterior roots, in the medulla oblongata, at the points of origin of the motor cerebral nerves, in the cortical substance of the cerebellum, the pons variolii, and crura cerebri; whilst the smallest cells are found in the sensitive regions, as in the posterior horns of the spinal chord, the corpora restiformia, and quadrigemina. There does not however, appear to be any constant relation between the size of the cells and the existence of

sensitive or motor functions; for, in the ganglia of the cerebro-spinal nerves and of the sympathetic, and in the optic thalami, both sorts of fibres arise in one place from small, and in another from large cells. It seems, therefore, as in the case of the nerve-fibres, that there are large and small motor cells, as well as sensitive cells of various dimensions, a fact which is confirmed by comparative anatomy, as the large bipolar cells in fishes are manifestly sensitive. No essential difference can be pointed out between sensitive and motor cells, whether the latter be of uniform or of different size, and in particular the variations existing between such cells are not greater than those between the motor cells in different localities. Even the cells in the cortical substance of the brain, to which physiologists assign the mental manifestations, with our present means of research, exhibit no perceptible peculiarities. The nerve-cells however may be divided into those which are in direct connection with nerve-fibres, and those which are not thus connected, but independent. The former, of course, are to be especially regarded as sensitive and motor; with respect to the latter, anatomy to some extent affords no information, inasmuch as that they present no processes as in the sympathetic ganglia, and in some situations in the brain. As regards those furnished with processes, particularly the many-rayed cells, which in many situations undoubtedly are not prolonged into nerve-fibres, it might be considered certain that they—both larger and smaller, by means of their processes which fulfil the functions of nerves, and whether the latter anastomose or not—bring different regions of the central organs into mutual connection, and participate in the reflex phenomena, the sympathies, and other modes of association of the functions. Cells of this kind exist in the spinal chord and brain everywhere in very large quantities, but not in the ganglia; although it is not from this intended to imply that no reflex actions are performed in those bodies.

"Respecting the nerve-fibres, anatomy is not in a position to point out any difference in them, between the sensitive and motor nerves; a circumstance however which physiologically can afford no reason to ascribe identical functions to them. As regards the various sizes of the nerve-fibres, the numerous changes in diameter undergone in their course by all the cerebro-spinal nerves, very obviously indicate that these proportions have no relation to the functions of the fibres in general. Nevertheless, I do not look upon these relations of size as altogether of little consequence, and in particular does the attenuation of the fibres, where they extend through gray substance, appear to me to be important, as also their diminution at their origins and terminations. It is however difficult to perceive the physiological import of these facts. Were it the case that in the nerve-fibres the axis-cylinder alone was the conducting, and the medullary sheath an insulating substance, and could it be proved that the medullary sheaths were wanting in the attenuated portions, the peculiar activity of the nerve-fibres in these situations (the transverse conduction in the spinal chord, the acuteness of sensibility at the terminations, &c.) would be satisfactorily explained. It is well known that such a notion has already been entertained by various writers, and its conception has usually proceeded upon the idea that a close alliance or identity exists between electricity and the nervous force, and the medullary sheath abounding in fatty matter has from this point of view been regarded as an insulator. But first, it is anything but demonstrated, that the nerves possess no other active force but electricity; and secondly, there is nothing to indicate an absence of the medullary sheath, and a free condition of the axis-fibres in many peripheral extremities of the nerves (skin, muscles), and in those portions of the central organs (spinal chord) in which a transverse conduction is evident. The question always remains, whether the medullary sheath, although not altogether, yet at all events partially, may not insulate more or less, according to its thickness. Since however this membrane is wanting not only in many terminations of nerves, where an insulating conducting faculty might not be required, but also in other situations, as in the *Invertebrata*, and the nerves of *Petromyzon* generally, as well as in the processes of the nerve-cells which certainly act as nerves, in the central organs of the higher animals, and in the finest nerve-fibres in those situations (brain), the notion that such is its effect in the dark-bordered nerves loses all ground of support. It would seem to me, that the medullary sheath represents nothing more than a protective soft envelope for the tender central fibre."

Although the possession of a nervous system is a distinguishing feature of the higher animals, the structural traces of its existence are not found in a large series of truly animal beings. It would appear in these cases that the function of both the nervous and muscular systems are carried on by the same tissues. Nor do these functions in the lower animals distinguish them from plants, for we find the protoplasm in the interior of the cells of plants endowed with the same power as the tissues of the polyp or jelly-fish. The possession therefore of a nervous or muscular system, or the performance of functions supposed to be dependent on these organs, is not a characteristic distinction of the animal world.

It is in the higher *Radiata* that we find the first definite indications of the existence of a connected nervous system. It is probable that such exists in all the *Acalephæ*, although the softness of their tissues renders it difficult of detection. According to Ehrenberg, two nervous circles may be detected in the *Medusæ;* one running along the margin

of the mantle and furnished with eight ganglia, from which filaments proceed to the eight red spots which he supposes to be eyes; whilst the other is disposed around the entrance to the stomach, and is furnished with four ganglia, from which filaments proceed to the tentacula. A nervous ring has also been detected by Professor Agassiz in *Sarsia*, one of the Naked-Eyed Pulmogrades; and he states that it is entirely composed of ganglionic cells. In *Beröe*, it is affirmed by Dr. Grant that a nervous ring exists round the mouth, furnished with eight ganglia, from each of which a filament passes towards the other extremity of the body, while others are sent to the lips and tentacula. In the *Echinodermata* however its manifestations are much less equivocal. In the *Asterias*, for instance, a ring of nervous matter surrounds the mouth, and sends three filaments to each of the rays; of these, one seems to traverse its length, while the two others are distributed on the cæcal prolongations of the stomach. In the species examined and figured by Tiedemann, no ganglionic enlargements of this ring appear to exist, and it seems not improbable that, as in the *Medusæ*, the entire ring is composed of vesicular nervous matter; but this element is usually collected into distinct ganglia, which are found at those points of the ring whence the branches diverge, the number of the ganglia being always equal to that of the rays. In those species which possess ocelli at the extremities of the rays, the nervous chord proceeding towards each swells into a minute ganglion in its neighbourhood. In the *Echinus* the arrangement of the nervous system follows the same general plan; the filaments which diverge from the oral ring being distributed (in the absence of rays) to the complicated dental apparatus, whilst others pass along the course of the vessels to the digestive organs. The transition between the *Radiata* and *Articulata*, presented by the *Holothuria* and *Sipunculus*, is peculiarly well marked in the nervous system of these animals; for the ring which encircles the mouth is here comparatively small, but a single or double non-gangliated filament traverses the length of their prolonged bodies, running near the abdominal surface (which is their situation in the articulated classes) and giving-off transverse branches.

When we compare the character of the nervous system of these Radiated classes with that of the higher animals of more heterogeneous structure, we find that every segment of the body which is similar to the rest is connected with a ganglionic centre that seems to be subservient to the functions of its own division alone, and to have little communication with, or dependence upon, the remainder; these centres being all apparently similar to each other in their endowments.

Among the Molluscous classes there is no radiate or longitudinal multiplication of parts, the only repetition being on the two sides of the median plane. It is chiefly in the organs of animal life that this bi-lateral symmetry is observable, the symmetry of their nutritive apparatus being obscured by the unequal development of its different parts; and the predominance of the latter in their organization impresses itself (so to speak) upon their nervous system, which is not formed until a late period of development, and which shows a want of constancy in the relative position of its centres, that is, in striking contrast with the uniformity of the plan which is so obvious in the nervous systems of *Articulata* and *Vertebrata*. Of these centres there are typically three pairs:—1. The Cephalic Ganglia, which lie either at the sides of the œsophagus, or above it; and may be either disjoined, although connected by a commissure, or fused into one mass, which is usually bi-lobed; this gives off nerves to the labial and olfactory tentacula, to the eyes, and to the muscular apparatus of the mouth; and upon either of these nerves accessory ganglia may be developed. 2. The Pedal Ganglia, which are commonly fused into one mass which is situated below the œsophagus, and are connected with the cephalic ganglia by a commissural band on each side, forming a ring which encircles that canal; though, in the *Nudibranchiata* and some other Gasteropoda, the pedal ganglion of each side is fused into one mass with the corresponding cephalic ganglion: from the pedal ganglion are given off nerves to the foot, and also to the organs of hearing, when those are not actually lodged in them, as frequently happens. 3. The Parieto-Splanchnic Ganglia, which are usually found in the posterior part of the body, and are connected by commissural bands both with the cephalic and with the pedal ganglia: these give off nerves to the muscular and sensitive parietes of the body, to the shell-muscle or muscles, to the branchial apparatus, and to the heart and large vessels. The function of these is divided, in the higher *Mollusca*, between two or more pairs of ganglia; and the proper visceral or sympathetic system becomes more distinct from it. [Mollusca.]

The nervous system of the *Mollusca* becomes gradually more complicated as we ascend from the lower to the higher forms. It is in the *Cephalopoda*, which stand at the head of the Molluscan series, that we find an approach towards the structure of the Vertebrate animals. [Cephalopoda; Nautilidæ.]

The plan on which the nervous system is distributed in the sub-kingdom *Articulata* exhibits a remarkable uniformity throughout the whole series, whilst its character gradually becomes more elevated as we trace it from the lowest to the highest divisions of the group. It usually consists of a double nervous chord, studded with ganglia at intervals; and the more alike the different segments, the more equal are these ganglia. The two filaments of the nervous chord are sometimes at a considerable distance one from the other, and their ganglia distinct; but more frequently they are in close apposition, and the ganglia appear single and common to both. That which may be regarded as the typical conformation of the nervous system of this group is seen in the ganglionic chord of *Scolopendra*, or in that of the larva of most insects, such as that of *Sphinx Ligustri*. Here we see the nervous chord nearly uniform throughout, its two halves being separated however at the anterior portion of the body; the ganglia are disposed at tolerably regular intervals, are similar to each other in size (with the exception of the last, which is formed by the coalescence of two), and every one supplies its own segment, having little connection with any other. The two filaments of the chord diverge behind the head to inclose the œsophagus; above which we find a pair of ganglia that receive the nerves of the eyes and antennæ. We shall find that, in the higher classes, the inequality in the formation and office of the different segments, and the increased powers of special sensation, involve a considerable change in the nervous system, which is concentrated about the head and thorax. In the simplest Vermiform tribes, on the other hand, we lose all trace of separate ganglia, the nervous chord passing without evident enlargement from one extremity to the other. Whatever may be the degree of multiplication of the ganglia of the trunk, they seem but repetitions one of another; the functions of each segment being the same with those of the rest. The cephalic ganglia however are always larger and more important; they are connected with the organs of special sense; and they evidently possess a power of directing and controlling the movements of the entire body, whilst the power of each ganglion of the trunk is confined to its own segment. The longitudinal gangliated chord of *Articulata* occupies a position which seems at first sight altogether different from that of the nervous system of Vertebrated animals, being found in the neighbourhood of the ventral or inferior surface of their bodies, instead of lying just beneath their dorsal or upper surface. From the history of their development however, and from some other considerations, it has been suggested that the whole body of these animals may be considered as in an inverted position; the part in which the segmentation is first distinguished in insects being the real equivalent of the dorsal region in *Vertebrata*, and that over which the germinal membrane is the last to close in being homologous with the ventral region. This view applies also to the position of the 'dorsal vessel,' which would then be on the ventral side of the axis, as in *Vertebrata*. Regarded under this aspect, the longitudinal nervous tract of *Articulata* corresponds with the spinal chord of Vertebrated animals in position, as we shall find that it does in function.

When the structure of the chain of ganglia is more particularly inquired into, it is found to consist of two distinct tracts; one of which is composed of nerve-fibres only, and passes backwards from the cephalic ganglia over the surface of all the ganglia of the trunk, giving off branches to the nerves that proceed from them; whilst the other includes the ganglia themselves. Hence, as in the *Mollusca*, every part of the body has two sets of nervous connections; one with the cephalic ganglia; and the other with the ganglion of its own segment. Impressions made upon the afferent fibres, which proceed from any part of the body to the cephalic ganglia, become sensations when conveyed to the latter; whilst, in correspondence to these, the consensual impulses, operating through the cephalic ganglia, harmonise and direct the general movements of the body, by means of the efferent nerves proceeding from them. For the lower reflex operations, on the other hand, the ganglia of the ventral chord are sufficient; each one ministering to the actions of its own segment, and, to a certain extent also, to those of other segments. It has been ascertained by the careful dissections of Mr. Newport, to whom we owe all our most accurate knowledge of the structure of the nervous system in articulated animals, that of the fibres constituting the roots by which the nerves are implanted in the ganglia, some pass into the vesicular matter of the ganglion, and, after coming into relation with the vesicular substance, pass out again on the same side; whilst a second set, after traversing the vesicular matter, pass out by the trunks, proceeding from the opposite side of the same ganglion; whilst a third set run along the portion of the chord which connects the ganglia of different segments, and enter the nervous trunks that issue from them, at a distance of one or more ganglia above or below. Thus it appears, that an impression conveyed by an afferent fibre to any ganglion, may excite motion either in the muscles of the same side of its own segment, or in those of the opposite side, or in those of segments at a greater or less distance, according to the point at which the efferent fibres leave the chord. And as the function of these ganglia is altogether related to the locomotive actions of the segments, we may regard them as so many repetitions of the pedal ganglia of the *Mollusca*; their multiplication being in precise accordance with that of the instruments which they supply. [Insecta; Crustacea.]

Proceeding to the Vertebrated Series we find their Nervous System constitutes a far more important portion of the entire organism than it does in any Invertebrated animal; and that, in its most characteristic forms, it combines the locomotive centres of the *Articulata* with the sensorial centres of the *Mollusca*, possessing in addition two organs, the Cerebrum and Cerebellum, to which nothing distinctly analogous can be detected in any of the inferior classes. That which may be regarded as the fundamental portion of the nervous system in

Vertebrata is the Cranio-Spinal Axis, which consists of the medulla spinalis, or spinal chord, of its anterior prolongation, termed the medulla oblongata, and of the chain of sensory ganglia, which forms the superior continuation of the latter. The whole of this axis lies above the alimentary canal, and there is consequently no œsophageal ring, like that of Articulated and Molluscous animals; but the two lateral strands of the cranio-spinal axis still diverge from each other as they enter the cranium, so as to leave the space which is termed the fourth ventricle. This cavity communicates anteriorly with the third ventricle, which separates the lateral halves of the anterior portion of the sensorial apparatus; and posteriorly with the spinal canal, which intervenes between the two lateral halves of the spinal chord. This last however, like the space between the lateral halves of the ventral chord in the higher *Articulata*, is nearly obliterated in man and the *Mammalia*, although sufficiently distinguishable in Fishes. The spinal chord consists of a continuous tract of gray matter, inclosed within strands of longitudinal fibres; and it may thus be regarded as analogous to the ganglionic chain of the *Articulata*. Below the medulla oblongata its endowments appear nearly similar throughout, for all the nerves which proceed from it are distributed to the sensory surfaces and to the locomotive organs. In some *Vertebrata*, whose form resembles that of the *Articulata* (such as the eel and serpent), there is no difference in the size or distribution of the several pairs of nerves, as no extremities are developed; but in other cases, the size of the trunks, proceeding to the anterior and posterior extremities, is much greater than that of the nerves given off from the other segments of the chord; and the quantity of gray matter at their roots is correspondingly increased. In these trunks, both afferent and efferent fibres are bound up; but they separate at their roots, or junction with the spinal chord—the afferent being connected with the side of the chord nearest the surface of the back—and the motor with that next the viscera. Both these roots have two sets of connections; some of each enter the gray substance of the chord, in which they seem lost, whilst others are continuous with the fibrous portion of the chord, and are thus put in connection either with other segments or with the encephalic centres. In this respect, then, there is a precise correspondence between the spinal column of *Vertebrata* and the ventral chord of insects; and in the former, as in the latter, experiment indicates that each segment of the chord has a certain degree of independence, reflex actions being excitable through it, so long as the circle of afferent and motor nerves, and their ganglionic centre, are in an active and uninjured state, even though it be completely separated from all the rest. At the upper portion of the spinal chord however, there is a series of ganglionic enlargements, having several distinct functions. From the medulla oblongata proceed the chief nerves which are subservient to the respiratory actions, and also those concerned in mastication and deglutition; so that this may be regarded as combining the respiratory and the stomato-gastric ganglia. Above, or in front of this again, we find auditory, optic, and olfactive ganglia, corresponding to the various subdivisions of the cephalic ganglia in the *Invertebrata;* these receive trunks from their respective organs of sensation, and may probably be regarded as sensorial centres, or seats of consciousness for the impressions which they severally transmit. The cranio-spinal axis constitutes the whole nervous system of *Amphioxus*, in which there seems nothing that in the least resembles a cerebrum, or cerebellum; and among the cyclostome fishes generally, the condition of this apparatus is but little higher, save as regards the larger development of the sensory ganglia.

But in all higher *Vertebrata* we find superimposed (as it were) upon the sensory ganglia the bodies which are known as the Cerebral Hemispheres or Ganglia; whilst superimposed upon the medulla oblongata we find the Cerebellum. The former constitute the mass of the brain in the *Mammalia;* covering-in and obscuring the sensory ganglia so completely, that the fundamental importance of these is by no means generally recognised. In fishes however the proportion between the two sets of centres is entirely reversed, the rudiments of the cerebral hemispheres being usually inferior in size to the optic ganglia alone. The intermediate classes present us with a succession of gradations from the one type to the other, as regards not merely the size of the cerebrum, but also its complexity of structure; and a very close relation may be seen between the degree of development which it exhibits and the degree of intelligence of the species. It is a point which is especially worthy of note, that no sensory nerves terminate directly in the cerebrum, nor do any motor nerves issue directly from it; and there seems a strong probability that there is not (as was formerly supposed) a direct continuity between any of the nerve-fibres distributed to the body and the medullary substance of the cerebrum. For whilst the nerves of special sense have their own ganglionic centres, it cannot be shown that the nervous fibres of general sense, which either enter the cranium as part of the cephalic nerves, or which pass up from the cranio-spinal axis, have any higher destination than the ganglionic masses termed thalami optici, which undoubtedly form part of the group of sensorial centres. So the motor fibres which pass forth from the cranium, either into the cephalic nerve-trunks, or into the motor columns of the spinal chord, cannot be certainly said to have an origin higher than the corpora striata; which, like the thalami, are most assuredly to be regarded as ganglionic centres, possessing considerable independence of the cerebrum, though formerly regarded as mere appendages to it. And we shall find strong physiological ground for the belief that the cerebrum has no communication with the external world otherwise than by the sensori-motor apparatus which ministers to the automatic actions; receiving through the sensory ganglia that consciousness of external objects and events, which is the spring of its intellectual or emotional operations; and communicating its voluntary determinations to the motor part of the same system, to be worked-out (so to speak) by it through the instrumentality of the muscles upon which it plays. The cerebellum, in like manner, presents a great difference in relative development in the several classes of *Vertebrata;* being in the lowest a mere thin lamina of nervous matter on the median line, only partially covering-in the fourth ventricle; whilst in the highest it is a mass of considerable size, having two lateral lobes, or hemispheres, in addition to its central portion. It is connected with both the anterior and the posterior columns of the spinal chord; and experiment leads to the belief that its chief office is to combine the individual actions of different members into the complex and nicely-balanced movements required for progression of various kinds, and in man for the execution of the various operations which his intelligence prompts him to undertake. (Carpenter.)

The part of the nervous system of the *Vertebrata* which is subject to most alteration is the Brain. The chief differences in its form depend on the degree in which the hemisphores of the cerebrum and cerebellum are developed. In fishes these are usually smaller than the ganglia on the origin of the optic nerves; but ascending in the scale they become more and more predominant in size over the rest of the nervous centres, and appear to have a certain relation to the development of intelligence in the animal. In the highest animals and in man the lobes of the cerebrum and cerebellum are by far the largest of all the nervous organs; their surfaces are convoluted and furrowed, the quantity of the gray matter upon them augmented, and the complexity of their structure greatly increased. But as a special article is devoted to this subject [BRAIN], it need not be further considered here; for similar reasons we shall here treat of only the general phenomena and laws of the actions of the nerves as they are observed in man, and the cerebro-spinal system only in reference to the nerves of common sensation and motion; referring for the description of the special senses to the articles EYE, EAR, NOSE, and TONGUE, and for the peculiar influence of the nervous system in the most important organs, to the articles devoted to them. [HEART; STOMACH.]

The constant functions of the cerebro-spinal nerves are—to convey impressions made on the points in which they are distributed, to the brain, where they are perceived as sensations, or to the spinal chord, where they are perceived without sensation; and to convey the influence of the will from the brain, or some involuntary influence from it or the spinal chord, to the muscles by which some motion is to be performed. The influences that thus pass to and from the brain are conveyed through distinct nervous filaments, though the filaments subservient to each are generally inclosed in the same sheath, and appear to form a single and simple nerve. The filaments which convey impressions to the nervous centres are called sensitive, centripetal, or afferent; while those conveying impressions from the centres to the muscles are named motor, centrifugal, or efferent filaments.

The spinal chord, in which all the nerves of the trunk have their apparent origin, is composed of two lateral halves, symmetrical in form and size, and united together by a part of their inner surfaces at the median line. The outer portion of the chord is composed of white nervous matter, the inner of gray, an arrangement the reverse of that of the brain, in which the cortical substance is gray, and the medullary or central white. Each lateral half of the spinal chord is again obscurely divided by superficial furrows into an anterior and a posterior column, and a smaller middle portion between them. All the nerves by which sensitive impressions pass arise from the groove between the posterior and middle columns, and all those (with the exception of the spinal accessory nerve) by which the excitants to muscular motion are conveyed arise from the groove between the anterior and middle columns. They all arise by what are called roots, that is, by a number of fine nervous threads or narrow bands attached to the grooves, and passing for a short distance into the substance of the chord, which, as they proceed outwards, converge and unite into a single chord or nerve. There is an important distinction however between them: the roots of the posterior or sensitive nerves have a ganglion at their union just where they are leaving the vertebral canal, while those of the anterior or motor nerves unite without any ganglion into a single chord, which passes over but does not communicate with the ganglion on the posterior roots. Beyond this ganglion the anterior and posterior roots unite in a common sheath, in which their filaments, though they continue distinct, are indiscriminately mixed; and in this manner they proceed through the varied branchings of the sheath to nearly all parts of the body, conveying the power of perceiving impressions to all, and the power of motion to the muscles and probably a few other tissues.

Nearly the same mode of origin and distribution, and the same distinctness of office, are found in the nerves that have their centre in the brain, in which those of the fifth pair [BRAIN] are almost exactly analogous to the spinal nerves. But in the other cerebral nerves there

is less regularity of origin, the nerves of peculiar sensation having no muscular nerves corresponding to them, the seventh nerve, or portio dura, being exclusively motor, without any corresponding sensitive root, &c. Thus, of the nerves proceeding from the brain, some are in all their course sensitive only; others are (except for the occasional connection of some of their branches with branches of the fifth) entirely motor; others (part of those of the fifth) mixed, that is, containing in a common sheath both sensitive and motor filaments, like all the nerves derived from the spinal chord.

The following table will give the student an idea of the functions of the cerebral nerves:—

Nerves of Special Sense	Olfactory. Optic. Auditory. Part of Glosso-Pharyngeal. Lingual branch of 5th.
Nerves of Common Sensation	Greater portion of 5th, and part of Glosso-Pharyngeal.
Nerves of Motion	3rd, 4th, lesser division of 5th, 6th, Facial, and Hypoglossal.
Mixed Nerves	Pneumogastric and Accessory.

The conveyance of those impressions which produce common sensation is the property exclusively of those nervous filaments which arise from the posterior columns of the spinal chord and their continuations in the brain. To possess this power, their connection with the brain, either directly or through the medium of the spinal chord (which, in this view, may be regarded merely as a collection of a vast number of the nervous filaments which have their centre in the brain), must remain uninjured. Hence, when any sensitive nerve is cut through, all the parts to which its filaments are distributed beyond the place of division are rendered perfectly insensible. The nearer to the brain that the injury is inflicted, the more extensive is the destruction of sensibility. When the spinal chord is injured by fracture of the vertebræ, or by disease, or any other means, all the parts whose nerves come out from the portion below that which is destroyed, become insensible; they lose also all power of voluntary motion, but for the present we shall consider the sensitive filaments and their functions only. If the posterior roots of a nerve be divided, all the parts supplied by that nerve lose their sensibility; or if a nerve be divided in any part of its course, then all the parts supplied by branches given off between the point of division and the brain retain their sensibility, while those which are supplied by branches given off in the other part of the nerve more distant from the brain are rendered insensible. These facts prove that the influence of an impression upon the distal or peripheral extremity of a nervous filament can only be conveyed to the brain so as to produce sensation through a continuity of nervous tissue, and only through the very filaments that are impressed; and that there is no such communication of adjacent filaments, that if one is injured, another can convey the impression made on it, as in the circulation, by the anastomosis or communication of the bloodvessels, when one is obliterated, the blood which should traverse it passes through another. The same facts evidently explain also many of the phenomena of partial paralysis.

If that part of a divided nerve which is still connected with the brain be stimulated, the same sensation is perceived as if the stimulus were applied to all the parts in which the branches that the nerve gives off below the division are distributed. This is shown in the sensation which every one must have felt on striking the inside of the elbow (the 'funny bone,' as it is commonly called); the tingling pain that the blow produces, and which appears to have its seat in the inner side of the fore arm and hand, and in the little and ring fingers, is owing to the filaments of the ulnar nerve (which passes behind the elbow) being distributed to those parts, and to the sensation being always referred to the peripheral termination of the filament, in whatever part of its course it is irritated. It is of course impossible to experiment upon a single nervous filament, but the accuracy with which the imagined seat of sensation produced by irritating a bundle of filaments accords with their distribution leaves no doubt of the fact just mentioned. The nearer to the brain that the stimulus is applied, the more extended is the sensation; hence in disease of the spinal chord, pain is often felt in all the parts supplied with nerves coming off from the chord below the diseased portion, and the pain of dividing a nerve is felt over all the parts to which its branches are distributed. The same circumstance gives rise to the apparently strange ideas which those who have lost a limb entertain that they still possess it, till by their sight or some other means they correct the erroneous impressions of their sense of touch. For example, the constant cry of a patient who has just lost his leg, while the stump is being dressed, is that his attendants are squeezing his knee, or cutting his foot, or injuring some other part of the limb, which he cannot believe has been cut off. The reason is, that when those filaments of the nerves in the stump which are destined for the knee are touched, the knee seems to be touched; when those which are going to the foot are injured, the foot appears to suffer. So deceptive are these sensations, that even years after the loss of a limb, or for the rest of their lives, persons occasionally endeavour to perform some act with the stump which they were accustomed to do with the part they have lost. From the same circumstance of the sameness of sensation, whatever be the part of a nervous filament to which the stimulus is applied, arises the well-known feeling of the foot having fallen asleep, when the ischiatic nerve has been pressed upon, and the peculiar

character of the pain in many cases of tic douloureux, in which the trunk of a nerve being diseased, the pain is referred to all the parts to which its filaments are distributed.

The laws deduced from these facts, and which are of great importance in the explanation of many diseases of the nervous system, are briefly these:—The impressions producing sensation always pass from the circumference of the distribution of the nerves to the centre; they are always centripetal, and their centre, the seat of sensation, is the brain. They can pass only through the tissue of the nervous filaments to which they have been applied, and whose connection with the brain must therefore be unimpaired. The sensation is the same on whatever part of the nervous filament the impression is first made, and it is always referred to the peripheral end of the filament.

If the connection of the nerve with the brain be broken, the same impression may pass along its filaments to the part where its continuity is destroyed, but it will produce no sensation; though when the spinal chord remains, its passage may be indicated by the phenomena of reflex motion, which will be presently considered. It is chiefly through the medium of the nerves of common sensation that we become acquainted with all that the contact of other palpable bodies teaches, as their form, size, hardness, heat, &c. For the perception of these properties we must suppose a peculiar condition of nervous matter; for although the laws under which impressions are conducted through all the sensitive nerves to the brain are the same, yet the nerves of peculiar sensation, as the optic [EYE] and the auditory [EAR] are no more capable of perceiving the impressions of contact of non-vibrating bodies, than the nerves of the limbs, &c., are of perceiving light and sound. If the retina be touched in an operation on the eye (as in the experiments which M. Magendie has often made in operating for cataract), the sensation produced is that of a brilliant flash of light; if the auditory nerve be electrified, the sensation is that of a sudden loud noise; but in neither case is pain produced, unless the nerves of common sensation, with which parts of the eye and ear are supplied, be irritated at the same time.

Our ideas of the form and size as well as of the hardness of bodies are dependent in some degree on another sense, which is peculiarly connected with the muscles [MUSCLE], and is called Muscular Sensibility. By it we know what degree and extent of muscular force we exert at any given time. Thus, if the hand grasps a ball, we estimate its size by the degree in which the fingers are extended to inclose its circumference, for the mere impression of its contact on the fingers would be the same whether the ball were large or small; we estimate its weight by the muscular exertion which we feel it necessary to make to prevent it from falling; and its hardness by the degree of exertion which is sufficient or insufficient to make an impression on its exterior. In like manner, if the body be larger than the hand can grasp, then (unless we can see it) we estimate its size by the distance through which the hand moves in passing over the whole surface, and its form by the differences of position in which, in thus passing over it, the hand is from time to time placed. It is only the smaller differences in the form of the surfaces of bodies, their smoothness and roughness, and other similar characters, that are estimated by the touch alone. Thus, when a sensitive part (as the hand) is placed or moved with a certain force on the surface of a body, we know that it is smooth if all the hand receives the same sensation, or rough if the sensation of contact is perceived at points distant from each other. In like manner, from the extent of surface touched, we form our ideas of the sharpness or obtuseness of bodies.

Perceptions of temperature are also the peculiar attributes of the nerves of common sensation, but they do not admit of our forming very accurate ideas of the heat of bodies, because our sensations depend rather on the rapidity with which heat is abstracted from or added to our bodies, than on the quantity which we lose or receive. Hence we feel marble, which conducts heat rapidly, as if it were much colder than a slowly-conducting carpet of the same temperature; and when the difference of temperature between the hand or any other part of the body and that which it touches is very great, we lose all power of judging, and cannot directly tell whether it is in contact with (for example) ice or boiling water. Peculiar states of the circulation in and around the nerves give rise to very different sensations of heat, as in fever or in shivering, in which, though the skin feels as if it were burning or freezing, the actual temperature of the surface does not in either case differ more than five or six degrees from that which is natural to it.

The acuteness of the common sensibility of parts probably depends, cæteris paribus, in the healthy state, on the closeness with which they are beset with the termination of sensitive nervous filaments. E. H. Weber ('Annot. Anatom. et Phys.') has suggested a mode of estimating the degrees of sensibility of different parts of the surface of the body by touching two adjacent points of it at the same instant, and observing at what distance from each other the two contacts can be discerned as two distinct impressions. This may be effected by putting small pieces of cork on the points of a pair of compasses, and pressing both at the same instant on the part to be examined; the angles which the legs of the compass form will thus measure the distances at which the two impressions are distinguished or are confounded into one. By this method of examination it is found that the tip of the tongue is the most sensible of all the surface of the body, being able to distinguish

two impressions when the distance between the points on which they are applied is not more than 1-20th of an inch, a result which might have been anticipated, from the accuracy with which the tongue perceives and estimates the characters of the smallest portions of foreign matter in the mouth, and from the great share which the sense of touch takes in what we confound in the general idea of taste. The balls of the fingers can distinguish double impressions from 1-12th to 1-4th of an inch apart; the palm at about half an inch, and other parts of the skin at various greater distances. Applied to the skin at the back of the neck, of the upper arm, the thigh, and some other parts, such double impressions are confounded into one when the points touched are upwards of two inches asunder.

Numerous circumstances have the power of modifying or increasing the sensibility of parts, giving rise to varieties of agreeable and painful sensations. Most parts moreover have certain sensations peculiar to themselves; thus no other tissue than the skin is ever the seat of the sensations of tickling, or itching, or burning heat, &c.; the muscles alone feel fatigue; the pain of disease in different tissues is as varied as any other of its phenomena. Certain parts also are insensible to any but particular impressions; the tendons and other similar tissues may be cut or burnt, or in any way injured without exciting any sensation, unless they are pulled or twisted, or subjected to any other of those mechanical influences which it is their office in the animal economy to resist. Other parts again, as most of the internal organs, the bones and cartilages, are insensible during health, but in disease excite severe and peculiar pain. For all these differences however no explanation is yet known. It is known that certain nerves (the motor) never, under any circumstances, convey sensible impressions; that others (the nerves of the sympathetic system) are, if ever, only occasionally conductors of sensations; that others (the nerves of the peculiar senses) convey only the impressions of those agents for the reception of which certain organs are peculiarly adapted; and that others have the constant office of conveying impressions of contact, heat, &c.; but upon what differences of structure or arrangement these varieties of function depend no reasonable opinion can at present be formed.

Many of the phenomena illustrative of the mode of conduction of the nervous influence in the sensitive nerves are repeated in the motor filaments, with this difference, that while in the sensitive nerves impressions always proceed from the circumference to the centre, or from the termination of the nervous filament in any tissue, to its termination in the brain or spinal chord; in the motor nerves the impressions always pass in the opposite direction, that is, from the centre to the circumference, or from the brain or spinal chord to the muscle or other contractile tissue. When the motor filaments of a nerve are irritated in any part of its course, no pain is felt, but the muscles to which it is distributed contract; when a similar nerve is cut through (or otherwise prevented from conveying the nervous influence), all the muscles to which the filaments that pass off from it, beyond the injured portion, are distributed, lose the power of being acted upon by the will, and very soon of being excited by any stimulus, while those from between the injured part and the brain retain their power. If the end of that portion of a divided motor nerve which is still connected with the nervous centre be irritated, no perceptible effect follows; if the end of the other portion, which is now separated from the brain, be irritated, the muscles to which its filaments proceed will for a time continue to contract. The same observations on the necessity of a continuity of nervous substance, on the absence of any communication between adjacent filaments, by which one might assume the office of another, and on the sameness of effect, whatever part of a nervous filament is irritated, may be made of the motor as of the sensitive filaments. As in by far the greater number of nerves, sensitive and motor filaments are contained within the same sheath, the phenomena, which have been described separately, will, in the case of injury or other affection of such nerves, be combined. Thus when the nerve of any limb is irritated, sudden pain is felt and coincident convulsions ensue; when a similar nerve is divided, the limb becomes both senseless and motionless; if the upper part of the divided nerve (that still connected with the brain) be irritated, pain is felt, but no motion is excited; if the lower part be irritated, convulsions of the limb take place, but no pain is felt.

Of the nature of the influence which, passing along the nerves, excites motion, and of the manner in which it is set in motion, nothing whatever is known. Through some nerves it can be transmitted at will, and the muscles supplied with these are therefore called voluntary; through others the will has no influence in sending the excitant to motion, and the involuntary muscles to which they pass are entirely removed from any connection with the mind, except in the excitement of violent passion or grief, or other exalted mental affection. Whatever stimulus is applied to the motor nerves, the same effect is produced; whether it be the stimulus of the will, or of any mechanical, chemical, or electrical application, the same muscular contraction, varying only in degree, is produced. The mind alone has the power of determining the strength and extent of muscular contraction, and this it effects by an operation which it scarcely appreciates; for even one who knows accurately the position and the mode of action of each muscle cannot, except in certain cases, order the act of a single muscle, but to produce a certain kind or strength of motion is obliged to exert coincidently all the muscles that can minister to that motion. Thus there are two muscles, at least, that bend the fore arm, and no person can make one of them act while the other remains inactive; the will can only determine certain effects, but it cannot determine the muscles by which they shall be accomplished.

In all the phenomena hitherto considered, the mind takes a part; but in some circumstances an impression passes along a sensitive nerve to the nervous centre, and although no sensation may have been produced, an influence is in return conveyed back from the centre through a motor nerve, and motion is produced, either in the muscles adjacent to the part first impressed, or in those of some other part of the body. The phenomena of this class are those of what is called the Reflex Function; a term which is derived from the idea that the impression, passing centripetally, is reflected from the centre as soon as it arrives there, and made to pass from it centrifugally.

For the occurrence of these reflex actions, it is essential that the nerves acted upon should retain their connection with the spinal chord or with the brain. The spinal chord is sufficient for some of these actions, and the power is therefore often spoken of as if it belonged exclusively to it; but it is evidently possessed by the whole cerebro-spinal axis. Thus, if the hind leg of a reptile or any other animal be separated from the body, and the skin of any part of it be irritated, no motion of its muscles will ensue; but if the leg be allowed to retain its connection with that part of the spinal chord from which its nerves come out, the same irritation of the skin will produce convulsive contractions of the muscles. In the first case the impression on the skin, if it passed along the sensitive nervous filaments at all, was lost at their cut extremity; in the second, it passed through them to the spinal chord, and thence either it or some other influence returned immediately through the motor nerves to the muscles.

On this property of Reflecting the impressions received from sensitive to motor nerves, many of the muscular motions which were formerly regarded as instinctive or sympathetic, and many others of the most important phenomena, depend. Thus when light falls on the retina, the impression received by the brain is instantly reflected through the third nerve, and the iris, without any effort of the will, contracts; and if the light be very strong and sudden, the eyelids involuntarily wince, as they do before any expected injury. In like manner a stimulus applied to the nose excites involuntary sneezing; food, or any other substance in the fauces or pharynx, excites the involuntary act of swallowing, and still more an irritation of the larynx is reflected from the medulla oblongata, and excites in all the respiratory muscles involuntary coughing. In all these cases sensation coexists with the reflection of the impression through the motor nerves; but sensation is by no means essential to the phenomena; on the contrary, in the most marked examples the centripetal impression is not perceived by the brain. Thus the sphincter muscles are constantly maintained in a state of contraction under the influence which passes unfelt from the spinal chord; and all the motions occurring in decapitated animals (in which the reflex actions are more remarkable than under any other circumstances) must probably be regarded as unaccompanied by sensation, since exactly similar phenomena occur in persons suffering from some forms of paralysis, and who can never feel the impression on the skin upon which the involuntary motions instantly follow. In the case of reflection from the optic nerve to the nerves of the iris, and in most of those in which the sensitive nerves pass directly to the brain, sensation is produced with the reflex action; but in all the cases where the centripetal nerves pass to the spinal chord, the reflex actions take place as well, or even more certainly, after the removal of the brain. The spinal chord is essential for a reflex action in the nerves that pass out from it; the brain for a similar action in its own nerves: in the first case sensation is not involved, in the second it generally is.

Mr. Grainger ('Observations on the Spinal Chord') believes that the impressions which produce reflex actions, and those which pass to and from the brain in sensation and voluntary motion, are not conveyed by the same sets of nervous fibres. He considers that there meet in the spinal chord four sets of nervous filaments: one passing only to the exterior white matter, and then ascending to the brain, to which they convey sensations; a second, corresponding to these, which pass from the brain along the exterior white matter of the chord, and thence to the muscles, for the conveyance of the influence of the will to them. These two sets are the same as the commonly described sensitive and motor filaments; the others are analogous to these, but are supposed to be subservient only to the reflex actions; they pass to and from the chord with the others, but instead of being continued up with them to the brain along the exterior of the chord, penetrate into its substance, and lose themselves in its central gray matter—the recipient and reflector of the impressions which they convey. The observations of the course of the filaments of the nerves, where they pass into the spinal chord, upon which this very ingenious view is founded, have not yet been sufficiently confirmed to establish its truth beyond doubt; but it still affords the most intelligible explanation of the manner in which impressions, passing apparently through the same filaments, in some cases produce sensation, and in others none; and in which, for certain purposes, organs supplied with nerves from the cerebro-spinal axis are yet usually removed from the influence of the brain.

It deserves particular remark, that in the cases in which the impression is conveyed only to the spinal chord, as in beheaded animals, the motions that result from the reflected influence evince design. They are in fact instinctive. Thus, when a bird's or any other lower animal's (as a frog's) head is cut off, the body endeavours to escape, and evinces method in its attempts; if a limb is touched, it is drawn away from the contact; if a part of the body is irritated, the foot will sometimes be raised in an endeavour to remove the source of irritation. These actions are similar to those of monsters born without brains, many of which have been known to cry, to take milk, and perform many other instinctive acts. From such facts as these it is inferred that the brainless animals perform all their functions unconsciously. We can however draw a distinction between the functions performed under the influence of the action of the nerves of special sense (the sensory ganglia) and those performed by the ganglia supplying the stomach, heart, lungs, and other organs.

Of the nature of the agent which, passing along the nervous filaments, produces sensation or excites motion, nothing satisfactory is at present known. The imperceptible velocity of its passage naturally suggested the idea of an electric current, and except by the supposition of the motion, or the vibration of the particles of some such subtle material as electricity or the other imponderable agents are conceived to be, its velocity is scarcely to be accounted for. Some idea may be formed of its rapidity of passage along the nerves to and from the brain, by a rough calculation which the writer lately made, that when a person plays rapidly on the piano, upwards of 1000 distinct movements are performed within the minute; each of which has its time, place, and strength exactly ordered. At the same time that the mind imparts this number of impressions to the muscles, it is receiving not less than 2000 impressions by each of three distinct senses, the eye, the ear, and the touch, and perceives the most minute variations with each. From the similarity of this velocity of the nervous agent, to that of the passage of electricity, and from a few apparent analogies, some have imagined the nervous agent, or fluid, to be identical with the electric; but the grounds for such an opinion are at present few and uncertain, while many evident facts militate strongly against it, as the equal conducting power of all the moist tissues as well as the nervous; the improbability that electric fluid should be isolated in the filaments, the inconstancy of the results of experiments in which a current of electricity is used to replace a removed portion of a nerve, &c.

The more probable theory is that the nervous force is correlative with the forces engaged in the nutrition of the body. We find light and heat necessary to the production of the materials from which the nervous system is formed. These are correlative with the chemical forces brought into action in forming the compounds of our food, as sugar, starch, and protein. The sugar and starch, on the dissolution of their physical conditions in contact with oxygen, yield heat to the body; and it is quite as probable that protein, under the same circumstances, should exhibit muscular and nervous force. At any rate this theory is rendered very probable by a large and increasing number of facts. In animals capable of developing electricity it is clearly correlative with the nervous force. [Electricity in Organic Beings.]

The nervous force appears to be generated in the brain, spinal chord, and in all parts where there is ganglionic or gray nervous matter, and from these centres distributed to the nerves. Thus, if the trunk of a mixed nerve be divided, that part which is separated from the nervous centre soon loses that which may be called its stock of excitability, while that which remains attached to the centres retains its excitability as if no injury had been inflicted. For the maintenance of the excitability on which the reflex actions depend, the spinal chord alone seems to be necessary; for it is not more rapidly expended after the removal of the brain than when the brain is present. For the maintenance of the excitability for other actions the brain is essential.

Each impression made on the sensitive nerves, and each excitant to motion, may be considered to cause a certain consumption of the nervous influence, which it is the office of the nervous centres to replace; and a healthy condition of the nervous system may reasonably be conceived to depend on a due proportion between the waste and the supply. When the former has been excessive, weakness or fatigue of the senses, or of the power of muscular motion, is produced, which a period of sleep or rest from excitement is necessary to replace. The necessity of such rest is indicated to us by the fatigue at the close of each day, and cannot long be safely resisted; for after the loss of the night's rest, the excitant necessary to produce a certain effect is found to become greater in a rapidly increasing ratio through every hour of the succeeding day. During rest the brain may be considered as producing the excitability by which the nerves may act during the period of exertion; and hence exertion is not less necessary for health than rest; and many disorders show that excitability may, for want of being wasted by exertion, accumulate. Hence much of that which passes under the popular name of nervousness—a condition in which a given excitant produces a greater effect than is natural or healthy; and this (although the use of terms usually applied to material things may give too definite an idea of it) we may reasonably believe to result from an accumulation of nervous influence, as fatigue, or the need of a greater excitement to produce a certain effect, results from its waste. The influence of exercise of the nerves follows the same rule as that of exercise of the muscles or any other tissue; by it, within certain limits, the power of perceiving impressions and of exciting motion is progressively increased; the excitability of each organ or of the whole system being, within those limits, capable of adaptation to the need of the individual; hence the power by practice of attaining to perfection of touch, or of hearing, or sight, or any other sense. Impressions are distinctly felt by the practised sense which are completely imperceptible to that which has been only casually employed. In like manner, when the organ of one sense is destroyed, and thus one outlet for excitability is closed, the rest acquire increased acuteness; hence the accuracy of the hearing and touch in the blind, of the sight in the deaf, &c.

The study of the functions of the spinal chord in health is especially important in relation to the numerous diseased actions of the nervous system. In the previous remarks we have seen that the spinal chord is the seat of an important series of reflex functions. It must not however be supposed that the spinal chord alone is the seat of reflex functions, the masses of nervous matter which lie at the base of the brain, the medulla oblongata, and the nervous centres giving origin to the nerves of special sense, and the brain itself, are all seats of special reflex functions. The reflex actions more especially presided over by the spinal chord in man, appear to be the expulsive movements of the organs of organic life and the muscular movements of the posterior extremities. The expulsive movements alluded to, and which can be performed independent of any action of the brain or will, are defecation, urination, parturition, and other functions connected with the reproductive processes. These functions are performed in diseased conditions such as apoplexy, and in the anæsthetic state produced by chloroform, or ether, without the consciousness of the individual. So also the movements of the posterior extremities occur as the result of stimulation when the individual is entirely unconscious. Amongst the lower animals muscular movements are manifested in the *Invertebrata* after the removal of the cephalic ganglia, and in the *Vertebrata* after the destruction of the brain. Thus frogs will leap when irritated after their brains are removed, and birds are known to fly after their heads have been cut off. From these facts we may infer that the muscular movements in man, of the lower extremities especially, may be the result of the reflex action of nerves proceeding from the spinal chord, and supplying these parts. It is very certain that the movements of the body are continued in walking whilst the mind is entirely abstracted.

In morbid conditions of the nervous system, the functions of the spinal chord are frequently deranged. In many diseases convulsions occur, which are the result of the derangement of the spinal chord and its nerves. [Convulsions, in Arts and Sc. Div.] Convulsive diseases may arise from three causes: 1, from irritation of the excitor nerves; 2, from deranged or morbid conditions of the spinal chord or medulla oblongata; or 3, from a combination of these two. Such conditions of the nervous system are seen in the convulsions of hydrophobia, tetanus, epilepsy, and hysteria. When these diseases destroy life, it is usually by suspending the respiratory movements, the muscles effecting which being fixed by the spasms prevent the ingress and egress of air to and from the lungs.

The Medulla Oblongata [Brain] is distinct from the spinal chord and the brain, although it has an intimate relation with both. From this relationship arises one of its special functions, which appears to be, to bring the parts of the nervous system above and below it into intimate connection. It also serves as a centre for the reflex operations of the nerves which issue from it. These reflex actions are connected with the most important functions in the life of animals—Deglutition and Respiration. This explains the fact that the activity of almost every other portion of the nervous system may be suspended, and yet life continue, but should the functions of the medulla oblongata cease, death ensues.

"The chief excitor nerve of the Respiratory Movements, is the afferent portion of the par vagum; but the afferent portion of the fifth pair is also a powerful excitor; and the afferent portions of all the spinal nerves, conveying impressions from the general surface of the body, are also capable of contributing to the excitement necessary for the production of the movement. The chief motor nerves are the phrenic and intercostals, which, though issuing from the chord at a considerable space lower down, probably originate in the medulla oblongata. The motor portions of several other spinal nerves are also partly concerned, as are also the facial nerve, the motor portion of the par vagum, and the spinal accessory. The ordinary movements of respiration involve little action of any motor nerves but the phrenic and intercostal; and it is only when an excess of the stimulus (produced for example by two long a suspension of the aërating process) excites extraordinary movements, that the nerves last enumerated are called into action.

"The acts of prehension of food with the lips, and of mastication, though usually effected by voluntary power in the adult, seem to be capable of taking place as a part of the reflex operation of the medulla oblongata in the infant, as in the lower animals. This is particularly evident in the prehension of the nipple by the lips of the infant, and the act of suction which the contact of that body (or of any resemblance it) seems to excite. The experiments provided for us by natu

the production of anencephalous monstrosities, fully prove that the integrity of the nervous connection of the lips and respiratory organs with the medulla oblongata, is alone sufficient for the performance of this action; and experiments upon young animals from which the brain has been removed establish the same fact. Thus Mr. Grainger found that upon introducing his finger moistened with milk, or with sugar and water, between the lips of a puppy thus mutilated, the act of suction was excited, and not merely the act of suction itself, but other movements having a relation to it: for as the puppy lay on its side sucking the finger it pushed out its feet in the same manner as young pigs exert theirs in compressing the sow's dugs. This action seems akin to many of those by which the lower animals take in their food; and we may thus recognise in the medulla oblongata a distinct centre of reflex action for the reception and deglutition of aliment, analagous to the stomato-gastric ganglia of invertebrated animals. In the movements of deglutition, which as formerly explained are purely reflex, the chief excitor is undoubtedly the adherent portion of the glosso-pharyngeal nerve. It is found that, if the trunk of this nerve or its pharyngeal (but not its lingual) branches be pinched, pricked, or otherwise irritated, whilst still in connection with the medulla oblongata, the movements concerned in the act of swallowing are excited. The same occurs if when the trunk of the glosso-pharyngeal has been divided, the cut extremity in connection with the medulla oblongata is irritated; but little or no muscular contraction is produced by irritation of the separated extremity, whence it is apparent that the glosso-pharyngeal has little or no direct motal power, but acts as an excitor. In this it appears to be assisted by the branches of the fifth pair distributed upon the fauces; and probably also by the branches of the superior laryngal distributed upon the pharynx. The motor influence, which is generated in respondence to the stimulus thus conveyed, appears to act chiefly through the branches of the par vagum, which are distributed to most of the muscles concerned in swallowing; but the facial, the hypoglossal, the motor portion of the fifth, and perhaps also the motor portion of some of the cervical nerves, are also concerned in the movement, and may effect it, though with difficulty, after the pharyngeal branches of the par vagum have been divided.

"In the propulsion of the food down the œsophagus, to which the glosso-pharyngeal nerve does not extend, the muscular contraction, so far as it is of a reflex nature, must depend upon the œsophageal branches of the par vagum alone; their afferent portion being the excitor, and their motor portion giving the requisite stimulus to the muscles. The same must be the case in regard to the muscular contractions of the cardiac and piloric sphincters, and of the walls of the stomach, so far as regards their dependence upon the nervous system at all; but the degree of this is doubtful. It is also through the reflex actions of the medulla oblongata that the aperture of the glottis is regulated. [LARYNX], and the regulation of the aperture of the iris in the eyes is effected." [EYE.]

That part of the brain which gives origin to the olfactory, optic, and auditory nerves, is seen in the lower animals, especially in fishes, to consist of separate and independent ganglia. In the human brain they are not so distinct, but at the base of the brain two ganglionic masses are observed which are called the corpora striata and thalami optici. [BRAIN.] The fibres forming these two masses may be readily separated, for we find that, whilst the fibres passing to the corpora striata give rise to none but motor nerves, those that pass to the thalami afford origin to sensory nerves.

The functions of this group of ganglia may be partly inferred from the results of experiments, and these have been chiefly made upon the optic ganglia, or corpora quadrigemina. The partial loss of the ganglion produces temporary blindness in the eye of the opposite side, and partial loss of muscular power on the opposite side of the body; and the removal of a larger portion, or the complete extirpation of it, occasions permanent blindness or immobility of the pupil, and temporary muscular weakness on the opposite side.

"This temporary disorder of the muscular system sometimes manifests itself in a tendency to move on the axis, as if the animal were giddy; and sometimes in irregular convulsive movements. Here then we have proof of the necessity of the integrity of this ganglionic centre for the possession of the sense of vision; and we have further proof that the ganglion is connected with the muscular apparatus by motor nerves issuing from it. The reason why the eye of the opposite side is affected, is to be found in the decussation of the optic nerves. The influence of the operation on the muscles of the opposite side of the body is at once understood from the fact of the decussation of the motor fibres in the anterior pyramids.

"Thus we see that the optic ganglia receive the impressions from the eyes by the optic nerves, convert them as it were into sensations, and also transmit motor impulses to the muscular system, in respondence to those sensations. Thus they have much analogy to the cephalic ganglia of the lower animals, the greater part of whose purpose seems to be to guide the actions of the beings to which they belong through the sensations which they receive. But with a function which is probably the same, there is this important difference, as to the purpose served by these parts, in the encephalon of man, and of the animals that approach nearest to him, in the conformation of his nervous centres.

"The consensual or instinctive movements which make up nearly the whole of those actions in the *Invertebrata* that are not simply reflex, constitute a comparatively smaller proportion of the actions of the higher *Vertebrata;* these being guided in a much greater degree by intelligence, which reasons upon the sensations, and devises means to gratify the desires created by them. Consequently there is reason to think that the direct action of the sensory ganglia upon the muscles is comparatively seldom exercised in the active condition of the cerebrum.

"There are certain actions however which would seem to take place regularly through this channel. Thus the consensual movements of the eyes, which concur to direct their axis towards the same object, appear to depend upon the impressions made upon the retina, for we do not see these movements taking place with nearly the same exactness in the eyes of persons who have been born totally blind; and in those who have completely lost their sight after having enjoyed the power of vision, we may also perceive that although the two eyes move consentaneously from habit, yet that their axes are parallel instead of convergent, so that they do not seem to look at any object but beyond it into vacancy.

"The existence of a Sensation of some kind, in connection with a Muscular exertion, seems essential to the continuance of the latter. Our ordinary movements are guided by what is termed the muscular sense, that is, by a feeling of the condition of the muscle that comes to us through its own sensory nerves. How necessary this is to the exercise of muscular power may be best judged of from cases in which it has been lost. Thus a woman who had suffered complete loss of sensation in one arm, but who retained its motor power, found that she could not support her infant upon it, without constantly looking at it; and that if she were to remove her eyes for a moment the child would fall, in spite of her knowledge that her infant was resting on her arm, and of her desire to sustain it. Here, the muscular sense being entirely deficient, the sense of vision supplied what was deficient so long as it was exercised upon the object, but as soon as this guiding influence was withdrawn, the strongest will could not sustain the muscular action. Again, in the production of vocal sounds, the nice adjustment of the vocal larynx, which is requisite to produce determinate tones, can only be effected in obedience to a mental conception of the tone to be uttered; and this conception cannot be formed unless the sense of hearing has brought similar tones to the mind. Hence it is, that persons who are born deaf are also dumb. They may have no malformation of the organs of speech, but they are incapable of uttering distinct vocal sounds or musical tones because they have not the guiding conception, or recalled sensation of the nature of these. By long training, and by efforts directed by the muscular sense of the larnyx itself, some persons thus circumstanced have acquired the power of speech; but the want of sufficiently definite control over the vocal muscles is always very evident in the use of the organ.

"Various other facts might be adduced to show that in man certain movements are as intimately connected with the excitement of sensations in the sensory ganglia as others are with the production of impressions in the ganglia of reflex actions. And it may be further questioned, in the absence of any precise knowledge upon the subject, whether the emotions, when so strongly excited as to act involuntarily on the body, do not operate through this group of ganglia and the fibres proceeding from them.

"There are many analogies between the purely emotional actions of man and the instinctive movements of the lower animals, each following closely upon sensations, without any exercise of the reasoning faculty, and each being performed not merely without the mandate of the will, but often in direct opposition to it. That the emotions, when they thus affect the body, do not operate through the same set of nervous fibres as those which convey the influence of the will, seems proved by this fact—that cases have occurred in which muscles have been paralysed by the will, whilst they remain obedient to the emotions; and vice versâ. Thus, in one instance the muscles of one side of the face were palsied in such a manner that the individual could not voluntarily shut his eye nor draw his mouth towards that side, yet when any ludicrous circumstance caused him to laugh, their usual play was manifested in the expression of his countenance; and in another case the muscles were in obedience to the will, but when the individual laughed or cried, under the influence of an emotion, it was only on one side of the face. To these may be added another case in which the right arm was completely palsied, so that the individual had not the least voluntary power over it; yet it was violently agitated whenever he met a friend whom he desired to greet. These and similar cases afford sufficient proof that the direct influence of the emotions on the muscular system operates through a channel distinct from that which conveys the influence of the will; and when we consider how closely the emotions are connected with the sensations which excite them, and their close analogy with the instincts of the lower animals, there seems a strong presumption in favour of the idea that the motor nerves proceeding from the sensory ganglia constitute their peculiar instrument of operation on the body.

"A very characteristic example of the immediate dependence of the action of this class upon sensations, is afforded by the peculiar movements which are excited by the act of tickling."

No one can question the completely involuntary nature of these movements; on the other hand, they are not reflex, for they do not take place unless the irritation is felt.

Now the tickling may produce not merely a variety of semi-convulsive movements, tending to withdraw the body from the source of irritation, but also a tendency to laughter, and an emotional state connected with it. But it would appear that the semi-convulsive movements are immediately excited not by the emotion but by the sensation; for there is a great variation amongst different individuals as to the results of the irritation, the action of laughter being excited in some, without any other effect; whilst in others, spasmodic movements of the extremities take place without any tendency to laughter, indeed with a feeling of extreme distress.

In many Diseases the influence of emotional states are remarkable. In Hydrophobia and Hysteria convulsions are frequently brought on by causes that excite emotional states. In hydrophobia the sight or sound of moving water will sometimes produce frightful paroxysms, whilst in hysteria the sight of one individual labouring under an attack will produce it in another. Many of the phenomena presented by persons in the mesmeric state may be also traced to an excessive activity of the consensual or emotional system, so that slight impressions produce powerful effects. If it is also recollected that such individuals have frequently a morbid desire of gratifying the wishes of those who witness them in the expectation of seeing marvels, a further explanation is afforded of the singular phenomena presented by persons in this state.

The functions of the Cerebellum [BRAIN] have been the subject of much discussion. According to phrenologists [PHRENOLOGY, A. & SCI. DIV.], this organ is the seat of the sexual instinct. This doctrine derives little or no support from comparative anatomy, as there is no correspondence between the size of this organ and the strength of this instinct among the lower animals. Nor does it appear to be always the case that there is a derangement of the sexual instinct where there is disease of this organ. The more probable view of the functions of the cerebellum seems to be that it is in some way connected with the functions of locomotion. Its development in the lower animals corresponds with the variety and energy of the muscular movements, whilst injury to this organ is invariably attended with derangements in the functions of locomotion. From experiments upon all classes of vertebrated animals it has been found that when the cerebellum is removed, the power of walking, flying, standing, or maintaining the equilibrium of the body is destroyed. It does not seem that the animal has in any degree lost the voluntary power over its individual muscles, but it cannot combine their actions for any general movements of the body. Again, it is found that when the cerebellum is diseased, the motor function of the muscles is not destroyed, but that the same want of combining or harmonising the movements of the body result as are observed when the cerebellum is injured.

From what has been previously said, it will be seen that the cerebral lobes, although so important in man and the higher animals, are, after all, not the fundamental portions of the nervous system. They are the last-formed portions of the nervous system, and all the functions of animal life can be carried on without them. But whilst this is the case there is no doubt that the cerebral hemispheres are the seat of all those phenomena which we call intelligence, and which distinguish so greatly man from the lower animals. The substitute for intelligence in the lower animals is what we call instinct. The distinction between actions resulting from the operation of these two principles are very evident. In intelligence there is an intentional and known end produced, as the result of definite ideas; whilst in instinctive actions there are no preceding ideas and no knowledge of the end to be attained. Such actions are purely automatic. Because instinctive actions evince design, it is no proof that the animal exhibiting them is aware of the design. In fact, the great mass of instinctive actions are so perfect, that none of the results of intelligence can equal them. The bee builds its cells with inimitable certainty; the *Chætodon rostratus* projects from its prolonged snout a drop of water, which strikes the insects that are flying above its head, and thus secures them as its prey. The great majority of the actions of the lower animals are purely instinctive and automatic; and many even of those which possess cerebral lobes lead rather an instinctive than an intelligent life. So even with man, many of the actions of his life are instinctive, especially those which are performed during infancy.

That the cerebral lobes are the seat of Intelligence, seems to be proved in various ways. When they are destroyed the animal or human being is no longer capable of exhibiting the functions of intelligence. At the same time this is not the case when one lobe of the brain only is destroyed, for when this is the case from disease or accident, persons have been known to perform all the ordinary acts of intelligence. This has led to the conclusion that just as all the functions of seeing or hearing can be performed by one eye or one ear, so all the functions of the mind may be performed by one lobe of the brain. The arguments in favour of this view have been well developed by Dr. Wigan in his work on the 'Duality of the Mind.'

In cases of children who are born with a deficiency of the cerebral lobes, we find a deficiency of intellectual activity. In the case of many idiots there is simply a want of size of brain. This is remarkably exemplified in the case of the two Aztec children recently exhibited in London, whose brains are exceedingly small, and whose want of intelligence corresponds with this deficient development of their brains. It is thus we find there is some truth in the phrenological axiom [PHRENOLOGY, *loc. c.*] that the size of the brain is the measure of its power. But this is only true in respect of the gray matter, as there can be little doubt that the vesicular or gray matter of the cerebral lobes is the seat of intelligence. In regard to the human brain it holds good as far as the operations of the understanding are concerned, and persons with large heads are remarkable for the influence they exercise over the judgments and acts of others. In the case however of those intellectual operations which we call Genius, and which seem to take their rise in the feelings and to address the feelings, it is not found that there is any relation between the size of the cerebral lobes and its manifestations, persons manifesting considerable genius possessing but small brains.

It appears to be perfectly true that varieties of mental character accompany varieties in the form of the brain, and that the manifestations of intelligence vary according to the temperament of various individuals.

All the operations of the mind are dependent upon sensations. Without sensation there is no development of intelligence. A blind man has no idea of colour; he has had no impression of colour produced upon his eye, and consequently no idea formed in his mind. The seat of Sensorial Consciousness, as we have seen, is evidently the sensorial ganglia; but in animals without cerebral lobes there can be no impressions produced, such as we call sensations; these are in fact ideas or impressions produced upon the cerebral lobes by the transmission of the impressions upon the sensory ganglia upwards. Thus we find the sensory ganglia producing reflex automatic movements by acting on the spinal chord below, and becoming the source of ideas to the cerebral lobes above. Dr. Carpenter, to whom physiologists are deeply indebted for the masterly manner in which he has investigated the whole of this subject, goes farther than this, and states his opinion that the sensory ganglia constitute the seat of consciousness, "not merely for impressions on the organs of sense, but also for changes on the cortical substance of the cerebrum; so that until the latter have reacted downwards upon the sensorium we have no consciousness either of the formation of ideas or of any intellectual process of which these may be the subjects."

Although it follows from this that animals without cerebral lobes have no ideas, we may suppose that the conditions of their consciousness would produce the feelings of pleasure and pain; and just as these feelings are produced by external impressions, so do ideas of pleasure and pain produce emotional states of the mind, which determine the character of our thought and influence our conduct. The sentiments and propensities dwelt on by mental philosophers [PHRENOLOGY, *loc. c.*] seem to take origin in this way,—the activity of the sentiment of Benevolence or Malevolence having for its excitement the idea of an object to be loved or hated, and so on with the other sentiments, and what are called the propensities. "The same view may be applied to the love of Truth, of Beauty, of Sublimity, of Goodness, of Order, of Possessions, of Country, &c., and also to Cheerfulness, Wit, Humour, &c., and to many conditions usually considered as purely intellectual. And in fact the association of sensorial pleasure with any idea or class of ideas gives it an emotional character; so that emotional states are not by any means limited within the categories which most psychologists have attempted to lay down; these being for the most part generic terms, which comprehend certain groups of ideas bearing more or less similarity to each other, but not by any means including all possible combinations."

We have seen how the movements of the body may be influenced by impressions made upon the sensory ganglia, and we can now see how it is that ideas may become the source of movements. In persons who are 'ticklish' it is not necessary to tickle them to make them laugh, but the mere idea of tickling produced by pointing the finger will set them off. Thus throughout the whole series of emotional ideas they may be recalled without sensations so as to produce movements. Such movements may or may not be under the control of the will. That they are not always so, that there is frequently an antagonism between the emotions and the will, Dr. Carpenter regards as evidence that the seat of the emotions is different from that of the will. It also sometimes happens that muscles paralysed to volitional will act under the influence of emotional impulses, and vice versâ. This subject is fraught with lessons of practical value. In the education of the human being it becomes of the utmost importance so to cultivate the will that it may control those tendencies to impulsive action which are the result of the various emotional states. Excessive indulgence in particular feelings constantly lead to those conditions of insanity which are known by the name of Monomania. [INSANITY, in ARTS AND SC. DIV.] In certain forms of hysteria, and in habitual stammering we have also instances of the loss of control of the will over muscular actions, brought on by emotional states.

The result of the activity of the cerebral lobes in the way we have pointed out, is to produce what are called the Intellectual Powers. To these we can only briefly refer. Thus the first in order of these is called the Association of Ideas, which consists in the production of such a connection between two or more ideas, that the consciousness of the one tends to bring the other before the mind—one idea, or set

of ideas, tending to the production of other ideas. This is called Suggestion. The activity of this power lies at the foundation of the intellectual qualities of man. It is owing to this association of ideas that he is enabled to trace the relation of cause and effect. It is through this same power of associating ideas that he is enabled to separate those things which differ, and to combine those things which are alike; and thus to Classify, and also to arrive at general facts, from the investigation of special ones. It is also by means of this power that he is enabled to put his ideas into new forms, and to produce those results which are called Imagination.

When the consciousness is specially directed to the changes going on in the sensorium, whether these are produced by objects from without, or by the operation of the brain itself, the act is called Attention. This condition may be either produced by an effort of the will, or it may occur as the result of the irresistible attraction of the object or train of thought going on in the cerebrum. Memory occurs when past states of consciousness are reproduced by the association of ideas. From what we know of the exercise of this faculty, it would appear that every sensory impression is registered in the cerebral organisation, whether individuals are conscious of it or not. Thus persons will entirely forget for days and weeks, or even longer periods, facts which are nevertheless duly registered in their minds. An extraordinary case of this kind is related, in which a poor woman, during the delirium of fever, was discovered to be repeating passages from the Psalms in Hebrew. When she recovered she was quite unconscious of any knowledge of Hebrew, but in the early part of her life she had lived in the family of a clergyman who was in the habit of repeating frequently in her hearing parts of the Psalms in Hebrew. In this instance the woman must have acquired her knowledge unconsciously. Memory is either voluntary, when it is called Recollection, or it is automatic, reproducing ideas without the direct interference of the will.

When we attend to our own mental operations a very different class of ideas is called up from those which are produced by external objects. This class of ideas is entirely dependent on the intellectual powers, and they have no relation to sensations, but are the original source of all our knowledge. To this class of ideas we may refer the Beliefs in our own present existence, in our past existence, and in our personal identity; the Belief in the external and independent existence of the causes of our sensations, the Belief in an efficient cause for all things around us, the Belief in the stability of the order of nature, and in our own free will. Amongst those elementary modes of thought which arise from the constitution of our minds we must rank the ideas of Truth, Beauty, and Right; and closely connected with these are the ideas connected with the being and attributes of Deity.

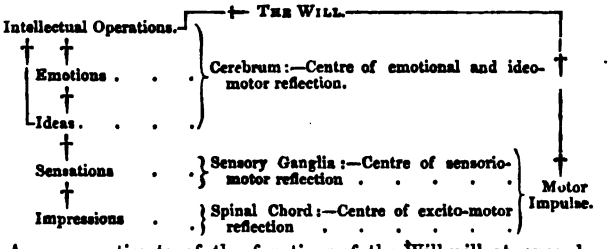
Upon the sensational and intellectual ideas thus brought before the mind, all acts of what is called Reasoning are founded. These consist for the most part in the aggregation and collocation of ideas, the resolution of compound ideas into simple ones, and the combination of simple ideas into general expressions. In these processes the faculty of Comparison, by which the connection and relation of ideas are perceived, is exercised; also that of Abstraction, by which we separate and isolate particular qualities of an object; and Generalisation, by which the qualities of an object or objects which are alike are brought together.

One of the most interesting and important points in connection with the function of the cerebral hemispheres is the influence of what we call Will, not only on the intellectual powers, but on the whole of the functions of the nervous system. We have seen that the functions of the spinal chord, the medulla oblongata, and the sensory ganglia, are to a certain extent under the influence of the will, whilst on the other hand we find them constantly acting automatically and independently of any control on the part of the will. What the real nature of the will is presents a difficulty not yet overcome, and perhaps never will be, and we can only speak of the conditions of its action. In order that the will may act it appears necessary that there should be in the first place a distinct idea of the object to be attained, and secondly, that there should be a belief in the possibility of attaining it by the means employed. It is also found that, cæteris paribus, the degree of intensity with which the will acts, is in proportion to the concentration of the attention upon the effort it is making. It is a curious fact, and one which Dr. Carpenter has recently pointed out, that the influence of the will in the production of muscular effort may be superseded or supplanted by the simple Dominance of Ideas. This condition is seen in persons who are what is called 'electro-biologised,' or in the mesmeric trance. Persons in this state are readily brought under the dominance of a single idea, suggested by the operator from without, and in consequence of the attention being thus concentrated, they are capable of performing feats of strength of which they are otherwise quite incapable. Just as the will by its influence can produce, by its activity, a paralysing effect on muscular activity, arising from emotional or other causes, so a dominant idea in this condition will entirely suppress the action of the muscular system. Persons are told they cannot open their eyes, and they do not; that they cannot move, and they remain fixed. In the condition brought on by the electro-biologists, as they call themselves, and in the induced sleep of the mesmerist, most of the phenomena can be traced to this cause. This extends not only to their corporeal condition, but also to their mental states. The three conditions necessary to produce the phenomena which have so greatly astonished the world seem to be:—

First, a condition of the cerebral lobes in which, without the consciousness of the individual, they readily come under the influence of ideas suggested by others from without. Secondly, the dominancy of these ideas in the mind, so as to preclude all interference with them on the part of other ideas. Thirdly, an intensification of the nervous energy in the production of the effects upon the muscular system or mind resulting from the dominancy of the idea suggested. (Carpenter, 'Human Physiology.' Carpenter, in 'Quarterly Review,' 1854.)

In states quite independent of those induced for the sake of amusement by electro-biologists and mesmerists, the same condition of the brain comes on. Thus, in what is called Reverie, persons are influenced by external sensations, without the controlling influence of the will. This is called day-dreaming. What is called Absence of Mind is also a condition in which the mind is acting automatically. Sleep-Walking is also a natural occurrence, and in this state persons display much the same phenomena as under the mesmeric and other influences. [SOMNAMBULISM, A. & SCI. DIV.] In Dreaming also we have the same general condition, in which there is no control of the will. Here however the person is under the influence of his own suggestions, although not unfrequently the course of the dream may be dependent on suggestions from without. [SLEEP.] The diseased conditions known as Delirium and Mania are also other instances in which the cerebral lobes are as it were abandoned to the influence of suggestion, without the control of the will. [INSANITY, in ARTS AND SC. DIV.]

It is from conditions like these that it is concluded that in all those states in which the directing power of the will over the current of thought is suspended, the course of action is determined by some dominant idea, which for the time has full possession of the mind, and from which the individual has no power of withdrawing his consciousness. So that we here see that the influence of the idea is similar to that of the sensation, or the excitant in producing movements. Dr. Laycock proposes to call actions thus produced Ideo-motor. The following diagram, after Dr. Carpenter, will afford a complete view of this series of actions:—



A proper estimate of the functions of the Will will at once show that it is of all the faculties possessed by man the one which most distinguishes him, and influences his character. From it in a great measure arises his moral and religious character. His Habits, his Feelings, his sense of Right and Wrong, are dependent for their development and their varied character in different individuals upon the way in which they have been acted upon by the will. It is the possession of will that constitutes man a free agent, and gives him the sense of responsibility.

"From the time when the human being first becomes conscious that he has a power within himself of determining the succession of his mental states, from that time does he begin to be a free agent; and in proportion as he exerts that power, does he emancipate himself from the domination of his constitutional or automatic tendencies. It is a principle now recognised by all the most enlightened educators, that the development of this power of self-control ought to be the object of all nursery discipline; and the process of its acquirement is very gradual. When an infant is excited to a fit of passion by some unpleasant sensation, its nurse attempts to restore its equanimity by presenting some new object to its attention, so that the more recent and vivid pleasurable impression may efface the sense of past uneasiness. As the infant grows into childhood, the judicious parent no longer trusts to mere sensory impressions for the diversion of the passionate excitement, but calls up in its mind such ideas and feelings as it is capable of appreciating, and endeavours to keep the attention fixed upon these until the violence of the emotion has subsided; and recourse is had to the same process whenever it is desired to check any tendency to action which depends upon the selfish propensities—appeal being always made to the highest motives which the child is capable of recognising, and punishment being only had recourse to for the purpose of supplying an additional set of motives when all others fail. For a time this process of external suggestion may need to be continually repeated, where there are strong impulses whose unworthy character calls for repression; but if it be judiciously adopted, and consistently persevered in, a very slight suggestion serves to recall the superior motives to the conflict. And in further space, the child comes to feel that he has himself the power of recalling them, and of controlling his urgent impulses to immediate action. The power of self-control, thus usually acquired in the first instance in regard to those impulses which directly determine the conduct, gradually extends itself to the habitual succession of the thoughts; and in proportion as this is brought under the direction of the will, does the individual

become capable of forming his own character, and therefore truly responsible for his actions. It must not be forgotten however, that the power of self-control may be turned to a bad as well as to a good account; and that the value of its results will entirely depend upon the direction in which it is employed. The thoughts may be so determinatively drawn away from the higher class of motives, the suggestions of conscience so habitually disregarded, and the whole attention so completely fixed upon the gratification of selfish or malevolent propensities, that the human nature acquires far more of the Satanic than of the Divine character; the highest development of this type (if the term may be permitted) being displayed by those who use their power of self-control for the purposes of hypocrisy and dissimulation, and cover the most malignant designs under the veil of friendship.

"Such men (whose portraiture is presented by our great dramatist in the character of Iago) show us to what evil account the highest intellect and the most powerful will may be turned when directed by the baser class of motives; and we cannot but feel that they are far more degraded in the moral scale than those who, having never learned to control their animal propensities, and being unconscious of the very existence of a higher nature within themselves, simply obey the promptings of their automatic impulses, and are rather to be considered as ill-conditioned automata than as vicious men. Of this latter class, some, from original constitution and early influences of the most degrading kind, seem altogether destitute of anything but a brutal nature; such ought to be treated as irresponsible beings, and as such restrained by external coercion from doing injury to society. But this class is small in proportion to that of individuals who act viciously simply because they have never been led to know that any other course is open to them, or to feel any motive that might give them a different impulse. With these the object should rather be to awaken the higher parts of the moral nature, 'to find out the holy spot in every child's heart,' and to develop habits of self-control in the manner just described, than to subjugate by external restraint; and the success which has attended this method, in the hands of those who have judiciously applied it, is sufficient evidence of its superiority; many of the most apparently-debased natures having been thus elevated to a grade which it seemed at first impossible they could ever attain. From the Satanic or positively and wilfully evil type of human nature, in which the highest powers are turned to the worst account, we are thus conducted through the brutal or negatively evil type, towards that higher aspect of humanity which is presented by those who habitually keep before them the Divine ideal, and who steadily endeavour to bring their whole nature into conformity with it. This is not to be effected by dwelling exclusively on any one set of the motives already referred to, as those which the truly religious man keeps before his mind. Even the idea of duty, operating alone, tends to reduce the individual to the subservience of a slave, rather than to induce in him that true mastery over himself which consists in such a regulation of his emotions and propensities, that his course of duty becomes the spontaneous expression of his own higher nature; but it is a most powerful aid in the acquirement of that regulation, by the fixation of the thoughts and affections on 'things on high,' which is the best means of detaching them from all that is earthly and debasing. It is by the assimilation, rather than by the subjugation, of the human will to the divine that man is really lifted towards God; and in proportion as this assimilation has been effected, does it manifest itself in the life and conduct; so that even the lowliest actions become holy ministrations in a temple consecrated by the felt presence of the Divinity. Such was the life of the Saviour; towards that standard it is for the Christian disciple to aspire." (Carpenter, 'Human Physiology,' page 848.)

In the previous view of the Nervous System we have not spoken of the Sympathetic Nerve.

The system of the great Sympathetic Nerve is that whose branches are distributed to all the organs of organic life, the heart, lungs, digestive canal, and glands, &c., chiefly following the course of the blood-vessels, bearing numerous and large ganglia in all parts of their course, and communicating with the brain and spinal chord or their nerves only by few and small filaments. The parts to which the branches of the sympathetic nerve are distributed have but vague if any sensibility, unless under peculiar circumstances of disease; and the motions which some of them possess are usually quite independent of the mind. Numerous experiments of irritating the ganglia of the sympathetic to see whether it produces pain, have had unsatisfactory results; nor would any results of apparent insensibility be conclusive, because the ganglia might, like part of the brain, be insensible to injury, though fully capable of perceiving the impressions transmitted to them through their nerves. But the pain of the diseases of internal organs is amply sufficient to prove their sensibility, though it does not determine whether the impression of pain is conveyed through filaments of the sympathetic system or through those few of the cerebro-spinal system which are mingled with the former in the common sheath. In the same manner, in extraordinary cases, the brain and spinal chord have an evident influence on the motions of the organs supplied by the sympathetic nerve, as in the effects of strong passion and other mental affections on the circulation, the digestive functions, &c. The impressions conveyed from the viscera to the brain and spinal chord may also be reflected either to the voluntary muscles, as in the convulsions of children with disordered digestion, or to the involuntary muscles, as in the increased rapidity of pulse, the sickness, &c., which occur in various diseases.

In the natural state however, the organs chiefly supplied by the sympathetic nerves are entirely independent of the cerebro-spinal system, and will maintain their actions for a time even after their removal from the body. Thus the peristaltic motion of the intestines, the contractions and dilatations of the heart of some animals, and some other similar actions, will continue for a considerable time after they are separated from the body, or after all the nerves passing to them have been divided. Many other facts prove also that the internal organs are much less dependent on the influence of the sympathetic nerve than the external animal organs are on that of their cerebro-spinal nerves: severe irritation of the sympathetic nerves, such as, if applied to the cerebro-spinal motor nerves, would excite sudden and violent convulsions of their muscles, gives rise to but weak and slow contractions of the viscera; and these follow at perceptible intervals after the application of the stimulus, so that it is often difficult to say whether the irritation has exerted any influence at all.

The office of the numerous ganglia placed in the course of the sympathetic nerves is perhaps the most obscure point in the whole range of physiology. Some have regarded them as so many brains, by which impressions are received through the branches of which each ganglion is the centre, and from which excitements to motion are sent out; others have believed that they exercise a power of isolating the organs they supply from the influence of the mind or of obstructing the constant passage of impressions to and from the brain; and many other functions have been supposed to be performed by them; but for each and all the evidence is altogether unsatisfactory.

The Sympathetic Nerve, or system of nerves, has received its name from the idea that it is of ultimate importance in the phenomena of what is called sympathy, in which one part of the body is affected in consequence of some peculiar condition of another. A great number of the phenomena which were formerly regarded as the effects of sympathy are now more clearly explained by the reflecting action of the cerebro-spinal axis; many others depend on some generally operating influence, as a peculiar condition of the blood, &c.; and in those that remain it is questionable whether the sympathetic system of nerves exercises any peculiar power. The universality of its distribution among the viscera is the only ground on which it can be believed to possess this property of exciting impressions or actions in one, in consequence of being itself excited by the condition of another.

It exerts a more evident influence in the various secretions of the glands and other surfaces which it supplies. In some instances the excitant to secretion is conveyed primarily from the brain, either directly, as in the flowing of tears in grief, &c., or by a reflex action, as in the tears that flow when the mucous membrane of the nose is irritated, or as in the flow of saliva in a strong irritation of the membrane of the mouth, in the sweating of fear or of great agony, &c. In the more constant secretions the influence of the sympathetic nerves is in some degree assumed; but there are sufficient facts to prove that their injury is very soon followed by a suppression or modification of the secretion in the organ to which the injured nerves are destined. The cerebro-spinal nerves also exercise an influence on the secretion and nutrition of the parts which they supply; but its amount is indistinct, in consequence of the interruption of other circumstances favourable to those processes, by the same injury which cuts off the secretory power of the nerves, as the loss of exercise of the muscles, &c.

(The literature upon the Nervous System is very extensive. In the preceding article we have almost exclusively consulted the works of Dr. Carpenter, whose several physiological works contain by far the best account of the physiology of the Nervous System with which we are acquainted. The following are the works of Dr. Carpenter which have been consulted and used in this article:—'Principles of Human Physiology,' 4th edition, 1853; 'Principles of Comparative Physiology,' 4th edition, 1854; 'Principles of Physiology, General and Comparative,' 3rd edition, 1851; 'Manual of Physiology,' 1846. The best account of the Histology of the Nervous System will be found in Kölliker's 'Manual of Human Histology,' translated for the Sydenham Society by Messrs. Busk and Huxley. The following works may also be consulted with great advantage on both the structure and functions of the Nervous System:—Valentin, 'Text-Book of Physiology,' translated by Brinton; Müller, 'Physiology,' translated by Baly; Marshall Hall, 'Memoirs on the Nervous System;' Newport, article 'Insecta,' in 'Cyclopædia of Anatomy;' Noble, 'On the Brain;' Todd, 'Anatomy of the Brain and Spinal Cord;' Kirks and Paget, 'Handbook of Physiology;' Unzer and Prochaska, 'On the Nervous System,' translated by Laycock for the Sydenham Society.)

NERVOUS TISSUE. [NERVOUS SYSTEM.]

NE'SEA (Lamouroux), a genus of Corallines.

NESOTRAGUS. [ANTILOPEÆ.]

NETTLE, a name applied to various plants. The true Nettles are various species of the genus *Urtica*, well known for their stinging properties, which are owing to the presence of an acrid poisonous secretion that in some Indian species is so dangerous as to cause excruciating pain and even death. Dead-Nettles are species of *Lamium*,

monopetalous plants belonging to *Labiatæ*, and wholly inert. The Nettle-Trees belong to the genus *Celtis*, also destitute of stinging properties, but having leaves resembling those of some kinds of *Urtica*. [URTICA; LAMIUM.]

NEUROLITE, a Mineral occurring massive. Its texture is imperfectly foliated. Fracture uneven. Hardness 4·25. Brittle. Colour greenish-yellow. Opaque, or only translucent on the edges. Specific gravity 2·476. Before the blow-pipe it gives out water, becoming snow-white and fusible, but does not melt; with carbonate of soda it fuses slowly into a transparent glass, of a slightly yellow colour, which on cooling cracks in various directions.

It is found at Stanstead, in Lower Canada, and appears to form a vein about two inches wide. The following is an analysis by Dr. Thompson:—

Silica	73·00
Alumina	17·35
Lime	3·25
Magnesia	1·50
Peroxide of Iron	0·40
Water	4·30
	99·80

NEURO'PTERA (from *νεῦρον*, a nerve, and *πτερόν*, a wing), one of the orders into which the class *Insecta* is divided. The insects composing this order may be distinguished by the following characters:—wings, four in number, membranous, generally naked, and more or less transparent, but sometimes hairy; the mouth is usually fitted for mastication, or furnished with mandibles and maxillæ; the larvæ are provided with six legs, and are active; their metamorphosis is variable, but is usually semi-complete. The character which gave rise to the name, namely the minute reticulation of the nervures of the wing, will also in most instances serve to distinguish the insects of the present order from others. The May-Fly and Dragon-Fly afford familiar examples.

The order *Neuroptera* is divided by Latreille into three sections, to which he applies the names *Subulicornes*, *Planipennes*, and *Plicipennes*.

Subulicornes contains the Dragon-Flies (*Libellula*, Linn.) and the *Ephemeræ*. The larvæ of these insects are carnivorous, and live in the water, respiring by means of appendages situated on the sides or extremity of the body; the pupæ also live in the water, but leave that element to undergo the final transformation. In the perfect insect the wings are always reticulated, and when at rest are in some species horizontal, in others vertical; the compound eyes are very large and prominent; and the ocelli, or simple eyes, are two or three in number; the mandibles and maxillæ are covered by the labrum and labium; the antennæ are short, slender, and subulate.

The Dragon-Flies (*Libellulidæ*) have the four wings of equal length, the tarsi three-jointed, the antennæ very small and resembling minute bristles, the eyes extremely large, and generally approximated above; the fore part of the head, or what might be termed the face, has an inflated appearance; the legs are rather small, and the abdomen is elongated, sometimes cylindrical, and sometimes depressed, and terminated by membranous appendages. The larvæ and pupæ, both of which are active, nearly resemble the perfect insect in general form, and are remarkable for the great development of the labial apparatus, which is elongated and dilated at the extremity, and covers the fore part of the head like a mask.

The *Libellulæ* are divided into three genera by Fabricius. Those species which have the wings extended horizontally when at rest, the head almost globular, the eyes very large and meeting on the vertex, an elevation in front and close to the eyes, and the abdomen depressed, form the genus *Libellula* as restricted by that author.

The second genus (*Æshna*, Fab.) is chiefly distinguished by the cylindrical form of the abdomen and its greater proportionate length. The wings are as in *Libellula*, and the head is of the same globular form.

In the third genus (*Agrion*, Fab.) the wings when at rest are elevated perpendicularly; the head is transverse, and the eyes are widely separated. Examples of each of these genera are found in this country.

The second division of the *Subulicornes*, or the family *Ephemeridæ*, is distinguished from the *Libellulidæ* by the comparative softness of the parts of the mouth, they being of a membranous character in the insects of the present family, and the parts less defined; the tarsi are 5-jointed; the inferior wings are much smaller than the upper, and in some are absent; the abdomen is terminated by two or three long and hair-like appendages. They form the genus *Ephemera*, according to Linnæus, and were so called on account of their short term of life, that is, in the imago or perfect state.

The *Ephemeræ*, or May-Flies, Latreille states, usually appear at sunset, in fine weather in summer and autumn, on the banks of rivers, lakes, &c., and sometimes in such remarkable numbers, that after their death the surface of the ground is completely covered with them, and in certain districts on the continent they have been collected in cart-loads for manure.

These insects collect together in great numbers in the air, and fly in an undulating manner, constantly ascending and descending, and have a very beautiful appearance. The males are distinguished from the females by the abdomen being furnished with two articulated hooks at the extremity, and apparently the anterior legs and the terminal filaments of the abdomen are larger in this sex; the eyes are also larger. In some there are four compound eyes, two of which are elevated and larger than the others.

The female insect deposits her eggs in the water, and these are collected together in a mass, after which it dies, the duration of life in the perfect state being very short in both sexes. When however we trace them through the transformations, we find their existence is in reality a long one, for in the larva and pupa state some of them exist for two or three years. During this time they are generally hidden, at least in the day-time, in the mud or under stones; sometimes in horizontal holes in the banks of rivers.

The species of *Planipennes* have the antennæ composed of numerous joints, always longer than the head; the mandibles are well developed, and the posterior wings are nearly equal in size to the superior; they are either naturally extended or have the anterior portion simply folded beneath: the reticulations of the wings are very distinct, and they are naked; the maxillary palpi are usually filiform, or slightly thickened at the apex, shorter than the head, and 4-jointed.

This section is divided into four families:—

1st. The *Panorpidæ*, the species of which are distinguished by all the tarsi being 5-jointed, and the anterior portion of the head drawn out in the form of a snout or probocis.

It consists chiefly of the Linnæan genus *Panorpa*, which is now divided into the following genera:—*Nemoptera*, Latreille; *Bittacus*, Lat.; *Panorpa* proper, and *Boreus*, Lat.

The *Panorpa communis* of Linnæus is a common insect in hedges and in woods. It is about three-quarters of an inch in length, black; the snout and apical portion of the abdomen red; the elytra are irregularly spotted with black.

Of the genus *Boreus* we also have an example in this country; the *B. hyemalis*, a small insect, which is found usually in moss, and during the winter season.

2nd. The *Myrmeleonidæ*.—In this family the antennæ are more or less suddenly incrassated at the apex; the head is transverse, and the eyes project considerably; there are six palpi, of which the labial are usually the longest, and thickened at the apex; the first segment of the thorax is small; the anterior and posterior wings are equal, elongated, and when closed meet at an angle like the roof of a house; the abdomen is usually elongated, and furnished at the apex in the male sex with two appendages; the legs are short. These insects are found in the warmer portions both of the Old and New World: they form two genera according to Fabricius, *Myrmeleon* and *Ascalaphus*. The curious habits of the larva of the *Myrmeleon Formicarium*, a European insect, though not found in this country, have often attracted the attention of the naturalist. This insect is of a grayish colour, and short and broad form; the head is small, and furnished with a large pair of sharply-pointed mandibles, which serve both to seize its prey and to extract the juices upon which it lives. [MYRMELEON.]

The third family consists of the *Hemerobiidæ*, which are chiefly distinguished from the last group by their filiform antennæ; they moreover differ in having only four palpi. In some (the genus *Hemerobius*) the wings when closed meet at an angle, as in the Myrmeleons, whilst in others (*Semblis*) they are horizontal.

Hemerobius perla is common in our gardens, and is often seen flying about the lilacs, especially towards the evening. It is rather more than half an inch in length, of a green colour, and has transparent wings with numerous green nervures; its eyes resemble small globes of gold; when touched it emits a very disagreeable odour.

To the fourth family Latreille applies the name *Termitinæ*; it includes those Neuropterous Insects which have a semi-complete metamorphosis; they are terrestrial and active, and are either carnivorous or gnawers in all their states.

The *Mantispæ*, which Latreille places in this division, differ much from other insects of the order in having large anterior legs formed like those of the *Mantidæ*; their tarsi have never more than four joints; the mandibles are strong, and the wings have no folds; the inferior pair are either smaller or equal to the superior wings in size.

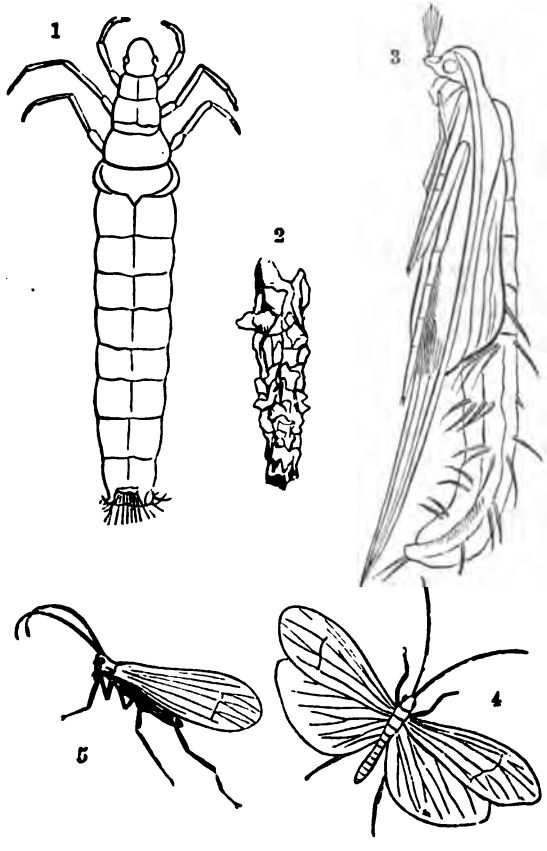
Besides the genus *Mantispa* this family includes *Raphidia*, *Termes*, and *Psocus*.

The last family of the *Planipennes* is the *Perlidæ*, in which the tarsi are 3-jointed, and the mandibles almost always small and partly membranous; the inferior wings are wider than the others, and are folded when not in use. This family contains the genera *Perla* and *Nemura*. The larvæ of the *Perlæ* live in the water, and inhabit sheaths which they construct by joining together various substances by means of a silken web which they spin.

The insects belonging to the third section, the *Plicipennes*, are well-known to anglers by the name of Caddis-Fly, and in the larvæ state they are called Caddis-Worm, or Cadew-Worm. They constitute the genus *Phrygania* of De Geer, and have been raised to the rank of an order by Messrs. Kirby and Spence and Dr. Leach, being the order *Trichoptera* of their systems.

The *Phryganiæ*, or Caddis-Flies, are distinguished from other Neuropterous Insects by the absence of mandibles and in the structure of their mouth; in fact they evince an approach to the Lepidopterous Insects as well as in some other characters; the wings are semi-transparent, and when closed meet at an angle, like the roof of a house; they are usually hairy, hence the name *Trichoptera*; the

posterior wings are longitudinally folded, and usually broader than the anterior pair; the head is small, and furnished with two simple eyes situated on the vertex, besides the ordinary compound eyes; the antennæ are very long and thread-like, and composed of very numerous indistinct joints; the palpi are four in number; the maxillary palpi have often five joints in the females, and the labial palpi are 3-jointed.



Caddis-Fly (*Phryganía*).

1, Larva of a species of *Phryganía*, magnified; 2, case inhabited by the larva; 3, the pupa, magnified; 4, the perfect insect with the wings expanded; 5, ditto, with the wings in the ordinary position when the insect is at rest.

The larva, or Caddis-Worm, always lives in the water, and incloses itself in a cylindrical case, open at both ends, and formed of pieces of stick, small shells, and various other substances, which the insect joins together by a silken web. It never quits this case, but when it wishes to move it protrudes the fore part of the body, which is furnished with six tolerably long legs, and crawls about with the case attached to the hinder part, it being held by means of two hooks situated on the last segment of the abdomen. The form of the larva is nearly cylindrical, but slightly compressed. The head and first three segments of the body (which in fact constitute the thorax) are coriaceous; the remaining segments are soft. When about to change into the pupa state the larva fixes its tube to some substance in the water, and closes the ends. The transformation is what is termed complete, the pupa resembling the perfect insect, except in having the wings imperfectly developed, and also in having two hooks on the fore part of the head, by means of which it makes its escape from the case, that it may swim to some dry situation when about to assume the perfect state.

The *Phryganiæ* are very numerous, and M. Pictet states that they abound more in the northern than in the southern parts of Europe. Their larvæ being always aquatic, they are generally found near the water; they fly chiefly in the evening, and are not unfrequently seen in immense numbers. The author just quoted, M. Pictet, has published a quarto volume with numerous plates, in which, after giving a detailed account of the anatomy and habits of these insects, he traces very many of them through all their stages. In this work, which is one of the most perfect monographs ever published, the *Phryganiæ* are divided into eight genera, as follows:—

1. *Phryganía* proper.—Distinguished by the superior wings having some transverse nervures near the bifurcation of the principal nervures, the posterior wings folded; the antennæ setaceous, and equal in length to the wings; maxillary palpi but slightly pubescent, those in the males 3-jointed, and those of the female having 5 joints; the terminal joint is ovate, and shorter than the two preceding taken together. Of this genus upwards of 30 species are known in Europe, some of which are the largest of the *Phryganidæ*.

2. *Mystacida*, Latreille.—Anterior wings straight and elongated, having a few transverse nervures; posterior wings much folded; antennæ setaceous and slender, longer than the wings; maxillary palpi 5-jointed in both sexes, long and pubescent.

3. *Trichostoma*, Pictet.—Anterior wings short, without transverse nervures; posterior wings but slightly folded; antennæ comparatively thick and short, the basal joint very hairy; maxillary palpi 3-jointed in the male, the terminal joint stout, and more densely clothed with hair on the apical portion than at the base.

4. *Sericostoma*, Latreille.—Anterior wings without transverse nervures; posterior small, and but slightly folded; antennæ stout and short, and having the basal joint long and thick; the maxillary palpi in the male shaped like the bowl of a spoon, and uniting to form a rounded muzzle. The larvæ of the species of this genus inhabit a case which approaches to a conical form, and is more or less curved; it is composed of pieces of sand and small stones joined together. The perfect insect is slow in its movements.

5. *Rhyacophila*, Pictet.—Anterior wings without transverse nervures; posterior wings straight, of the same form as the anterior pair, and almost destitute of folds; antennæ moderate; maxillary palpi 5-jointed in both sexes, the second joint almost as short as the first, and the terminal joint ovate; abdomen often terminated by coriaceous appendages. This genus contains many species, all of which are of small size.

6. *Hydropsyche*, Pictet.—Anterior wings without transverse nervures; posterior wings folded; antennæ slender; maxillary palpi 5-jointed in both sexes, the terminal joint almost equal in length to the other joints taken together, and very slender. This is also a numerous group. The larvæ live almost always in running waters. The perfect insect is often spotted.

7. *Psychomyia*, Latreille.—Anterior wings straight, pointed, and without transverse nervures; posterior wings resembling the anterior, and not folded; antennæ moderate; maxillary palpi 5-jointed in both sexes, the terminal joint long and slender.

8. *Hydroptila*, Dalman.—Anterior wings attenuated and pointed, very hairy, and with the nervures indistinct; posterior wings resembling the anterior, not folded; antennæ short and filiform; maxillary palpi 5-jointed in both sexes, the terminal joint ovate.

NEUROPTERIS. [Coal-Plants.]

NEUTRIA. [Hystricidæ.]

NEWFOUNDLAND DOG, a well-known and fine variety of the Dog, seldom seen in a state of purity, when it is comparatively small, but very muscular and strong, and generally black. The large, and it must be confessed, handsome dogs, which are so often seen in this country, and pass for Newfoundland Dogs ("dogs"—it is Colonel Hawker, if we recollect right, who so designates them—"as big as a jackass, and as hairy as a bear"), are very different from the compact and moderate-sized animals which, in their native country, are employed in drawing sledges and little carriages laden with wood, fish, or other commodities. Some of these true Newfoundland Dogs make admirable retrievers. The great and less pure English Newfoundland Dogs, so to speak, are also employed in the field for the same purpose with great success. One of the leading qualities of both, when so broken in, is the gallant manner in which they will face and penetrate cover, however thick and rough, in pursuit of the lost object. Whether it be furze, bramble, or blackthorn, in they dash, and almost always persevere till they have recovered the lost piece of game. As water-dogs they are above all praise. Their zeal, their devotedness, their entire abandonment of self when they rush to the rescue of some drowning wretch, are admirable; to be sure, in their eagerness to save, they sometimes encumber those with help who do not need it; and there have been instances where they have nearly destroyed the swimmer by their kindness. Directly they see anybody, or indeed any animal whatsoever, struggling in the water, in they jump, and seem to think that it is their duty never to leave them till they have got them out. They have been employed most successfully in wrecks, and will work against the most heavy sea—not always with success however. There is a case on record where the compact frame and indomitable courage of a bull-dog succeeded in carrying him through breakers which proved fatal to the Newfoundland breed. During a heavy gale a ship had struck on a rock near the land. The only chance of escape for the shipwrecked was to get a rope ashore, for it was impossible for any boat to live in the sea then running. There were two Newfoundland dogs and a bull-dog on board. One of the Newfoundland dogs was thrown overboard with a rope tied round him, and perished in the waves. The second shared a similar fate; but the bull-dog fought his way through that terrible sea, and, arriving safe on shore, rope and all, became the saviour of the anxious people on the wreck.

The Newfoundland Dog is confiding, very sagacious, and capable of the warmest attachment to his master. The attacks of little dogs are generally either coolly looked down upon, as if hardly understood, or treated with marked contempt; but there are exceptions to this lofty behaviour. We saw a harmless and very affectionate pug receive his mortal hurt from one of these dogs, and that without the slightest provocation on the part of the poor little pug. This however was a

bad-tempered exception to the general rule; and the Newfoundland Dog may notwithstanding be pronounced to be as generous as he is brave.

NEWT. [AMPHIBIA.]

NICKEL. This metal was first described by Cronstedt in 1751. For nice purposes the metal may be obtained in a state of purity by the following process:—Roast the native sulphuret of nickel to expel the sulphur and oxidise the metal; dissolve the residue in a mixture of four parts of sulphuric acid and one part of nitric acid moderately diluted with water. Evaporate the clear solution till crystals are formed, which are sulphate of nickel, of a fine emerald-green colour; re-dissolve these, and separate any copper they may contain by a plate of iron, and add excess of ammonia, which dissolves the oxide of nickel and any oxide of cobalt that may be mixed with it. To the clear solution add potash dissolved in water, which throws down hydrate of nickel of a green colour, and this, after washing and drying, is to be mixed with black flux, and reduced into the metallic state by a strong heat in a wind-furnace.

Nickel has the following properties:—It is of a white colour with a yellowish tint. Its lustre is considerable, and it is both malleable and ductile. Like iron, it is attracted by the magnet, and may, like it, be rendered magnetic at common temperatures, but it loses this power when heated to 630° Fahrenheit. The specific gravity of fused nickel is about 8·28, and by hammering it is increased to almost 9·0. It is nearly as hard as iron.

Nickel suffers little or no change by exposure to air and moisture at common temperatures. It is very difficult of fusion, but melts at a lower temperature than iron; at a red heat it absorbs oxygen gradually from the air, and also decomposes water at this temperature. Nitric acid is the only acid which readily acts upon nickel. Nickel occurs in meteoric iron and aërolites. [AEROLITES.]

The uses of nickel are very limited, and until within a few years it was scarcely employed at all; but it is now very usefully employed, and, to a considerable extent, in forming an alloy with copper and zinc, known by the name of German silver. Its oxides impart a green colour to glass and porcelain.

The ores of nickel are as follows:—

Sulphuret of Nickel, Capillary Nickel.—This occurs in regular hexagonal capillary crystals. Primary form a rhomboid. Colour brass-yellow or grayish; lustre metallic. Hardness, scratches mica, and is scratched by felspar. Opaque; brittle. It is soluble in nitric acid, and before the blow-pipe, when strongly heated, gives a malleable and metallic button. It occurs in Wales, Cornwall, Saxony, &c. The following is an analysis by Arfwedson:—

Sulphur	34·26
Nickel	64·35
	98·61

Arseniuret of Nickel, Copper Nickel.—It occurs crystallised, botryoidal, reniform, and amorphous. Primary form a right rhombic prism. Structure compact, fibrous. Fracture uneven, conchoidal, splintery. Hardness 5·0 to 5·5. Colour yellowish and grayish-red. Lustre metallic. Opaque. Specific gravity 7·655. Before the blow-pipe on charcoal it emits an alliaceous smell, and melts. It is found in Cornwall, Saxony, Bohemia, &c., and also in South America. The analysis by Pfaff gives—

Nickel	48·90
Arsenic	46·42
Iron	0·34
Lead	0·56
Sulphur	0·80
	97·02

Sulpho-Arseniuret of Nickel, Nickelglanz, Gray Nickel.—It occurs massive. Its structure is granular. Fracture uneven. Easily frangible. Colour pale lead-gray. Opaque. Specific gravity 6·129. It is found in Sweden and in the Harz, &c. An analysis of a specimen from Loos, in Helsingland, by Berzelius, which was mixed with some Mispickel, gave—

Nickel	29·9
Arsenic	45·4
Sulphur	19·3
Cobalt	0·9
Iron	4·1
	99·6

Silicate of Nickel, Pimelite.—It occurs massive, and investing other minerals. Colour apple-green or yellowish-green. It is earthy, dull, opaque, soft and greasy to the feel. It is infusible before the blow-pipe, but becomes of a dark-gray colour. It is found in Sweden and the Harz. It was analysed by Klaproth, and gave—

Silica	35·00
Oxide of Nickel	15·62
Alumina	5·10
Lime	0·40
Magnesia	2·25
Water	37·91
	96·28

Arseniate of Nickel.—It occurs powdery on the surface of arseniuret of nickel, and massive. Colour greenish-white and green. Opaque. It is found in Allemont, Hesse, &c. Analysis by Stromeyer:—

Arsenic Acid	36·97
Oxide of Nickel	37·35
Water	24·32
	98·64

NICOTIANA, a genus of Plants belonging to the natural order *Solanaceæ*. The species of this genus are called Tobacco. Tobacco was the name used by the Caribbees for the pipe in which they smoked it, but this word was transferred by the Spaniards to the herb itself. The genus *Nicotiana* contains about 40 species, most of them yielding tobacco for smoking, and many of them cultivated in the gardens of Europe. The name *Nicotiana* was given these plants after Jean Nicot, of Nimes, in Languedoc, who was an agent of the king of France at Portugal, and there procured the seeds of the tobacco from a Dutchman who had procured them in Florida. Nicot sent them to France in 1560.

The species of *Nicotiana* are most of them herbs, rarely undershrubs, and generally clothed with clammy hairs or down. The flowers are terminal, racemose, or panicled, and of a white, green, or purplish colour. The calyx is 5-cleft, permanent; corolla funnel- or salver-shaped, divisions 5, plicate and spreading; stamens 5, as long as the tube of the corolla; anthers dehiscing lengthwise; stigma capitate; capsule 2-celled, 2-valved, valves bipartite; seeds minute, numerous.

N. Tabacum, Common Virginian or Sweet-Scented Tobacco, is an herbaceous plant, with acuminated oblong-lanceolate sessile leaves, lower ones decurrent; throat of corolla inflated, segments of the limb pointed. This plant is a native of the West Indies, where it first became known to the Spaniards, and of Virginia, where the English first became acquainted with its properties. Of the various species it is that which is most commonly cultivated in gardens as an ornament. It is also largely cultivated in Europe for the purpose of smoking. The other species are however in some cases preferred. Schrank has described a large number of varieties of the common tobacco, varying in the size and form of their leaves, as well as the colour and form of their corollas. This species is the one most commonly employed for making tobacco and cigars. [TOBACCO, in ARTS AND SC. DIV.]

N. macrophylla, Orinoco Tobacco, is an herbaceous plant, with ovate-acute leaves clasping the stem; throat of corolla inflated, segments short, pointed. It is a larger plant than the last, the stem rising from 5 to 7 feet high. It is a native of America, and is frequently used for smoking, under the name of Orinoco Tobacco; it is however inferior to the last; the milder Havannah cigars are said to be made from it.

N. rustica, English Tobacco, has an herbaceous square stem, with petiolate ovate quite entire leaves; tube of corolla cylindrical, longer than the calyx; segments of the limbs roundish, obtuse. This plant is a native of Europe, Asia, Africa, and America. It is called English Tobacco because it was the first species that was introduced into this country for growth; it was then brought from America. It grows very well in this climate, and in some places is almost naturalised. It is known in France as Tabac Pausse, in Germany as Bauern-Tabak, and in Spain as Tabaco Cimaroso. This plant grows on the coast of the Mediterranean, and thence finds its way into India, where it is highly valued. The tobaccoes of Salonica and Latakia, which are much esteemed, appear to be the produce of *N. rustica*. From the extensive range of climate and difference of situation which this plant occupies, its characters suffer considerable change; hence a number of varities have been described. In the shops this tobacco is known as Turkish.

N. Persica, Shiraz Tobacco, is an herbaceous plant, clothed with clammy down, with the leaves of the root oblong, those of the stem acuminate and sessile; corolla salver-shaped, with a long tube, and rather unequal segments. This plant is a native of Persia, and furnishes the famous Shiraz Tobacco. This tobacco is milder than that produced by the *N. Tabacum*, and but a small quantity is consumed in this country. The English smoke more of the strongest tobacco than any nation in the world.

There are several other species of tobacco which are used for smoking in the places where they naturally grow. *N. quadrivalvis* has capsules with four valves; it grows near the Missouri River, and is there smoked by the natives. *N. multivalvis* has capsules with many valves; it is cultivated by the Indians on the Columbia River for smoking. It is a fetid plant, and the calyx, the most fetid part, is selected by the Indians for smoking. *N. nana*, a small species of tobacco, is a native among the Rocky Mountains of North America, and is smoked by the Indians. *N. repanda* is a native of Cuba, and is said to furnish the tobacco for making the small cigars known as Queen's.

NIDULARIACEÆ, a sub-order of Plants belonging to the order *Gasteromycetes*, the alliance *Fungales*, and the class *Thallogens*. It includes the genera *Nidularia*, *Cyathus*, *Crucibulum*, *Sphærobolus*, *Thelebolus*, and *Atractobolus*.

NIGELLA (from *niger*, black, because of the colour of the seeds), a genus of Plants belonging to the natural order *Ranunculaceæ*. It has 5 coloured petal-like spreading sepals. The petals small, from

5 to 10, bilabiate, with a hollow nectariferous claw. The capsules more or less connected together, terminated by the elongated styles opening in the inside, many-seeded. The leaves are capillary, multifid, often surrounding the flowers like an involucre, and finely cut like fennel. The flowers are solitary on the tops of the stems or branches. The species are erect annual smoothish herbs. The species are vulgarly known by the names Devil in a Bush and Devil in a Mist.

N. sativa has ovate-obtuse anthers; capsules muricated, united up to the very point into an ovate fruit, terminated by 5 erect styles; the stem erect and rather hairy; flowers naked. The seeds are angular, aromatic, subacid, and were formerly used instead of pepper; and have also been employed as carminatives. It is the Μελάνθιον of Hippocrates, 'Steril.' 675, and of Dioscorides, 3, 93; the Githex of Pliny, 20, 17.

N. arvensis has pointed anthers; from 5 to 7 styles circinately revolute, outwardly smooth; capsules connected below the middle into an obconical fruit, which is narrowest at the base. It has a smooth stem, with diverging branches. It is a native of middle and southern Europe in corn fields, also in the north of Africa. The seeds are sometimes used instead of those of *N. sativa*, but they are not so aromatic, neither have they so pleasant a smell. Both species are employed in the adulteration of pepper.

(Lindley, *Flora Medica;* Fraas, *Synopsis Plantarum Floræ Classicæ.*)

NIGHT-HERON. [Nycticorax.]

NIGHT-JARS. [Goat-Suckers.]

NIGHTINGALE. [Philomela.]

NIGHTSHADE, DEADLY. [Atropa.]

NIGRIN, a Mineral consisting principally of oxide of titanium, and containing about 14 per cent. of iron. It resembles *Menaccanite* in colour, lustre, and appearance of the fractured surfaces. It occurs in Ceylon and in Transylvania.

NIKA, a name given by M. Risso to a genus of Macrurous Crustaceans. [Palemonidæ.]

NIMA, a genus of Plants belonging to the natural order *Simarubaceæ*. It has hermaphrodite flowers, a 5-parted permanent calyx, 5 oblong petals, 5 stamens with filaments dilated at the base; the 5 ovaries are connected together, pilose, and seated on the thick disc beneath the petals. The embryo is large, without albumen. The species are trees, with alternate imparipinnate leaves, having four pairs of serrated leaflets. The flowers are disposed in panicle corymbs.

N. quassioides is a native of Nepaul, in a valley near the town called Thankot. It has elliptical oblong leaflets, which are acuminated and serrated. The corymbs are trichotomous. It is as bitter as the quassia of South America.

(Don, *Dichlamydeous Plants;* Lindley, *Flora Medica.*)

NIPADI'TES (Bowerbank), a genus of Fossil Fruits from Sheppey.

NIPPLEWORT. [Lapsana.]

NISSO'LIA (in honour of William Nissole, a French botanist), a genus of Plants belonging to the natural order *Leguminosæ*. It has a campanulate calyx, a papilionaceous corolla, and 10 monadelphous stamens. The legume is stipitate, one- or few-seeded. The species are climbing shrubs, with imparipinnate leaves.

N. ferruginea has from 7 to 11 leaflets, which are alternate, oblong, mucronate, and clothed with rusty velvety down; beneath, the flowers are panicled, monadelphous, and the legume straight and rather velvety. The flowers are violaceous. It is a native of Guyana, and exudes from its stem a red transparent gum that has a powerful astringent flavour. It is also known by the name of *N. quiriata.*

None of the species of this genus are European, nor are they of use in art or science. A mixture of loam and peat is the best soil for them, and young cuttings will strike root in sand under a bell-glass in heat.

(Don, *Dichlamydeous Plants;* Burnett, *Outlines of Botany.*)

NISUS. [Falconidæ.]

NITELLA, a genus of Plants belonging to the natural order *Characeæ*. It is characterised by the whole plant being more or less pellucid; the cells are tubular, not invested with a secondary layer of smaller cells as in *Chara;* the reproductive organs consist of globules and nucules, mostly seated on the terminal whorl, and axillary.

Four species of this genus have been described inhabiting Great Britain.

N. translucens has an elongated flaccid pellucid glossy stem, with the branches of the whorls spreading, elongated; the nucules and globules approximate, on the smaller ramuli scarcely bracteated. It grows in deep and stagnant ponds, but is by no means a common plant in Great Britain. It is the largest of the British species, and best adapted for the examination of the curious currents, which are obvious in the whole of the family to which it belongs. [Sap; Cyclosis.]

N. flexilis has a stem 1 to 2 feet long, smooth, flaccid, somewhat glossy and pellucid. It is not unfrequent in lakes and still waters. The nucules are often solitary. The stem, like that of *Chara*, is often incrusted with carbonate of lime. Hassall thinks this constitutes the only distinction of Agardh's *N. opaca.*

N. nidifica has single stems, smooth below, flaccid, somewhat glossy and pellucid: the nucules and globules separate. It is a native of the salt-water ditches in the south and east of England.

N. gracilis has smooth, glossy, pellucid stems, with whorls of the branches compound, the segments acute, the bracts wanting. This is a small delicate and elegant species, but probably not distinct from *N. flexilis.* In fact it may be questioned whether all these species are not varieties of one.

(Hassall, *Freshwater Algæ;* Smith, *English Botany;* Babington *Manual of British Botany.*)

NITIDULA, a genus of Insects belonging to the Clavicorn family of the *Coleoptera Pentamera.*

NITRE. [Potassium.]

NO'BIA. [Cirripedia.]

NOBLE. [Aspidophorus.]

NO'CTHORA, F. Cuvier's name for the Douroucouli, a quadrumanous animal of the New World, with several characters that remind the observer of some of the *Lemuridæ* (the Loris especially) of the ancient continent and its islands. Indeed Dr. Horsfield and Mr. Vigors observe ('Zool. Jour.,' vol. v.) that to the philosophic inquirer "it will equally be a Lemur among the Monkeys, or a Monkey among the Lemurs."

Humboldt, who first gave a detailed and clear account of this curious form, sees in it, and with good reason, an approximation to the Slow Lemur, or Lori Paresseux of the French (*Lemur tardigradus* of the south of Asia), and the physiognomy and features, particularly the eyes, well justify the comparison. So far it would seem to represent in America the *Lemuridæ* of the Old World; but the teeth are the same with those of the Sajous (*Simiæ apella, S. capucina,* &c., Linn.), according to F. Cuvier, who observes, that if the canines were small and little in the individual examined by him, it was because that individual was a female. The diameter of the small intestines was extremely small, and the cœcum simple and only about two inches deep, and sensibly smaller than the stomach.

The organs of motion do not present anything very particular; the four extremities or hands are formed exactly like those of the Sajous, except that the animal does not extend the fingers of the fore hands, which remain raised as F. Cuvier has represented them (see the cuts). The nails are long, narrow, channelled (en gouttières), and a little hooked: the tail is very moveable, but not prehensile, though the animal can turn it over its back, or round its neck or its legs. The pupil of the eye is round, and the eyes themselves are very large and without any accessory organ.

Profile of the Douroucouli.

Fore hands of the Douroucouli.

The external ear is much developed and very like that of the *Simiæ* generally. The aperture of the nostrils is not wide. The mouth is very large and without cheek-pouches. The fur is soft, thick, and of a silky nature. The interior of the hands presents areæ formed of very fine strie, always parallel and ordinarily circumscribed the one within the other. Vulva grandis externè vulvæ canum simillima. Under each axilla a teat.

The habits of this creature are entirely nocturnal. It spends the day in sleep, folded up with the head hidden between the fore legs; but as soon as the brightness fades into twilight the animal awakes to activity. The eyes, which, if exposed to the full brilliancy of day, are darkened with excess of light, for the iris is then closed completely, perform their office as the shades of night approach, and the pupil then dilates nearly to the size of the eye.

Humboldt informs us that, in a state of nature, the Douroucouli hunts small birds, and also, especially, insects: it eats all sorts of vegetables, but is particularly fond of bananas, sugar-cane, the fruit of

the palms, the nuts of the *Bertholletia*, and the seeds of the *Mimosa Inga*. They do not live in societies, but pass their time together in pairs. Their nocturnal cry (muh-muh) resembles that of the Jaguar, and the whites who visit the missions of Oromooko call it Titi-Tigre. Its voice is of extraordinary power and volume when considered in relation to its size. Besides the Jaguar-like cry it has two others, one a species of mewing (e-i-aou), and a very disagreeable sound (quer-quer). Its throat swells when it is irritated, and the animal then resembles in its dilatation and posture a cat attacked by a dog.

Humboldt's specimen, which he kept for five months, was lethargic during the day, sleeping from nine in the morning to seven at night (whence the species is called *Mona Dormillon*). Sometimes it would begin to slumber at daybreak, and always selected the most shady places; and, like squirrels and weasels, passed readily through small holes and openings. If roused during the day, its large eyes, which at night resembled those of the owl, were lustreless; and when it was wrapped up in the soundness of sleep, its mouth might be opened and its teeth examined with impunity. It was very fond of flies, and sometimes would even hunt for them on a dull day, capturing them with great skill. It drank but little, and sometimes passed twenty or thirty days without taking any liquid. It was kept at night in Humboldt's bed-room, notwithstanding the belief of the natives, that the Douroucoulis will tear out the eyes of sleeping persons. In a state of nature it is generally caught by the natives when sleeping in some hollow tree by day, and the male and female are often taken together.

F. Cuvier's Douroucouli was very mild in temper, which he attributes to the sex. He fed her on milk, biscuit, and fruit. Humboldt could not familiarise his.

F. Cuvier observes that the genus of which the Douroucouli is the type received the name of *Aotus* because the absence of external ears appeared to be its dominant character. This name, he remarks, can hardly be applicable to the animal now before us.

The affinities of this curious form to the Sajous and Loris among the *Quadrumana* are shown by its fondness for insects, its nocturnal habits, and various parts of its organisation. The last-named habits, its cat-like cries and appearance when excited, and other points, indicate its relation to the *Feræ*. Mr. Swainson notices this approach to the ferocious quadrupeds, and makes this the genus by which we are conducted from the *Cebidæ* to the *Lemuridæ*. In his 'Classification' he places the form in the latter group, between *Tarsius* and *Galeopithecus*.

It is found in South America. Humboldt saw the species in the forests bordering the Cassiquaire and the woods at the base of Mount Duida; also in the vicinity of the cataracts of the Maypures.

Nocthora trivirgata.

NOCTILIO. [CHEIROPTERA.]

NOCTILUCA, a genus of Animals usually referred to the class *Acalephæ*. [ACALEPHÆ.] One species only of this genus has been described *N. miliaris*. It occurs occasionally in prodigious numbers around the coasts of England, and is the most frequent cause in this part of the world of the phosphorescence of the ocean. It was first discovered by M. Surriray in 1810.

According to M. Surriray the *Noctiluca* is a spherical gelatinous mass provided with a long filiform tentacle or appendage, presenting a mouth, an œsophagus, one or many stomachs and ramified ovaries, and thus possessing a certain complexity of organisation. De Blainville confirmed Surriray's account, and placed *Noctiluca*, without doubt most erroneously, among the *Diphydæ*. On the other hand, Van Beneden, Verhaeghe, and Doyére, denying the relation of *Noctiluca* with the *Acalephæ*—and conceiving its organisation to be of a much more elementary character—relegated it to the *Rhizopoda*.

To this doctrine M. De Quatrefages also attaches the weight of his authority in his valuable essay 'Observations sur les Noctiluques,' published in the 'Annales des Sciences Nat.' for 1850. M. De Quatrefages does not admit the existence of any true mouth or intestinal canal, and considers that the so-called stomachs are nothing but 'vacuoles' similar to those observed in the *Rhizopoda* and *Infusoria*.

Krohn was the first to describe the long cilium which proceeds from the mouth of *Noctiluca*. Mr. Huxley has recently described this animal in the 'Quarterly Journal of Microscopical Science.' (Vol. iii.) He says—

"*Noctiluca miliaris* may be best described as a gelatinous transparent body, about 160th of an inch in diameter, and having very nearly the form of a peach—that is to say, one surface is a little excavated, and a groove or depression runs from one side of the excavation half way to the other pole (échancrure, Quatrefages; Frauenbusenähnliche Einbucht, Krohn). Where the stalk of the peach might be, a filiform tentacle, equal in length to about the diameter of the body, depends from it, and exhibits slow wavy motions when the creature is in full activity. I have even seen a *Noctiluca* appear to push repeatedly against obstacles with this tentacle.

"The body is composed of a structureless and somewhat dense external membrane, which is continued on to the tentacle. Beneath this is a layer of granules, or rather a gelatinous membrane, through whose substance minute granules are scattered without any very definite arrangement. From hence arises a net-work of very delicate fibrils, whose meshes are not more than 1-3000th of an inch in diameter, and these gradually pass internally—the reticulation becoming more and more open—into coarser fibres, which take a convergent direction towards the stomach and nucleus. All these fibres and fibrils are covered with minute granules, which are usually larger towards the centre."

After describing minutely the structure of this creature, Mr. Huxley concludes—

"Not only does all I have observed lead me to believe that *Noctiluca* has a definite alimentary cavity, but I am inclined to think that this cavity has an excretory aperture distinct from the mouth. The funnel-shaped depression in the post-oral area in fact always appeared, when I could obtain a favourable view, to be connected with a special process of the stomach. On one occasion I observed the sides of this process to be surrounded by fusiform transversely-striated fibres or folds; I could not determine which.

"Krohn states that he repeatedly saw the egesta voided 'in the neighbourhood of the groove of the body,' but he could not determine at what exact point, and he inclines to think it must have taken place through the mouth.

"I am equally unable to bring forward direct evidence on this point, and my belief in the existence of a distinct anus is founded simply on the structural appearances.

"In front of and above the gastric cavity is the nucleus, described by Verhaeghe and Krohn. This is a strongly-refracting oval body of about 1-460th of an inch in length, which, by the action of acetic acid, assumes the appearance of a hollow vesicle. The anterior radiating fibres pass from it; the posterior from the alimentary canal.

"Quatrefages and Krohn consider that a process of fissiparous multiplication takes place in *Noctiluca;* both of these observers having found double individuals, though very rarely. According to the latter writer, division of the body is preceded by that of the nucleus. I have not had the good fortune to meet with any of these forms, and the only indication of a possible reproductive apparatus which I have seen consisted of a number of granular vesicular bodies, of about 1-2000th of an inch in diameter, scattered over the surface of the anterior and inferior part of the body.

"Such is what repeated examinations leads me to believe is the structure of *Noctiluca;* but if the preceding account be correct, it is obvious that the animal is no Rhizopod, but must be promoted from the lowest ranks of the *Protozoa* to the highest.

"The existence of a dental armature, and of a distinct anal aperture, are structural peculiarities which greatly increase the affinity to such forms as *Colpoda* and *Paramœcium*, indicated by Krohn. *Noctiluca* might be regarded as a gigantic Infusorium with the grooved body of *Colpoda*, the long process of *Trachelius*, and the dental armature of *Nassula* united in one animal.

"On the other hand, the general absence of cilia over the body, and the wide differences in detail, would require the constitution of at least a distinct family for this singular creature."

In the same volume of the 'Microscopical Journal' is an account of this creature by Dr. Woodham Webb, of Lowestoft.

NOCTUA. [STRIGIDÆ.]

NOCTUA, a genus of Insects belonging to the Nocturnal *Lepidoptera*, to which the Red Under-Wing Moths belong.

NOCTULE. [CHEIROPTERA.]

NODDY. [Booby.]

NOLA'NA (so named by Linnæus, from 'nola,' a little bell, on account of the bell-shaped form of the corolla), a genus of Plants belonging to the natural order *Nolanaceæ*. It has a 5-cleft calyx; a campanulate 5-lobed 5-plicate corolla; 5 stamens adhering to the tube of the corolla, nearly equal; the anthers are 2-celled, dehiscing lengthwise. The seeds are roundish, with a membranous testa, and fleshy copious albumen. The species are herbs; natives of Peru and Chili; usually annual. Leaves alternate, quite entire. The flowers are solitary, pedunculate, and of a showy blue colour.

N. prostrata, Prostrate Nolana, has a prostrate stem; ovate-oblong leaves; a pyramidal calyx, with triangularly sagittate segments, furnished with spur-like processes at the base. It is a native of Peru, but grows freely in this country in the open air. In France poultry are fed upon it, and are so fond of it that Persoon proposed to call it *N. gallinacea*.

N. paradoxa has prostrate hairy stems; ovate-obtuse pilose leaves; the segments of the calyx triangular; the corolla campanulately funnel-shaped; the drupes cumulated, 1-seeded. It is a native of Chili, on the sea-shore about Concepcion. The flowers are blue.

The species of *Nolana* are only valuable as ornamental plants; they are showy when in blossom, and are much like some of the trailing species of *Convolvulus*. The seeds should be sown in a gentle hot-bed in the spring, and the plants when of sufficient size, or about the middle of May, should be finally transplanted to the open ground, where they will flower and ripen seed; or the seeds may be sown at once in the open border in a warm sheltered situation.

(Don, *Dichlamydeous Plants;* Burnett, *Outlines of Botany.*)

NOLANACEÆ, *Nolanads*, a natural order of Plants, having erect or prostrate stems; alternate leaves without stipules. Flowers usually showy; calyx 5-parted, valvate in æstivation; corolla monopetalous, with a plaited æstivation usually thickened in the tube; stamens 5, equal, inserted into the tube, alternate with the segments of the corolla; anthers oblong, 2-celled, bursting longitudinally; pistil composed of several carpels, either distinct with a single style, or partially combined into several sets, with a single style seated on a succulent disc; stigma somewhat capitate. Fruit inclosed in the permanent calyx, constructed like the pistil; pericarp woody, often a little succulent; seeds ascending, solitary; embryo curved with either straight or double cotyledons in the midst of a small quantity of albumen; radicle next the hilum. This little order is remarkable for the various modes in which its carpels are disposed without ever being consolidated. In one genus there are but 5, and they are distinct; in another there are 20 combined in fours, in a third the combination is irregular though the number remains 20, and in others they are all wholly distinct. The species are all South American, and chiefly from Chili. Their uses are unknown. There are 6 genera and 35 species.

(Lindley, *Vegetable Kingdom.*)

NONATE'LLIA, a genus of Plants belonging to the natural order *Rubiaceæ*, the tribe *Guettardeæ*, the sub-tribe *Morindeæ*. It has a calyx with an ovate tube, and a 5-toothed permanent limb; a tubular funnel-shaped corolla, with the tube as if it were gibbous, and a 5-lobed limb; the stamens 5, almost inclosed; the stigmas (2?) obtuse; the fruit a globose drupe, furrowed, containing 5 coriaceous 1-seeded pyrenæ; the albumen horny. The species are shrubs or small trees with glabrous downy oval-oblong leaves, and the stipules combined together more or less, or free. The flowers are white and arranged in a panicle-formed or corymbose thyrse.

N. officinalis, Asthma Bush, has ovate acute glabrous leaves, the stipules combined into a 4-toothed sheath, the panicles corymbose; the involucrum small, 3-leaved under each flower. It is a native of Guyana, in forests and sterile places. All the parts of this plant, when bruised or dried, give out a slight aromatic odour. The creoles in Guyana call this plant Azier à L'Asthme, and it is said to have a powerful influence in subduing attacks of asthma.

There are several other species of *Nonatellia*, all natives of America, but none are used in the arts or as medicines.

(Lindley, *Flora Medica;* Burnett, *Outlines of Botany*).

NONIONI'NA, a genus of Fossil *Foraminifera*.

NONTRONITE, a Mineral consisting of Silicate of Iron. This mineral occurs in small nodules imbedded in an ore of manganese. Its colour is pale or greenish-yellow. Fracture earthy. Dull. Opaque. Unctuous to the touch, and very tender. It is found in the department of Dordogne in France, in the arrondissement of Nontron. The following is an analysis by Berthier:—

Silica	44·0
Peroxide of Iron	29·0
Alumina	3·6
Magnesia	2·1
Clay	1·2
Water	18·7
	98·6

NORFOLK ISLAND PINE. [Araucaria.]

NOROPS. [Iguanidæ.]

NOSE is one of the external apertures of the respiratory system and the organ for the sense of smell. The portion of the nose by which odours are perceived lies deep back in the cavity to which the external apertures of the nostrils lead; the portion which is prominent upon the face serves merely as the apparatus for inhaling the air which is impregnated with the odour. The most essential parts of the organ are the olfactory nerves, which come off from the olfactory bulbs of the brain [Brain], and passing through numerous holes in the ethmoid bone, which is situated between the orbits and above and behind the nostrils, ramify on the extended surfaces of that bone and the turbinated bones which form on each side the chambers of the nose. The sensitive terminations of the nerves are placed on the surface of a delicate and very vascular membrane which lines the whole cavity of the nose, and which is constantly kept moist by the secretion of a small quantity of mucus, in which the odoriferous particles are caught and for a time retained.

The sense of smell varies considerably, both in degree and in kind, in different animals. It is evidently possessed by insects and many others of the lower animals, but the organs by which they exercise it are unknown. In the higher animals its degree of acuteness is in general marked by the extent of surface of the ethmoid and turbinated bones, over which the olfactory nerves are distributed. In man this surface is proportionally smaller than in other animals, in most of which, besides occupying the greater part of the interior of the face, it is increased by peculiar branchings and convolutions of the thin layers of the bones. Each species has also a sense of smell in some degree peculiar to itself; thus herbivorous animals, though possessing the most delicate power of discerning the differences of vegetable odours, have no evident faculty of discriminating those of most animal substances; while the carnivora, on the other hand, can scarcely distinguish any others than the last. Each species has a fine sensibility for those substances which are of the greatest importance to its own existence, and thus obtains at once a knowledge of their presence in places concealed from all the other senses. Man possesses the sense of smell for a very large number of substances, but not in a very acute degree for any of them. The difference appears the greater between him and other animals in consequence of the neglect of the exercise of this sense which is common (except for particular purposes) in civilised society; but the American Indians and some of the northern Asiatic tribes, by their constant practice in hunting, are said to have acquired a power of scent scarcely inferior to that of the dog.

The olfactory nerve is appropriated exclusively to the sense of smell, and is incapable of perceiving pain or any other sensation. Of the peculiarities by which in different animals it is capable of perceiving only certain odours, we know no more than of the nature of those odours themselves, of whose existence we have no other evidence than that of the sense which they affect.

The sense of smell serves as an adjunct to that of taste, and is subservient in most instances to the same purpose, of providing proper and avoiding injurious food for the sustenance of the body. By it many animals seek out their food, and all select from that which they obtain; and much of that compound sensation which we regard as taste is really due to the smell, as for instance the sensation of the flavour of aromatic substances, which is completely lost by closing the nostrils while we are eating them.

For the full perception of odours it is necessary that the particles charged with them should be drawn with some force into the nose, and we may stand for some time in a very strongly-smelling atmosphere without perceiving it if we breathe only through the mouth. The most acute sensation is obtained by the sudden inhalation of a large quantity, or by a succession of short and quick inspirations. [Brain; Nervous System.]

NOSEAN, a Mineral identical with Haüyne. [Haüyne.]

NOSTOCACEÆ. [Algæ.]

NOTACANTHA, a family of Insects belonging to the order *Diptera*.

NOTACANTHUS, a little-known genus of Arctic Fishes belonging to the section *Acanthopterygii* and to the family *Scomberidæ*

NOTAMIA. [Cellariæa; Polyzoa.]

NOTHOSO'MUS. [Fish.]

NOTI'DANUS. [Fish.]

NOTONECTA, a genus of Insects belonging to the family *Hydrocorisæ*, of the order *Hemiptera*. *N. glauca*, the Water-Boatman, is one of our commonest insects. It is about half an inch long and swims upon its back in order the better to seize its prey.

NOTOPTERUS, a genus of Fishes belonging to the family *Clupeidæ*.

NOVACULI'NA, a sub-genus of *Solecurtus*. [Solenidæ.]

NOVACULITE, a name for a kind of Clay-Slate. [Slate.]

NOWD, the name of one of the gurnards.

NUCIFRAGA, a genus of Birds known by the name of Nutcracker. One species is a native of Britain. Its classification is difficult. Some of its habits, and the worn appearance of the tail-feathers from climbing about the branches of trees, together with the nesting in hollows of trees, indicate a relationship to the *Picidæ*. Its manners, which are said to resemble those of the Jay, and other circumstances, connected with its food and organisation, bring it into alliance with the Crows, to which family it is generally referred by ornithologists, and so placed as to approximate either to the Woodpeckers or Starlings. Mr. Vigors considers it as assimilating to the latter family, and especially to the genera *Cassicus* and *Barita*. Mr. Swainson makes it

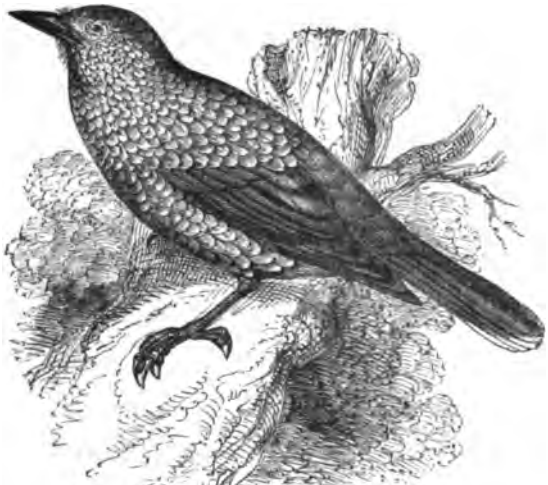
a sub-genus of *Corvus* in his sub-family *Corvinæ*, placing it immediately after the sub-genus *Pica*, and immediately before the genus *Barita*. Prince C. L. Bonaparte arranges it also under the sub-family *Corvinæ*, among which it occupies the last place in his 'Geographical and Comparative List,' whilst it immediately precedes the sub-family *Sturninæ*. Mr. Yarrell ('British Birds') places it at the end of the Crows, and immediately before the Woodpeckers. Sir W. Jardine ('British Birds') arranges the genus between the Magpie and the Jay. In Temminck's arrangement its place is between the Jays and the Choughs (Pyrrhocorax).

The bill is conical, longer than the head, straight, the upper mandible having the culmen rounded, overhanging the lower, both terminating in an obtuse and depressed point; nostrils basal, round, open, concealed by hairs directed forwards. Toes, three before and one behind, the two outer being united at their base. Tarsus longer than the middle toe. Wings long and pointed, the first quill shortest, the fourth and fifth longest. (Gould.)

This genus is generally considered to comprehend only two known species: *N. Caryocatactes* and *N. hemispila*, which bears a considerable resemblance to it, though it is clearly a distinct species, described and figured in Mr. Gould's 'Century of Birds from the Himalayan Mountains.' Prince C. L. Bonaparte and Mr. Audubon, include the *Corvus Columbianus* of Wilson in the genus *Nucifraga*.

N. Caryocatactes (the *Corvus Caryocatactes* of Linnæus; *Caryocatactes* of Willughby; Casse Noix of the French; *Ghiandaia Nucifraga* of 'Stor. degl. Uce.'; Nocciolaja of Savi.; Kurz und Langschnäbliger Nussknacker of Brehm; Tannen Heher (Pine Jay) oder Turkischer Holzschreyer of Frisch; Notwecka, Notkraka, of the Swedes; Noddekrige of the Norwegians; Notkraake of Brunnich; Nussrabbe of Meyer; and Aderyn y Cnau of the Welsh), the Nutcracker. Size about that of the Jackdaw, but the tail is longer. Plumage reddish umber-brown; the body, with the exception of the head and rump, dappled with large white spots which occupy the centre of each feather; wings and tail blackish, shot with green; the feathers of the latter (except the two middle ones) tipped with white. Bill and legs brownish-black. Sexes, as in the crows generally, nearly alike. The female is, if anything, a little smaller and her plumage less lively.

The manners of the Nutcracker are said by those who have observed it to resemble in some degree those of the Jay, and some of its habits those of the Woodpeckers. Like the former it feeds on nuts and berries, as well as on the seeds of the pine, of which it appears to be very fond; and like the latter it climbs the trunks and branches of trees, tapping the bark with its bill to start the insects and their larvæ that may lurk beneath, and devour them. They are said to crack nuts much in the same way as the Nuthatch. The nest is formed in the hollows of trees, which the bird is supposed to enlarge after the manner of the Woodpeckers. The eggs are five or six in number, of a yellowish white or gray, with a few spots of bright gray-brown. Temminck states that it sometimes devours young birds and eggs.



Nutcracker (*Nucifraga Caryocatactes*).

It inhabits central Europe. The bird is a rare visitant to Great Britain, and does not appear to have been seen in Ireland. The only one Pennant ever heard of was killed near Mostyn in Flintshire. Montagu mentions one that was killed in Kent, and states that one was seen by an accurate observer near Bridgewater. He also notices two others, which were shot in 1808, one in Devon, the other in Cornwall. Mr. Selby mentions one that was seen in Netherwitton Wood in Northumberland. Mr. Rodd of Penzance gave Mr. Yarrell information of one that was seen on a tree on the banks of Hooe Lake. It is recorded by Dr. Moore as having been shot in Devonshire near Washford Pyne Moor. Another is said to have been noticed at Pepper Harrow Park, Lord Middleton's seat. Mr. Macgillivray gives instances of its having been shot in Scotland.

Temminck records varieties of pure white, or yellowish white, with deeper spots; sometimes with the wings and tail white.

NUCLEOBRANCHIA'TA, M. De Blainville's name for his fifth order of his second section of his second sub-class (*Paracephalophora Monoica*).

M. Rang, who has illustrated the anatomy of some of the families, makes the *Nucleobranchiata*, in his arrangement, the first order of Cuvier's class *Gasteropoda*, and comprises under it some of the *Heteropoda* of Lamarck and the family Pterotrachées of De Férussac.

The following character of the order is given by M. Rang:—

Animal furnished with a foot compressed into the form of a fin, with an acetabulum or sucker (ventouse) on its superior border. Branchiæ pectinated. Both sexes comprised in the same individual.

Often a shell, which is spiral, has a very large aperture, and is vitreous and very fragile.

An operculum sometimes.

M. Rang observes that the Molluscs which he had already, in an anatomical memoir on the genus *Atlanta*, proposed to assemble under the name of *Nucleobranchiata*, borrowed from M. De Blainville, are all pelagic animals which are often met with on the surface of the sea in calm weather, swimming in an inverted position by the aid of their foot, which is compressed into a fin. They never creep, but they have the power of fixing themselves (to floating bodies only) by spreading upon them the sucker of their ventral fin, and at the same moment making a vacuum. The shells are very much sought after in collections on account of their extreme rarity.

Two families, according to M. Rang's arrangement, constitute the order *Nucleobranchiata*.

1. *Firolidæ* (Pterotrachées, Férrussac; *Nectopoda*, Blainville; *Urobranchia*, Latreille).

Animal elongated, straight, and horizontal; one or more fins; branchiæ forming, with the other viscera, a nucleus on the dorsal part.

Shell sometimes present, and when it is, incapable of containing more than a very small part of the animal.

Firola (*Pterotrachea*, Forsk.; *Firoloides* and *Sagitella*, Les.).—Animal very much elongated, gelatinous and transparent, terminated behind by a tail more or less long and pointed; mouth situated at the extremity of a proboscis, and including an apparatus proper for mastication (?). No tentacles, or only two tentacular rudiments carrying the eyes at their external base; one or more fins; nucleus exposed, protected only by a membrane, and always situated below and behind the ventral fin; termination of the intestinal canal and of the organs of generation in a tubercle on the right side.

No shell. (Rang.)

The *Firolæ* are very common animals in the seas of the warm and temperate zones, and are remarkable for their extreme transparency, which is often interrupted by golden spots.

Firola Frederici.

The other genera in this family are *Carinaria* [CARINARIA], and *Cardiapoda*.

2. *Atlantidæ*.

Animal furnished with a well-developed shell, into which it can retire; gills contained in a dorsal mouth-cavity; lingual teeth similar to *Carinaria*. The shell symmetrical, discoidal, sometimes closed by an operculum.

The following genera belong to this family:—

Atlanta. 15 species. [ATLANTA.]
Porcellia (fossil). 10 species.
Bellerophon (fossil). 70 species.
Cyrtolites (fossil). 13 species.
Maclurea (fossil). 5 species.

NUCLEOLITES. [ECHINIDÆ.]
NU'CLEUS. [SEED.]
NUCULA. [POLYODONTA.]

NUDIBRANCHIATA, a family of Gasteropodous *Mollusca*, characterised by the possession of distinct, external, and uncovered gills. The species of this family are all marine, and with few exceptions small in size. They are sometimes with other forms of animals called Sea-Slugs, arising from the fact that, like land-slugs, they are destitute of shells. Their body is usually elongated and soft, and attached throughout its whole length to the foot, or disc, upon which they crawl. They are not unfrequently covered with a cloak, which in some is strengthened with calcareous spiculæ. The head is anterior, and frequently indistinct, bearing one or two pairs of tentacles, the

upper pair of which are placed on the cloak when it is present, and behind them the eyes are situated. But the characteristic peculiarity of these molluscs is the appendages that constitute their breathing organs, placed upon the back, always symmetrically, in plumes, tufts, or papillæ, either forming a circle on the central line, or arranged in rows upon the sides.

None of the Nudibranchiate *Mollusca* appear to have been known to the ancients, and even up to the time of Linnæus they remained, with one or two rare exceptions, entirely unnoticed. In the twelfth edition of his 'Systema Naturæ' only seven species were described, scarcely any of which had come under his own observation in a living state. They were placed by him in the class *Vermes*, and referred to the genera *Doris*, *Scyllæa*, and *Tethys*. Otho Frederic Müller paid more attention to them; twelve species are characterised in his 'Zoologiæ Danicæ Prodromus,' most of which were afterwards figured with fuller descriptions in the 'Zoologia Danica.' The number of species introduced into the latter work is fourteen. Otho Fabricius has also excellent descriptions of two or three of these molluscs in his 'Fauna Grœnlandica.' Other authors contributed a little to increase the number of species; but it was not until the appearance of the celebrated 'Mémoires' of Cuvier, in the 'Annales du Muséum,' that much attention was drawn to this subject. These formed a new era in their history, and the dissections there given furnished the groundwork for those more correct views of their affinities which that distinguished naturalist carried out in the 'Règne Animal,' where the order *Nudibranchiata* was first instituted for their reception. Even at that time however very few species were known, and it is to be regretted that Cuvier was obliged to have recourse to specimens preserved in spirits for his descriptions. So far as their anatomy was concerned this disadvantage was not greatly felt, but the figures and descriptions of their external forms were in consequence very imperfect. The position of this group in relation to the testaceous tribes, from which they had been kept apart in the Linnæan arrangement, began now to be generally acknowledged. Their affinities were further illustrated in the celebrated 'Histoire Naturelle des Animaux sans Vertèbres' of Lamarck, and in the 'Manuel de Malacologie' of Blainville; each of which contributed something to the knowledge of their physiology and relations, but not much to the number of species.

Although little had been done up to this time by British naturalists in augmenting the species of this beautiful family, they have been since the subjects of most accurate and fruitful research; and the Monograph now publishing by the Ray Society on the 'British Nudibranchiate Mollusca', may be regarded as one of the most remarkable contributions made to the literature of natural history during the present century. This beautiful work contains the description of one hundred species; of these sixty have been added by Messrs. Alder and Hancock, and their forms and anatomy illustrated by a series of coloured plates from original drawings of the authors.

We need not enumerate the additions that have been made to this department of the European Fauna during the last half century; suffice it to say that of late years much attention has been paid to the *Nudibranchiata* by continental naturalists, and several new species have been described. Among the authors treating of the subject may be mentioned Risso, D'Orbigny, Cantraine, Quatrefages, Sars, Lovén, Delle Chiaje, Philippi, and Verany. No account however of the Nudibranchiate *Mollusca* of any one country has yet been published sufficiently complete to form the basis of a comparison with our own. The best are those of Lovén, ('Index Molluscorum Scandinaviæ'), who gives thirty-seven species as members of the Scandinavian Fauna; and of Verany, whose Catalogue of the Mollusca inhabiting the Gulf of Genoa ('Catalogo degli Animali Invertebrati,' &c.), includes forty-eight species of *Nudibranchiata*. The Sicilian species described by Philippi are twenty-six ('Enumeratio Molluscorum Siciliæ').

But it is not in a numerical point of view alone that our knowledge of this interesting tribe of animals has increased; their anatomy and physiology, their habits and alliances, have lately been studied with care and attention, and many curious facts concerning them have been ascertained. In 1841, the celebrated Norwegian naturalist, M. Sars, announced the discovery that these little creatures undergo a metamorphosis, having on their extrusion from the egg a very different form and character from those which they are afterwards destined to assume. In this first stage of their existence they have the appearance of small animalcules, swimming freely through the water by means of two ciliated lobes, and have their body covered by a nautiloid shell furnished with an operculum. Up to that time nothing approaching to a distinct metamorphosis had been known to exist in any of the true *Mollusca*; the announcement therefore did not fail to excite a considerable degree of interest. The investigation of this curious fact was pursued and extended by M. Lovén and other naturalists, the result of which showed that this peculiar mode of development was not confined to the Nudibranchs alone, but was common to many of the allied families; the metamorphosis however is most striking in those genera which, like the former, do not bear a shell in their adult state.

Professor Milne-Edwards was the first to describe ('Annales des Sciences Naturelles,' 2nd Series, vol. xviii., p. 330) a curious conformation of the digestive organs in the family of the *Eolididæ*, the true signification and uses of which have since been the subject of much controversy. Having observed in a small *Calliopæa*, found at Nice, a system of branched canals connected with the stomach, and extending to the papillæ and other parts of the external surface, he thought he saw in this arrangement a blending of the functions of digestion with those of the vascular system, which he in consequence called gastro-vascular. This apparatus he compares to the system of vessels radiating from the stomach of the *Medusidæ* on the one hand, and to the cæca connected with the digestive organs of the Nymphons among the *Crustacea* on the other.

During the same year (1842), M. Delle Chiaje had published a figure of his *Eolis cristata* (*Antiopa cristata*, A. and H.), in which a similar apparatus of branching vessels connected with the stomach is represented, but without any letter-press description. This view was adopted by M. Quatrefages, who founded on it his theory of the degradation of certain forms of *Mollusca*, which he placed in an order by themselves, and which he called *Phlebenterata*. The views of M. Quatrefages, although at first favourably regarded by the French Academy, have since met with much opposition; and in a report made by a Commission to the Biological Society in Paris, which was drawn up by Dr. Charles Robin, it is stated that the Commission regards the idea of Phlebenterism as untenable. They consider the ramifications of the digestive system, which M. Quatrefages regarded as a gastro-vascular system, to be true biliary ducts in connection with a divided liver, and that they do not fulfil any other function than the usual one of that organ. They moreover consider that the circulatory system in these animals (*Eolis*, *Actæon*, &c.) is complete, the so-called lacunes being similar to the blood-sinuses known to exist in particular cases throughout all departments of the animal kingdom. They further express an opinion that the facts upon which is founded the doctrine, enunciated by M. Quatrefages, "that the form of the body and the internal organisation are independent of each other," are not real, and that that hypothesis cannot be any longer maintained.

Prior to the appearance of these reports, a series of very excellent papers had been published by M. Milne-Edwards, taking an extended review of the circulatory system in the *Mollusca*. He states his conviction, founded on extensive researches undertaken for the purpose, that the venous system is incomplete throughout the whole of this large division of the animal kingdom. In all instances he finds the true veins more or less imperfect, their place being supplied by a series of lacunes, and the blood in most cases also flowing into the abdominal cavity. The condition of the Nudibranchs he does not consider to be exceptional.

The difference of opinion amongst these distinguished naturalists with respect to the circulatory system, has resolved itself into a very subtle anatomical fact. Both parties admit the existence of large cavities into which the blood flows, but, on the one part, they are considered as mere expansions of the vessels into blood-sinuses, and hence the vascular system is uninterrupted; while, on the other, they are held to be lacunes or gaps in the continuity of the vessels, showing a yet imperfect state in the structure of these organs, and thus forming an intermediate stage in the development of the vascular system, between its first imperfect appearance in the lower animals, and the complete system of closed vessels, only to be found, according to M. Milne-Edwards, in the *Vertebrata*.

The *Nudibranchiata* exhibit a high state of organisation, not much inferior to that of any of the *Gasteropoda*. They are all provided with a powerful muscular buccal apparatus, which has, in some instances, appended to it a gizzard, as in *Lamellidoris*, *Goniodoris*, *Idalia*, and others. The oral aperture is always guarded by fleshy lips, and the mouth itself is furnished with a tongue, bearing a spiny prehensile membrane, and occasionally with lateral corneous jaws.

The tongue is composed of a muscular apparatus bearing a stiffish membrane, furnished with small teeth or spines. These are divided into two kinds, central and lateral, distinguished by their position, and generally, when both are present, by a difference in form. The former have been called Dentes by Professor Lovén, the latter Uncini; and the portions of the tongue on which they are placed, are distinguished by that naturalist, under the names of Rachis and Pleuræ respectively. The lingual membrane in the typical *Dorides*, and in the *Tritoniadæ*, is very broad, and is supplied with numerous spines; it is narrow in *Lamellidoris* and *Acanthodoris*, there being very few spines in each transverse row—in some of the species as few as four. In such, the whole of the lingual spines do not amount to more than 112, while in *Doris tuberculata* there are no less than 6000, and in *Tritonia Hombergii* upwards of 36,000.

The œsophagus, stomach, and intestines are well marked; the former is generally short and passes from the upper surface of the buccal mass.

The stomach varies considerably in size and form; and in the *Doridida* is frequently buried in the liver. In them, too, there is occasionally, besides a buccal gizzard, an anterior stomach or crop, formed by a dilatation of the œsophagus.

The intestine is always short.

The liver presents two great tpyes of form. In the *Doridida* and *Tritoniadæ* it is entire (excepting in *Scyllæa*, where it is broken up into six or seven globular masses), occupying its normal abdominal position; in the *Eolididæ* it is more or less diffused. In those genera with an entire liver it is very bulky, pouring the hepatic fluid into the

stomach by one or several large ducts. When the gastric organ is free, as in *D. tuberculata*, it receives only one duct; but in those species with the stomach buried in the liver, the bile enters through several large openings in its under surface.

All the Nudibranchs are hermaphrodites, each individual being furnished with male, female, and androgynous parts. These organs, taken together, are very bulky, and occupy the greater portion of the abdominal cavity. They communicate with a common vestibule, opening upon a nipple-like process on the right side of the body, and always below the mantle, when it is present.

The organs of circulation and respiration consist of central organs of propulsion,—a systemic and portal heart,—arteries, veins, and sinuses or lacunes; and of laminated, branched, or papillose branchiæ; arranged either on the median line, or along the sides of the back.

The systemic heart lies always immediately below the skin of the back, and consists of two chambers,—an auricle and a ventricle,—inclosed within a pericardium. A large aorta passes forwards, distributing branches to the various organs; and the blood is returned again to the heart in a partially aërated state, only a portion of it having passed through the branchiæ. The blood system is somewhat modified in each of the three families of the order.

The partial or hepatic circulation is probably provided with a complete system of capillaries, and has, in connection with it, a portal circulation, to which is appended a ventricle or portal heart, that lies under the pericardium, the latter being related to the former as an auricle. This portal heart propels venous blood into the renal and hepatic organs.

The flow of the blood is rapid; the pulsations of the heart varying, in the different species, from fifty to a hundred in the minute.

It is evident, from the state of the circulatory apparatus, that respiration is performed only in part by the branchiæ. In all the three families, the skin, which is covered with vibratile cilia, acts as an imperfect accessory breathing organ, and thus the blood is returned to the heart in a partially aërated condition.

The nervous system presents a high degree of concentration,—perhaps higher than in any other group of Molluscs,—and is divided into two very distinct portions;—one, the cephalic or excito-motor; the second, the splanchnic or sympathetic; these two portions intercommunicate at several points. The cephalic ganglia are situated at the origin of the œsophagus, and naturally divide themselves into two sets, which may be denominated respectively œsophageal and buccal, or supra- and infra-œsophageal. The latter are attached to the buccal mass; the former are more immediately related to the œsophagus, upon which they are always seated, and about which they, with their commissures, form one or more constricted collars. The two sets of ganglia are also interconnected.

The œsophageal set is composed essentially of three pairs of principal ganglia, howsoever they may be fused or blended together, and of one or two accessory pairs. The principal ganglia are the cerebroid, the branchial, and the pedial; the accessory,—the olfactory and the optic. They are placed symmetrically with regard to the median line, there being one of each pair on either side. The cerebroids are invariably above the œsophagus; they hold a central position, and are united by a very short commissure across the median line, being usually in contact with each other, and, when distinct, are connected by commissures with the branchial and pedial: these two latter of the same side also intercommunicate. The branchials, as well as the cerebroids, are generally above the alimentary tube, and are frequently fused with them, so as to form a single mass on each side of the median line.

The œsophageal ganglia are united to the buccal by two long commissural cords, which pass from the under side of the cerebroids and embrace the gullet, forming a wide collar—the buccal—around that tube. A large sub-œsophageal commissure, passing between the œsophageal ganglia of either side, completes a second or great posterior œsophageal collar. This commissure varies in length, in accordance with the position of the ganglia: if they are all above the alimentary tube, it is long; if partly below, very short.

The cerebroid ganglia give nerves to the channel of the mouth, to the lips and oral tentacles, also to the veil, when it is formed by the fusion of these latter organs: they have likewise attached to them the two pairs of accessory ganglia—the olfactory and the optic.

The branchial ganglia distribute nerves to the mantle or dorsal skin, and to the branchial ganglia of the sympathetic system.

The pedial ganglia send all their nerves to the foot.

The buccal set of ganglia are generally two pairs: the buccal proper and the gastro-œsophageal.

The Sympathetic System is composed of numerous minute variously formed ganglia, connected together by open plexuses of nerves, spread out over the viscera. The principal of these plexuses are—the œsophageal, the gastro-hepatic, the pyloric, the intestinal, the branchial, and the genital. Similar ganglia and nerves have also been found in connection with the heart, arteries, buccal-mass, and skin. This system is connected with both sets of cephalic ganglia, with the œsophageal, through the visceral and branchial centres, and with the buccal by the par vagum, and gastro-œsophageal ganglia.

All the Nudibranchs are provided with auditory capsules, which contain numerous vibratile otolithes in all the genera, except *Embletonia* and a portion of *Eolis* (*Cavolina* and *Tergipes*), where there is only a single large spherical otolithe; the auditory organs thus, in these, retaining their embryonic condition. Eyes are also universally present, and are only a little inferior in organisation to those of the higher Gasteropoda. The dorsal tentacles are the organs of smell, and, judging from their great development, this sense must be more acute in most of the Nudibranchs than it is in any other mollusc, with the exception perhaps of *Nautilus*. Touch undoubtedly resides everywhere in the skin, but is specialised in the oral tentacles and parts about the mouth. The lips and channel of the mouth are probably the seat of taste.

The skin varies very much in thickness in the several groups. It appears to secrete the tenacious fluid that so abundantly exudes from these animals; though that which lubricates the foot is probably provided by a special gland.

As it is seldom possible to study these animals in their native haunts, the little that we know of their habits is mostly gathered from the observation of individuals kept in confinement, and consequently under influences more or less artificial.

Some of the species are nocturnal, but this is not the case with many of the littoral tribes. Such of these as are gregarious on small seaweeds, as *Polycera quadrilineata*, may be observed in a state of activity during the day time, in tide-pools left among the rocks, and apparently enjoying the warm rays of the sun. *Alderia modesta* has a similar habit in more shallow water, becoming almost amphibious: and *Doris bilamellata* is frequently found exposed on rocks left dry by the tide. But the greater number of the species avoid the light, concealing themselves under stones and shelving rocks. Most of the littoral tribes are found near to low-water mark; though some few kinds occur much higher up among the rocks, where they must remain several hours every tide deprived of water. *Doris pilosa*, *Eolis papillosa*, and *Eolis nana*, are generally met with in such situations; even the spawn of these species is frequently left dry by the receding tide.

The Nudibranchs partake largely of the sluggish character of the class to which they belong. Crawling is the usual mode of progression with these animals. This is effected in the manner of the snail, by a series of minute undulations of the under surface of the foot, arising from the alternate relaxation and contraction of the pedial muscles. None of our native species have the power of swimming freely through the water; and we are not aware of any means they have of reaching the surface but by crawling up any substance in contact with it. This they do frequently in confinement, by ascending the sides of the vessel, and then launching themselves, with outspread foot, on the surface of the water in an inverted position. Like most of the other aquatic Gasteropods, they are very fond of floating in this way, which they do without any apparent effort.

While floating in this manner the Nudibranchs occasionally drop suddenly down, suspending themselves from the surface by a thread of mucus, which is fixed to the tail or posterior extremity of the foot. In this way they will let themselves gradually down to the bottom, or remain some time pendent in the water without apparent support; for the thread of mucus is so transparent that it can scarcely be seen. On any of these occasions, either when floating or when suspended, if alarmed, the animal falls at once to the bottom. This is effected by the foot quitting its hold of the mucus, when the animal, being specifically heavier than the water, of course sinks; its specific gravity is, no doubt, increased by the collapse of the parts; but the Nudibranchs are never lighter than the water, even when fully expanded, though in this state many of them are nearly buoyant.

A species of *Peplidia* has been observed by the Rev. R. T. Lowe to be phosphorescent.

The Nudibranchiate *Mollusca* are very sensitive to external influences, shrinking quickly from contact, and withdrawing their organs on the least sense of danger. When crawling on sea-weeds or corallines, they often detach themselves on being disturbed, and drop to the bottom of the water. The *Eolides*, when alarmed, or irritated, erect their papillæ, and sometimes agitate them in a convulsed manner, directing their apices to any source of annoyance; each papilla being endowed with a motion independent of the others. On such occasions urticating filaments are probably ejected from the tips of these organs. The papillæ of *Eolis*, *Doto*, *Antiopa*, and some other allied genera, are very slightly attached to the back, and the animals appear to have the power of casting them off voluntarily, in the same manner as a crab throws off its claws, or a star-fish its arms. The organs thus cast off are quickly reproduced when the animal is in a healthy state; and what seems strange is, that in the meantime it does not appear to suffer any inconvenience from the loss of these, as might have been supposed, vital organs.

Their tenacity of life when kept in confinement varies much in the different species, but is greater than in many other marine animals. Any impurity in the water, or too great change of temperature, affects them very sensibly, so that it is difficult to keep them alive in warm weather, particularly those from deep water. The littoral species can sustain a greater change of temperature, and may be kept alive for a considerable time out of water in a moist saline atmosphere, but they die almost immediately when deprived of moisture. Several species have lived for months in the aquavivarium at the gardens of the Zoological Society, Regent's Park.

Though patient and long-suffering in the endurance of hunger, they are very voracious. The greater number of them are carnivorous; living principally upon zoophytes and sponges. The *Alcyonium digitatum* is a favourite food with the *Tritoniæ:* and the *Actiniæ* and *Lucernariæ* often fall a prey to the attacks of the *Eolides*. These latter indeed do not scruple occasionally to devour the weaker among their own brethren.

Most of the species that are found between tide-marks make their appearance periodically, and the common kinds are generally found in considerable numbers for a time, extending from one to three months, after which they almost entirely disappear. This is their breeding season, and it is generally considered that these animals live mostly beyond low-water mark for a great part of the year and come into shallower water to spawn, as is the case with several tribes of marine animals. It is however more probable that the old ones die off before the young are old enough to be observed. It would thus appear that the duration of their existence is but short.

The following table of the British species, drawn up by Messrs. Alder and Hancock, will supply a list of the British species, and afford at the same time a view of their distribution in depth:—

DISTRIBUTION IN ZONES OF DEPTH.

1. Littoral Zone. 2. Coralline Zone. 3. Deep-Water or Coral Zone.

	1	2	3
DORIDIDÆ.			
Doris tuberculata	×		
D. flammea	×	×	
D. Zetlandica	× ?		
D. millegrana	× ?		
D. planata	×		
D. Johnstoni	×		
D. coccinea	×		
D. reticulata	×		
D. aspera	×		
D. proxima	×		
D. muricata	×		
D. Ulidiana	×		
D. diaphana	×		
D. oblonga	×		
D. bilamellata	×		
D. depressa	×		
D. inconspicua		×	
D. pusilla	×		
D. sparsa		×	
D. pilosa	×	?	
D. subquadrata	×		
Goniodoris nodosa	×		
G. castanea	×		
Triopa claviger	×	×	
Ægirus punctilucens	×		
Thecacera pennigera	×		
T. virescens	×		
T. capitata		×	
Polycera quadrilineata	×	?	
P. ocellata	×		
P. Lessonii		×	
Ancula cristata	×		
Idalia elegans		×	
I. Leachii		×	×
I. aspersa		×	
I. inæqualis			×
I. pulchella		×	
I. quadricornis		×	
TRITONIADÆ.			
Tritonia Hombergii		×	×
T. alba		×	
T. plebeia		×	
T. lineata	×		
Scyllæa pelagica			×
EOLIDIDÆ.			
Lomanotus marmoratus		×	
L. flavidus		×	
Dendronotus arborescens	×	×	
Doto fragilis		×	×
D. pinnatifida		×	

	1	2	3
Doto coronata	×	×	×
Eolis papillosa	×	?	
E. glauca	×	×	
E. Alderi	×		
E. coronata	×	×	
E. Drummondi	×	×	
E. punctata		×	
E. elegans		×	
E. rufibranchialis	×	×	
E. lineata	×	×	
E. smaragdina	×		
E. gracilis	×	×	
E. pellucida		×	
E. Landsburgii	×	×	
E. alba	×	×	
E. carnea		×	
E. Glaucoides	×		
E. Peachii		×	
E. nana	×		
E. stipata		×	
E. angulata		×	
E. inornata	×		
E. concinna	×		
E. olivacea	×	×	
E. aurantiaca	×	×	
E. pustulata		×	
E. Couchii	×		
E. amœna		×	
E. Northumbrica		×	
E. arenicola		×	
E. Glottensis		×	
E. viridis	×	×	
E. purpurascens	×		
E. cingulata	×		
E. vittata		×	
E. cærulea	×		
E. exigua	×		
E. picta	×	×	
E. tricolor		×	
E. amethystina	×		
E. Farrani	×	×	
E. despecta	×		
Embletonia pulchra	×		
E. minuta		×	
E. pallida	×		
Fiona nobilis	×		
Hermæa bifida	×	×	
H. dendritica	×		
Alderia modesta	×		
Proctonotus mucroniferus		×	
Antiopa cristata	×	×	
A. hyalina	×		

With the imperfect knowledge of foreign species that we yet possess, it is scarcely possible to arrive at any satisfactory conclusion concerning the general distribution of the *Nudibranchiata* in the different regions of the globe. So far as the observations of travellers go, they appear to be pretty generally diffused throughout all seas and in all climates. The tropical forms are, as usual, larger and more brilliantly coloured than those of colder climates, but the notices of extra-European species are so scanty that we cannot form any idea of their numerical preponderance; nor can we, for the same reason, point out, as may be done in many groups of animals and plants, any particular centres of distribution where they are more especially congregated. With the exception of a few oceanic wanderers, such as *Glaucus* and *Scyllæa*,

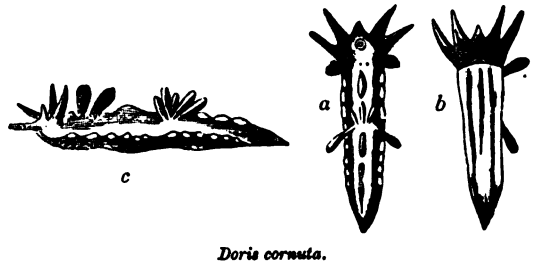
which have been met with by almost every voyager, nearly all the Nudibranchs that have been described by naturalists visiting the southern hemisphere belong to the *Doridida;* and these show a much greater variety of forms than are to be found in the same family with us. It may therefore be inferred that the members of this family are proportionally more numerous in warm climates than in the more northern and colder regions; but were we to take the number of species at present known as a ratio of their preponderance, we should certainly be very wide of the mark, for it cannot be doubted that a great deal of the apparent deficiency of other genera, in comparison with the *Doridida*, in foreign countries, arises from the want of proper examination, and from the little attention paid by collectors to the less conspicuous forms. It may therefore be expected that when naturalists visiting foreign countries shall have their attention directed more especially to this beautiful race of marine animals, they will not only collect those conspicuous species which, from their size and colour, obtrude themselves upon the eye, but will search out in their hidden retreats the smaller and often more interesting because more varied forms that belong to the other families.

From the previous table it will be seen that only three families of the *Nudibranchiata* are British. The following families are given in Woodward's 'Manual of Mollusca:'—

Doridæ, Sea-Lemons.

Animal oblong; gills plume-like, placed in a circle in the middle of the back; tentacles two; eye-specks immersed, behind the tentacles, not always visible in the adult; lingual membrane with usually numerous lateral teeth; rachis often edentulous; stomach simple; liver compact; skin strengthened with spicula, more or less definitely arranged.

The genera belonging to this family are—*Doris, Goniodoris, Triopa, Ægirus, Thecacera, Polycera, Idalia, Ancula, Ceratosoma.*



Doris cornuta.

a, seen from above; *b*, seen from below; *c*, side view.

Doris lacera.

Doris Solea.

Doris (Onchidoris) Leachii.

a, side view; *b*, seen from below.

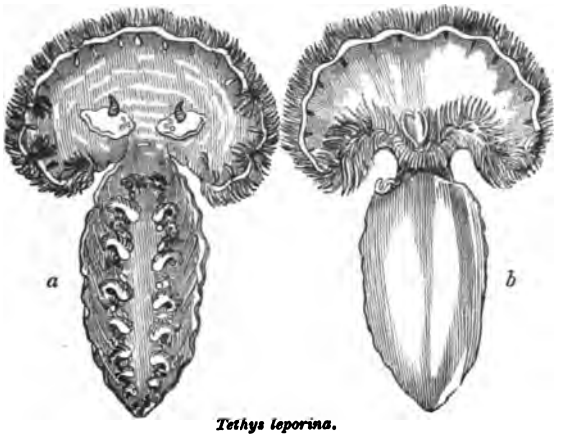
Tritoniadæ.

Animal with laminated, plumose, or papillose gills, arranged along the sides of the back tentacles retractile into sheaths; lingual membrane with one central and numerous lateral teeth; orifices on the right side.

The genera included in this family are—*Tritonia, Scyllæa, Tethys, Bornella, Dendronotus, Doto, Melibœa, Lomanotus.*

Tritonia Hombergii.

Scyllæa pelagica.



Tethys leporina.

a, seen from above; *b*, from below.

Melibœa rosea.

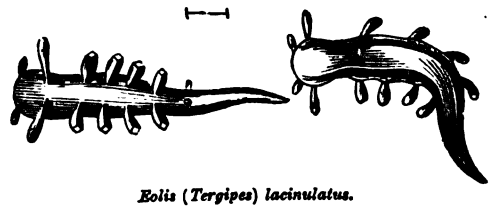
b, veil which surrounds the mouth; *e*, tentacles; *g*, branchial club-like processes; *h*, orifices of the organs of generation; *i*, orifice of the anus; *l*, foot; *s*, caudal extremity.

Æolidæ, or *Eolidæ.*

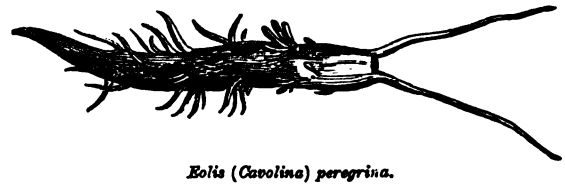
Animal with papillose gills, arranged along the sides of the back; tentacles sheathless, non-retractile; lingual teeth 0.1.0; ramifications of the stomach and liver extending into the dorsal papillæ; excretory orifices on the right side; skin smooth, without spicula; no distinct mantle.

The genera included in this family are—*Eolis, Glaucus, Fiona, Embletonia, Proctonotus, Antiopa, Hermæa, Alderia.*

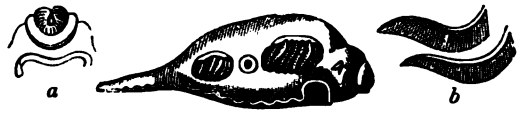
Eolis (Eolidia) Cuvieri.



Eolis (Tergipes) lacinulatus.



Eolis (Cavolina) peregrina.



Glaucus (Laniogerus) Elfortii. De Blainville.

a, the mouth; *b*, the branchial cirrhi.

Phyllirhoidæ.

Animal pelagic, footless (apodal), compressed, swimming freely, with a fin-like tail; tentacles two, dorsal; no branchiæ; lingual teeth in a single series; stomach furnished with elongated cœca; orifices on the right side; sexes united.

This family has but one genus, *Phillyröe* (*Eurydia*, Esch.).

Elysiadæ.

Animal shellless, limaciform, with no distinct mantle or breathing organ; respiration performed by the ciliated surface of the body; mouth armed with a single series of lingual teeth; stomach central; vent median, sub-central; hepatic organs branched, extending the length of the body, and opening into the sides of the stomach; sexes united; male and ovarian orifices below the right eye; female orifice in the middle of the right side; heart with an auricle behind, and traces of an arterial and venous system; eyes sessile on the sides of the head; tentacles simple or obsolete. The genera of this family are—*Acteonia, Cenia, Limapontia, Elysia.*

(We are indebted for the chief part of this article to the yet unpublished introduction to Messrs. Alder and Hancock's work on the 'British Nudibranchiata,' which the authors have kindly permitted us to use. Of this work Messrs. Forbes and Hanley, in the 'History of British Mollusca,' say that "it is one of the most beautiful and perfectly executed works of which zoological science can boast.")

NULLIPORA. [Corallinaceæ.]

NUMB-FISH, a name for the *Torpedo.* [Electricity of Organic Beings.]

NUMENIUS. [Abou-Hannes.]

NUMIDA. [Pavonidæ.]

NUMMULITES. [Foraminifera.]

NUPHAR, a genus of Plants belonging to the natural order *Nymphæaceæ.* It has a calyx composed of five or six petal-like sepals; the petals 10 to 18, much smaller than the sepals; the stamens indefinite, which, as well as the sepals and petals, are inserted into the base of the torus, so that the fruit appears as if it were superior. The stigmas are from 10 to 18, and radiated. Carpels 10 to 18, inclosed within the torus. The species, like those of the last genus, are elegant aquatic plants, and differ from them in appearance by their yellow flowers. There are several species growing in various parts of Europe and America. Of these the *N. lutea*, Yellow Water-Lily, is the most common. It has a calyx of 5 sepals; the stigmas are entire, 16- to 20-rayed, deeply umbilicated; the leaves ovato-cordate; the lobes approximate; the petioles triquetrous with acute angles. This plant is a native throughout Europe and in Siberia, and is also found in North America. The flowers have a strong smell, like that of brandy, and in many parts of the country the fruits are called Brandy-Bottles. There is a species very much resembling this in all points, except that it is about half the size; it is called *N. pumila*, Dwarf Yellow Water-Lily. It is a native of the North of Germany, Lapland, Norway, and Scotland. There are five or six other species, all of them natives of ponds and ditches of fresh water. There is a North American species, *N. advena*, which grows in salt water as well as fresh, and is very plentiful about Philadelphia and also in Canada.

NUSSIERITE, a Mineral which occurs in crystals almost lenticular. Primary form a rhomboid. It is generally found implanted in mammillary masses. Colour yellow, grayish, or greenish. Streak yellowish-white, grayish. Fracture somewhat conchoidal. Hardness 4·0. Lustre greasy, feeble. Specific gravity 5·0415. Found in the

mine of Nussière, near Beaujeu, department of the Rhône, France. The following is the analysis by Barruel :—

Phosphate of Lead	56·40
Phosphate of Lime	22·20
Chloride of Lead	7·65
Arseniate of Iron	6·50
	——92·75

NUTCRACKER. [NUCIFRAGA.]

NUTHATCH. [SITTA.]

NUTMEG. [MYRISTICA.]

NUTRITION. One of the chief differences between inorganic and organic bodies is, that the former retain their form and other characters by a passive resistance to change; the latter by a constant change of their particles, in which those that in the constant actions of life or by the influence of external agents have been destroyed, are replaced by others similar to themselves. This constant change is effected by the process of nutrition. Nutrition is the last step of the general process of assimilation, by which living bodies convert the materials which they derive from their food into substances like their own, and appropriate the materials thus changed to their own increase or repair. The several nutritive matters received into the living body are variously altered by digestion, absorption, respiration, and by all the other changes which the blood or other fluid undergoes in its passage to the several parts of the frame; these changes constitute the process of assimilation, at the end of which each part of the body abstracts from the general and homogeneous mass of nutritive fluid that which is required for its own growth or repair; muscle abstracting particles to form muscle, nerves from the same fluid abstracting particles to form nerve, and so on.

That a constant change of particles goes on in the majority of the tissues of the living body may be considered certain. It is evidently necessary from the nature of the case; for the living body is exposed to the same external agents as inorganic matter is, and all its own actions are so many more sources of waste to each tissue. Some constant power of repair must therefore be requisite to maintain living bodies in a state of integrity against these constant sources of waste; and that power is exerted in nutrition. Its influence is shown in the fact that the living body retains throughout life, or a great portion of it, its form and composition less altered than the most solid of inorganic matters exposed to similar influences. Within certain limits also, the greater the waste the greater the nutritive supply: thus, for example, by constant exercise the size of the muscles, so far from being decreased, is ultimately increased, the effect of nutrition being not only to replace that which was destroyed, but to supply a certain quantity more. We may clearly observe an application of the same law in the cuticle; that in the palm of the hand is more than twice as thick as that on the back of the arm, yet the former is subject to the most friction; and if the friction of the palm be greatly increased, the cuticle, notwithstanding the greater waste, increases in thickness in a yet greater proportion, so as to defend the subjacent skin from the greater source of injury to which it is exposed.

It is true that when the body does not change in any of its sensible qualities, we cannot be so well assured of any change of particles still going on; but we may reasonably assume that the two parts of nutrition, the removal of old and addition of new particles, which at other times we trace producing either an increase or decrease of the body, as one or the other of them predominates, are exactly balanced. If we examine, for example, the growth of any hollow organ of the body, as the heart, we find that in advancing years from childhood to manhood, it increases not only in its whole bulk, but also in the size of its cavities, and that, at every period of life, the size of the cavities and the thickness of their walls bear nearly the same proportion. Now, if only an addition were made to the exterior of the heart of a child, its whole bulk would be increased, but the size of its cavities would be disproportionately small. We must therefore assume that substance is removed from the interior of the heart, at the same time, though not in exactly the same quantity, that substance is added to its exterior. In like manner, when the heart diminishes in size, as it usually does in persons labouring under consumption, material must be at the same time abstracted from the exterior, and, in rather a less proportion, added to the interior. Whatever of this kind is true of the larger organs must be equally so of the small ones; so long as they preserve the same form and proportions, no change of size can take place without the concurrence of the two processes of nutritive deposition and absorption; when the former preponderates, the part will increase in size—when the latter preponderates, it will diminish; the former, when connected with disease is named Hypertrophy [HYPERTROPHY, in ARTS AND SC. DIV.], the latter Atrophy. [ATROPHY, in ARTS AND SC. DIV.]

The coincidence of these two processes, where any change of size takes place, being thus proved, and their continuance, when no such visible change occurs, being necessary, we may fairly assume that in the latter case, in the state of nutritive equilibrium, they still continue, though their opposite effects being exactly balanced, the ultimate result is not discernible. Popular belief, adopting this idea as one of whose truth there could be no possible doubt, has even assigned the periods of time in which one whole set of particles is removed and replaced. There is no evidence whatever upon which any such calculation can be made; the period in which an entire change is completed probably varies greatly in different tissues and different external circumstances, and in the bones and teeth it is probable that the particles once deposited are never removed, so long as the animal's size and other characters remain unaltered.

The process of nutrition is concerned in the production of two apparently different results—that of development and that of growth. In development the added particles not merely increase the size of the part, but produce a change in its form or its substance. Thus, the whole body, with all its varieties of tissues, and through all its changes of form, is developed by nutrition, from a small part of a little sac [REPRODUCTION], which, to all appearance, is composed of homogeneous materials. In growth each part increases by the predominant deposition of particles within and around those of which it was previously composed, and similar to them. These two nutritive processes, though in the period of life previous to the adult age they are usually concurrent, may go on independently of each other. Thus the body may be deficient in development, some part of it being monstrous, that is, remaining of the same form as that which it had in the embryonic state [MONSTER], and yet with this defect in form it may increase in size, for monsters are commonly well grown; and, on the other hand, being perfect in development and form, the body, or some part of it, may be deficient in size. A dwarf is an example of a defect of growth; a hare-lip, a cleft palate, an anormal unossified cartilage, are examples of defects of development: both are defects in the process of nutrition, but the failure is in each in a different direction.

One of the most important facts in regard to the process of nutrition, in both plants and animals, is that all tissues originate in cells. [CELL.] It is by the activity of these cells that all the processes of nutrition are carried on. In plants, they appropriate the inorganic or mineral matters and convert them into organic. In animals, they absorb the nutrient materials supplied by the chemistry of the plant-cell, and are the great agents by which these materials are first made subservient to life, and afterwards thrown off from the body. [ANIMAL KINGDOM; VEGETABLE KINGDOM.] In plants the materials of nutrition are brought to the cells by means of the sap, which consists of water holding other materials in solution. [SAP.] In the higher animals the blood is the great source of the materials from which the cells derive their constituents. [BLOOD.]

Thus the process of organic nutrition is widely different from that by which inorganic masses increase in size, as in crystallisation, which, as in it alone inorganic matter acquires definite forms as it increases, can alone be compared with organic growth. In crystallisation the addition of similar particles is entirely by external apposition, and the crystal has no power of attracting the particles of any matter different from its own. Organic particles (as cells), on the contrary, not only attract particles into their interior spaces, but alter them on their passage, decomposing them from their previous elementary composition, and recombining them into matter like their own.

In healthy nutrition each part appropriates particles similar to its own, or differing according to certain laws of development; in disease, parts frequently appropriate other substances than their own, and all the solid products of various diseases may be regarded as the effects of morbid processes of nutrition. Some of these are formed according to the laws of normal development, and are only morbid because out of place, as cicatrices, adhesions, and the other similar products of simple inflammation; others are produced by the deposition of substances different from any of those already existing in the body, as in the production of various tumours. The former are composed of a tissue similar to cellular tissue, but the injuries of parts are but partially repaired by it, because the new tissue, which is in all cases nearly the same, differs in many of its characters from that which it replaces.

The most complete exercise of the process of nutrition in repairing injuries, whether from accident or disease, is exhibited in the regeneration of parts, but in man and the higher animals there are but few examples of a perfect reproduction of the injured or destroyed tissue. The bones and the non-vascular tissues are probably the only instances in which a tissue destroyed by disease or internal injury is replaced by one similar to itself.

In all these cases of repair or regeneration of tissue, the same process of the effusion of nutritive matter and the several stages of formation and alteration of the cells is gone through which is observed in the first development of the tissues. But the process fails before the higher changes are accomplished, and the repairing tissue acquires only a low degree of development. As far also as they have been at present examined, the various morbid growths appear to be formed on a similar plan, and to proceed from a formation of primary cells.

NUTTAINIA, a genus of *Trilobites*, from the Silurian Strata of Tyrone. (Portlock.) It occurs also in England and Wales.

NUTTALITE, a Mineral which occurs crystallised. Primary form a square prism. Cleavage parallel to the lateral planes. Fracture uneven. Hardness 4·0 to 4·5. Colour gray. Lustre vitreous. Translucent. Specific gravity 2·7 to 2·8. It is found at Bolton in Massachusetts imbedded in calcareous spar. An analysis by Thomas gives :—

Silica	37·81
Alumina	25·10
Lime	18·33
Potash	7·30
Protoxide of Iron	7·89
Water	1·50
	97·93

NUT-WEEVIL. [BALANINUS.]

NUX-VOMICA. [STRYCHNOS.]

NYCTAGINACEÆ, *Nyctagins*, a small natural order of Hypogynous Exogenous Plants, belonging to Lindley's Chenopodal Alliance. They have a tubular often coloured calyx, which separates from its base, the latter becoming a hard spurious pericarp. The species are annuals or perennials often with fleshy roots, or shrubs or trees usually articulated at the tumid nodes. *Mirabilis dichotoma*, the Marvel of Peru of our gardens, may be taken as the type of the order. *M. Jalapa* was at one time supposed to be the plant yielding true jalap. This is however a mistake. [CONVOLVULACEÆ.] The roots of the plants of this order are generally purgative. They are natives of the warmer parts of the world in either hemisphere. They are tropical or subtropical. The order is related to *Polygonaceæ*, *Amarantaceæ*, and *Cannabinaceæ*. It contains 14 genera and about 100 species. (Lindley, *Vegetable Kingdom*.)

NYCTERI'BIA, a genus of Parasitic Insects of the order *Diptera*. They are closely allied to the Horse-Flies (*Hippoboscidæ*). They have neither wings nor balancers. Their intermediate legs are connected at the base by a pair of comb-like organs supposed to represent wings. They live on the bodies of bats.

NYCTERIS. [CHEIROPTERA.]

NYCTIARDEA. [NYCTICORAX.]

NYCTI'BIUS, M. Vieillot's name for a genus of Birds, the type of which is the Great Ibijau, the Grand Crapaud Volant de Cayenne of Buffon, *Caprimulgus grandis* of Latham.

The bill is very much depressed and dilated, especially at the base, where it is furnished with bristles, narrowed and hooked at the point; upper mandible with an obtuse tooth on each edge, towards its origin, very much developed in the old bird; lower mandible larger, with the edges curved outwards; gape very wide, reaching to the eyes; anterior toes united at the origin by a small membrane; lateral toes unequal; hallux robust and flattened. First quill shorter than the fifth.

N. grandis, the Great Ibijau, is about the size of a stout owl; total length of the bird rather more than twelve inches; of the bill, taken from the corners of the mouth, rather more than three inches; tail a little graduated, and exceeded by the wings when folded by a few

Great Ibijau (*Nyctibius grandis*).

lines; plumage brown, speckled with black, fulvous, and white, principally upon the back, wings, and tail; breast of a deeper brown than the spots; head, neck, and lower part of the body striped transversely with the same colours. In some individuals the plumage is more brown than it is in others.

Its habits are solitary. The bird haunts hollow trees, and prefers those which are near the water.

NYCTICEBUS. [LEMURIDÆ.]

NYCTI'CORAX, Mr. Stephen's name for a genus of *Grallatores*, or Wading Birds, belonging to the family *Ardeadæ* (Herons and Cranes). Mr. Swainson has changed the name to *Nyctiardea*; but besides the inconvenience arising from the change, the generic name *Nyctiardea* is a hybrid word derived from Greek and Latin roots, and therefore objectionable.

The genus has the bill very strong, rather longer than the head, compressed; upper mandible curved towards the point; maxilla sulcated for three-fourths of its length and emarginated; culmen rounded; tomia of both mandibles straight and sharp, that of the under mandible entering within the upper one. Nostrils basal, longitudinal, placed in the furrow of the maxilla, and covered above by a naked membrane; lores and orbits naked. Legs of mean length, slender. Toes three before and one behind; middle toe shorter than the tarsus, exterior toe connected by a membrane to the middle one as far as the first joint. Claws short, falcated, that of the middle toe pectinated. Tibia naked for a short space above the tarsal joint. (Gould.)

This form, of which several species are now known, is widely diffused. Species occur in Europe, Asia, Africa, and America; and have been found in Manilla, New South Wales, and Tierra del Fuego.

N. Europæus, Stephens; *N. Gardeni*, Jard.; *Ardea Nycticorax*, Linn. In the old birds there is no difference in that stage of life between the sexes. Top of the head, back, and scapulars, black with bluish and greenish reflections; three white very narrow feathers, 6 or 7 inches in length, taking their origin at the back of the head just above the nape, and descending backwards; lower part of the back, wings, and tail, clear ash-colour; forehead, space above the eyes, throat, front of the neck, and lower parts, white; bill black, yellowish at the base of the lower mandible; iris red; feet yellowish-green; length rather more than 1 foot 8 inches.

In the young of the year the three long nuchal feathers are absent; top of the head, nape, back, and scapulars, of a muddy brown, with longitudinal bright-red dashes on the centre of each feather; throat white, with small brown spots; feathers of the front and sides of the neck yellowish, with wide brown borders; coverts of the wings and quills ashy-brown, marked with great yellowish-white spots at the extremity of each feather; lower parts clouded with brown, white, and ash-colour; middle of the belly whitish; arête and point of the bill brown, the rest greenish-yellow; iris brown; feet olive-brown.

In this stage it is the *Ardea maculata* and *A. Gardeni*, Gmel.; Le Pouacre and Le Pouacre de Cayenne, Buff.; Scarza Cenerino, 'Stor. degl. Ucc.;' and Spotted and Gardenian Heron, Lath. Indeed ornithologists have described it as a distinct species in almost every progressive stage of plumage.

In the old state the bird is the Bihoureau, Roupeau, and Heron Gris of the French; Scarza Nitticora of the Italians; Der Nacht-Reiher and Aschgraue Reiger mit 3-Nacken Federn of the Germans; Blaauwekwak of the Netherlanders; Night-Heron and Lesser Ash-coloured Heron of the British.

Common Night-Heron (*Nycticorax Europæus*).
Front figure, adult; back figure, young.

The Common Night-Heron appears to affect high situations by day, and in the evening resorts to the low lands, marsh, or river-side, for

its food, which consists of fish, for choice, and in their absence of frogs, mice, and even insects. The old French quatrain says:—

"Le Bihoureau, espece de Heron,
Es haults rochers et es collines hante.
Sa forme est peu au Heron differente.
Sus le rivage il vit, et environ."

The general truth of this picture of its habits is borne out by modern observation; and its fondness for perching on high situations is attested by Mr. Gould, who received a fine adult specimen which had been shot from a high tree in the gardens at Frogmore, near Windsor. The nest is built of sticks on the topmost branches of trees, and the bird breeds, like the Common Heron, in society. Where there are no woods the nest has been found among reeds. The eggs, four in number, are pale greenish-blue.

The distribution of this bird is very wide. In these islands it is a rare visitor. In the last editions of Pennant, the specimen in the Leverian Museum, which was shot near London, is noticed, and the editor had heard of another having been killed in Suffolk; and Dr. Latham, in a note to the same work, records one that was killed at Cliefden in Buckinghamshire. He adds that it is common in Spain and about Gibraltar, and that it inhabits China and India; and falls into the general error, as it now seems to be considered, that the North American species is identical with it.

Montagu notices a specimen shot on the Ouse near Ampthill, and another (a young bird, Gardenian Heron) was shot near Thame, in Oxfordshire, by Lord Kirkwall. Bewick took his figure from a specimen in the Wycliffe Museum. Two came under the observation of Mr. Selby:—one shot by the Earl of Home, at the Hirsel, near Coldstream, in 1823; and another, now in Sir W. Jardine's museum, killed about two years afterwards in the neighbourhood of Dumfries. It appears in Mr. Thompson's Irish List. He saw a specimen in Dublin which, he was informed, was sent to the bird-preserver, in whose possession it was in a fresh state, from Letterkenny, early in 1834.

NYCTINOMUS. [CHEIROPTERA.]

NYCTIORNIS. [MEROPIDÆ.]

NYCTOPHILUS. [CHEIROPTERA.]

NYL-GHAU. [ANTILOPEÆ.]

NYMPHA'CEA. [MALACOLOGY.]

NYMPHÆA, a genus of Plants the type of the natural order *Nymphæaceæ*. It has a calyx of 4 sepals girding the base of the torus. The petals, 16 to 28, adnate to the torus, elevated about the ovary and covering the same, and therefore at first sight appearing inserted into it. The stamens are numerous, disposed in many series, and inserted in a similar way above the petals. There are upwards of 20 species of this genus described. They have all large floating leaves, with white, red, or blue flowers, which appear at the surface of the water.

N. cærulea, Blue Water-Lily, has peltate nearly entire leaves without dots, glabrous on both surfaces, and 2-lobed at the base, the lobes free; the anther with an appendage at the apex; the stigmas 16-rayed. This plant is a native of Lower Egypt in rice-grounds and canals about Rosetta, Damietta, and Cairo. The flowers are very fragrant, and from its frequent representation in the sculptures of Egypt, it appears to have been regarded as a sacred plant by the ancient Egyptians.

N. edulis, the Eatable Water-Lily, has peltate broad oval entire leaves, with the under surface pubescent. This plant is a native of the East Indies, in wet fenny districts. Its flowers are small, and white or reddish. Like all the species, it has large pear-shaped roots, which contain an abundance of starch, and they are consequently used as articles of diet. The seeds also of a species nearly allied to this, the *N. rubra*, which has deep-red flowers, are also used as an article of diet. Its flowers also are held in superstitious veneration by the Hindoos in the districts of the East Indies in which it grows.

N. pubescens has peltate, sharply-toothed leaves, orbicularly reniform, with the under surface pubescent and spotted, and the lobes roundish. It is a native of the East Indies, Malabar, Moluccas, Tranquebar, Ceylon, Java, and has been also found at Waree and Acra on the western coast of Africa. This plant is called Lotos throughout India, and is held sacred by the Hindoos. Its flowers are of a beautiful white. They expand during the day and close at night, and exhale a strong vinous odour.

N. Lotus, the Egyptian Lotos, has peltate leaves, sharply serrated; the under surface is pilose at the nerves, and pubescent between them. This plant is a native of Egypt, and grows in slow-running streams, especially in the Nile near Rosetta and Damietta, and is found in ricefields during the time they are under water. It has large white flowers, with the sepals red at the margins. The roots are large, tuberous, and eatable. The seeds dried were made into a bread by the ancient Egyptians, and the roots were employed in the same manner. This plant is regarded with superstitious veneration by the Egyptians. It resembles the Nelumbo of the Hindoos, a plant belonging to the same natural order, and called the True or East Indian Lotos. The latter has always been regarded as the emblem of fertility. Lotos is a name applied to various plants by the ancients. The Lotos of the *Lotophagi* was the *Zizyphus Lotos;* that of Homer and Dioscorides, a species of *Lotus*, or *Trifolium*. The Lotus of Hippocrates is the *Celtis Australis;* and the Italian Lotos is the *Diospyrus Lotus*.

N. alba, the Common White Water-Lily, has cordate quite entire leaves; the stigmas 16-rayed, the rays ascending. This plant is a native of ditches, ponds, and lakes throughout Europe, and is abundant in Great Britain. The flowers are white, and, according to Linnæus, open themselves in the morning at seven o'clock, and close them at four o'clock in the evening. This plant is very deservedly highly esteemed as the most beautiful of European plants. It is frequently accompanied with the yellow water-lily, and the two together give an exceedingly graceful appearance to the waters they occupy. The roots of the White Water-Lily contain an astringent principle, which renders them useful in dyeing. They also contain starch, and on this account swine feed on them, although other animals reject them. The whole plant was at one time regarded as medicinal, but is now seldom employed by medical men, although it has a popular reputation as a remedy in many diseases. There is a variety of this plant occasionally met with, called *N. alba minor*, which has smaller flowers and leaves than the species.

N. odorata, Sweet-Scented Water-Lily, has cordate quite entire leaves, with the nerves and veins on the under surface very prominent; the stigmas 16- to 20-rayed; the rays erect, inflexed at the top. This plant is a native of North America from Canada to the Carolinas; it is found in deep ditches and slow-running rivers. This plant is often confounded with the European Lily, but it is quite distinct. Its flowers are white tinged with red, very fragrant; they open in the morning, and close at noon. The root is astringent, and much more powerful than the last species. It contains tannin and gallic acid, and a decoction of the root gives a black precipitate with sulphate of iron. The root is used by medical men in America as an astringent, and is employed by the people for making poultices.

NYMPHÆA'CEÆ, a natural order of Aquatic Plants, with floating leaves and solitary flowers, found in all the hot and temperate parts of the world. They usually have 4 sepals and many petals, which latter gradually contract into stamens, indefinite in number, and either hypogynous or adherent to the sides of the carpels. The ovary is superior, divided internally into numerous cells, to whose sides adhere many seeds, containing an abundance of albumen and a small embryo external to it: the stigmas radiate from the apex of the ovary. The order differs from *Ranunculaceæ* in the consolidation of its carpels, from *Papaveraceæ* in the placentation not being parietal, and from *Nelumbiaceæ* in the want of a large truncated disc containing monospermous achenia. The stems of these plants are fleshy rhizomata, rooting in the mud at the bottom of the waters in which they grow; and their woody tissue is so loosely disposed among the cellular, as to

White Water-Lily (*Nymphæa alba*).

1, the ovary on which are seen the scars left by the petals and stamens removed from it; 2, a seed.

have given rise to a controversy concerning the real nature of the plan on which it is arranged, most writers considering, with us, that it is exogenous, while others refer it to the endogenous type. The species of this order are generally plants of great beauty, either the flowers or the leaves being of unusual size. The White Water-Lily (*Nymphæa alba*) [NYMPHÆA] and the Yellow (*Nuphar luteum*) [NUPHAR] of our own rivers and ponds are among the finest specimens of floral development in these latitudes; in other countries both their size and colour are augmented, brilliant tints of blue and crimson being added to the pure white of our native species, and the most delicious odour being also emitted. In Demerara grows the *Victoria regia*, whose flowers have a diameter of 15 inches, while the leaves are as much as 6½ feet across. [WATER-LILY.] In the East Indies the *Euryale ferox* emulates the Victoria in the size of the leaves, but its flowers are small and inconspicuous. [EURYALE.] In both these plants the farinaceous seeds are used for food. *Barclaya* is another genus belonging to this order. The five genera contain about 50 species.

NYMPHICUS. [PRITTACIDÆ.]

NYROCA. [DUCKS.]

NYSSO'NIDÆ, a family of Hymenopterous Insects belonging to the section *Fossores*. This family is thus characterised by Latreille:—Labium either entirely or for the most part hidden; the maxillæ and labium do not form a proboscis; mandibles without any internal notch; head moderately large; abdomen either conical or somewhat ovate, and with a short peduncle; antennæ filiform, with the first joint but slightly elongated.

The principal character which distinguishes this family from its congeners is the absence of a notch on the inner side of the mandibles. It contains the following genera:—*Astata*, *Nysson*, *Oxybelus*, *Nitela*, and *Pison*.

In the first of these genera, *Astata* of Latreille, the eyes are large and of an oval form, converging at the vertex, and in the male sex meeting; the mandibles are bifid at the apex; the anterior pair of wings have one narrow, short, and appendiculated marginal cell, and three submarginal cells, of which the first is narrow, longitudinal, divided obliquely near the middle by an obsolete nervure that runs from the base of the stigma to the middle of the first transverso-cubital; the second submarginal cell is triangular, and receives both the recurrent nervures; the third is very distant from the apex of the wing; the legs are moderately long and very spinous in the female.

Astata Boops (Schrank) is about half an inch in length; the head, thorax, and legs are black, and the body is red, with a black tip and a small spot of black at the base. This species is found in various parts of England and on the Continent, but appears to be local. The female builds her nest in the ground, and is said to select the burrow formed by some other insect for the purpose. Mr. Shuckard, in his excellent work on the 'British Fossorial Hymenoptera,' states that the males are much more abundant than the females; and whenever he succeeded in capturing the latter with its prey, he always found it to consist of the larvæ of *Pentatoma bidens*. Mr. Curtis has captured specimens laden with the larvæ of *Pentatoma prasina*, and a little bee (*Epeolus variegatus*) is preyed upon by the Astata to feed her larvæ.

In the genus *Nysson* (Latreille) the anterior wing has three submarginal cells; the second cell receives both recurrent nervures, and is petiolated; the first submarginal cell is considerably longer than the two others; the mandibles are terminated by a simple point; the eyes are oval and prominent. Five species of this genus are recorded as British.

The genus *Oxybelus* (Latreille) is distinguished by the eye being oval and slightly prominent; the antennæ short and arcuated; the anterior pair of wings have a narrow marginal cell slightly appendiculated, and one submarginal cell, which receives a single recurrent nervure; abdomen short. Eight species of this genus are described in Mr. Shuckard's work. The most common is the *O. uniglumis*, an insect about a quarter of an inch in length; black, with a row of white spots on each side of the abdomen, and with the tibiæ and tarsi red. It preys upon flies, which it carries by its hind legs to deposit in the burrow in which the young are reared.

The genus *Nitela* (Latreille) differs from the last in having the antennæ longer and nearly straight, and with the second and third joints of equal length. Like *Oxybelus*, it has but one submarginal cell; the mandibles are bifid at the apex; there are no protuberances on the thorax, nor spines on the legs.

In the genus *Pison* (Spinola) the eyes are emarginated; there are three submarginal cells to the anterior pair of wings; the second cell is very small, petiolated, and receives two recurrent nervures.

O

OAK. [QUERCUS.]

OAK-BEAUTY. [BISTON.]

OBSIDIAN (called by the Romans Obsidianus Lapis; by the Greeks, Ὀψιανὸς λίθος), a Mineral, probably of volcanic origin, and so called, as stated by Pliny ('Hist. Nat.,' xxxvi. 26) from a person named Obsidius, who first found it in Ethiopia. This substance occurs in beds, in large and rolled masses, and in small grains. Its structure is compact. Fracture large, conchoidal. Hardness 6·0 to 7·0. Scratches glass. Brittle. Colour greenish, grayish, or brownish black. Lustre vitreous. Opaque. Translucent on the edges. Specific gravity 2·34 to 2·39.

Obsidian in the form of little grains of the size of peas, and of a pearly white colour, and consisting of very thin concentric layers, has been found at Marekan in the Gulf of Kamtchatka. This variety has been called *Marekanite*.

Pliny says that gems and sometimes whole statues were made of obsidian: he also speaks of four elephants of obsidian which were dedicated by Augustus in the Temple of Concord. Statues were also made of it by the Egyptians.

Before the blow-pipe, it swells up strongly, and fuses into a transparent glass. It occurs in veins and beds traversing rocks, in many parts of Europe, Asia, and America, and in the neighbourhood of most volcanoes.

The analyses of different varieties of Obsidian differ considerably: the following analyses of Marekanite, and of Obsidian from Cerro de las Navagas, are by Klaproth and Vauquelin respectively:—

	Marekanite.	Obsidian.
Silica	77·50	78·0
Alumina	11·75	10·0
Soda	7·00	—
Potash	—	6·0
Oxide of Iron	1·25	3·6
Lime	0·50	1·0
Water	0·50	—
	98·5	98·6

OCEANIA. [ACALEPHÆ.]

OCEANIC SNAIL. [JANTHINA.]

OCE'ANUS. [NAUTILIDÆ.]

OCELOT. [FELIDÆ.]

OCHNA'CEÆ, a small natural order of Plants nearly allied to *Rutaceæ*, and remarkable for their fleshy carpels being elevated upon an enlarged succulent receptacle. They are shrubs, inhabiting the tropics of either hemisphere, with shining evergreen leaves, showy yellow flowers, with 5 or 10 stamens, whose anthers open by pores at the point. They appear to be possessed of tonic and astringent qualities. The order contains 6 genera and 82 species. It is related to *Rosaceæ*, *Geraniaceæ*, *Simarubaceæ*, and *Xanthoxylaceæ*.

OCHRA, or OKRO, a Plant of which the fruit is used as a vegetable in the West Indies, the United States, and in South America, and which is remarkable for the similarity of its name to the vegetable called Ochra by the Greeks, but which has not been ascertained by botanists. The names by which the produce of the New World is distinguished in the works of Marcgrave and Piso are Quingombo and Quigombo, and in the later works by that of Gombo, and Gombaut, or Gombeau. It is possible therefore that a classical name, which was not otherwise engaged, may have been applied to a new vegetable, and, as has been the case in many instances, without any attempt being made to identify the plant named with that which had been described by classical authors. This plant is the *Hibiscus esculentus* of authors. [HIBISCUS.]

OCHRE, Hydrated Sesquioxide of Iron. [IRON.]

O'CHREA. [STIPULES.]

OCTO'CERA, M. De Blainville's name for the first family of his order *Cryptodibranchiata*, containing the genus *Octopus*.

OCTODON. [HYSTRICIDÆ; MURIDÆ.]

OCTOLASMIS. [CIRRIPEDIA.]

OCTOMERIS. [CIRRIPEDIA.]

OCTOPODA, or OCTOPODIDÆ, a family of Cephalopodous *Mollusca*, to which the genera *Octopus*, *Eledone*, *Philonexis*, and *Argonauta* belong. It has the following characters:—Animal short, bursiform, ordinarily deprived of fins; head very distinct; 8 sessile arms, generally nearly equal, and furnished with simple suckers; naked or testaceous; no internal testaceous rudiment, but only two small cartilaginous pieces in some species.

Professor Owen, in common with other zoologists, divides the Octopods into two groups or families, the *Testacea* and the *Nuda*.

The *Testacea* consist of the genera *Argonauta* and *Bellerophon*. [BELLEROPHON; CEPHALOPODA.]

The *Nuda* comprise the genera *Eledone* and *Octopus*.

Argonauta (Linnæus).—The best known species of this genus is called the Paper-Nautilus, or Paper-Sailor. It is the Ναυτίλος or Ναυτικὸς of Aristotle. ('Hist. Anim.,' iv. i.) The *Argonauta* has the following characters:—Body oblong, rounded; mantle adhering posteriorly to the head; first or dorsal pair of arms dilated and

membranous at the extremity. Funnel without a valve, but articulated at its base by two ball-and-socket joints to the inner sides of the mantle. Branchial hearts with fleshy appendages. No internal horny or testaceous rudiments; but an external monothalamous symmetrical shell, containing, but not attached to, the body of the animal, which also deposits its eggs in the cavity of the shell. (Owen.)

Argonauta Argo has been from the earliest periods an object of great interest to zoologists, in consequence of the accounts of its sailor-like habits handed down to us from the ancients—we need only refer to the statements of Aristotle, Pliny, Ælian, Oppian, and others—and in consequence of the difference of opinion entertained with regard to the inhabitant of the shell by naturalists; some holding that the Cephalopod found in it was a mere parasite, or, even worse, a pirate that had destroyed the legitimate owner and possessed himself of the shell; and others, that the animal was the lawful possessor and original constructor of it.

Among those who supported the former opinion were Lamarck, De Montfort, Ranzani, Poli, and De Ferrussac, to say nothing of Cuvier, the inclination of whose mind evidently was that the shell belonged to the animal, though he only designates the opinion of those who held the contrary as extremely problematical. Professor Owen appears to have been early inclined to this view of the subject. Dr. Leach, M. Rafinesque, M. De Blainville, and Dr. Gray stand conspicuous among those who denied that the *Ocythöe* found in the shells of the genus *Argonauta* of Linnæus was the constructor of the shell.

The reasoning of those who held that the Argonautic Cephalopod was the constructor of the shell appears to have been based upon the numbers found always fitting the shell, and, in the case of Poli and De Ferrussac, upon the supposed discovery of the animal and shell in the egg.

Those who opposed these views, or still doubted, were struck with the supposed anomaly which would be manifested if the cephalopod really were the natural inhabitant. Evidence that the animal was not affixed to the shell had been given over and over again, till it became largely cumulative, and had never been controverted. The animal had been seen to quit it when alive, and to fall out when dead by its own weight upon reversing the shell. How then was the shell to be secreted? Again, the specimens found in the greater majority of the shells were apparently females, and placed upon a great mass of eggs, which filled up at least all the spiral part of the shell; and on these the body of the animal rested. An *Octopus*, nearly allied to *Ocythöe*, was caught in the Madras Roads with its ventricose body firmly imbedded in a ghee-bowl; and *Octopus arenarius* had been found in a *Dolium*. These and other facts, with which we will not weary the reader, seemed very powerful; but if any credence is to be given to the carefully-conducted experiments of the lady whose valuable observations we shall now proceed to notice (and, after strict scrutiny, we see no reason to view them with the slightest suspicion), the question is now set at rest, though it was not by Poli, who must, if this lady's experiments were correctly made and accurately reported, have been in error when he supposed that he saw the animal and shell in the egg.

In 1836 Madame Jeannette Power laid before the academy at Catania her 'Osservazione Fisiche sopra il Polpo dell' Argonauta Argo,' in which, after a long and careful course of inquiry, she declared the following results:—1st, that the cephalopodous mollusc usually found therein is the constructor of the shell which it inhabits; 2nd, the clearing up of the doubts with regard to the first development of its eggs; 3rd, new facts respecting its habits.

In order to obtain the data from which Madame Power came to her important conclusions, she had cages constructed which were eight palms long and four palms broad, with a convenient interval (three or four lines) between the bars, which allowed the water to enter freely when placed in the sea, whilst the escape of the animal was prevented. Madame Power placed these cages on a shallow bottom in the sea near the citadel of Messina, where she could examine them undisturbed, and inclosed in them a number of living Argonauts, which she supplied every two or three days with food, consisting of naked and testaceous molluscs.

The following is this lady's description of the cephalopod of the Argonaut:—"It is furnished with eight arms, having on each two rows of suckers; the first two arms are more robust than the others, and should be so, because they serve as masts to support the sails, which, spread out, act before the wind as such. At the base they have on the inferior sides the double row of suckers, like the other six; but from the inferior row, at about an inch from the base in adults, a rather furrowed membrane begins to develop itself, which extends as far as the tip of the arm, and, holding it bent, it can no longer execute the office of a rowing arm, but is employed by the animal as a sail. These sails are so large that, when turned backwards and pressed against the shell, they can entirely cover and protect it. Thus, as far as I can conclude, the true office of these sails is exactly that of keeping themselves applied to the shell at all times, in reserve for the moment when the animal, coming to the surface of the water, removes them, and, spreading them, raises them as sails. In fact, the series of suckers of the sail-arms, when the membrane of the sails is wrapped about the shell, is placed exactly over the keel of it in such a manner that each sucker corresponds to each point in which the ribs of the shell terminate, until they reach the two margins of the spiral."

Madame Power compares these sails with the two wing-like lobes of the mantle of *Cypræa* [CYPRÆIDÆ], not only from the manner in which they cover the shell, but because she has reason to believe that the formation of the shell is the result of a transudation from the membrane of the sails, the corrugations of which, in secreting the calcareous matter, may be the cause of the ribbed form of the shell.

This consideration, she remarks, may weigh in obviating the difficulties of those who cannot imagine how a shell containing a cephalopod should present no resemblance with the folds of the animal compressed within it. For if they would consider it the result of a calcareous deposition of the membrane of the sails, they would find not only the series of little points corresponding to the suckers, which adapt themselves to the keel of the spiral, but an explanation of the disposition of the ribs, and of the smooth and paper-like condition of the shell.

The sail, when spread out, presents, according to Madame Power, a silvery surface, speckled with concentric circles of spots, with a black spot in the middle, surrounded with a beautiful gold colour; this and the vicinity of the suckers along the keel and the spiral assume a purple colour so vivid that it approaches that of the *Janthina*. The mouth, the head, the bag, and the branchiæ, did not present Madame Power with any novelty beyond what had been already well described by naturalists, and which is common to the Cuttles and the Calamaries; but she makes two observations with regard to the funnel, which she believes to be new: that it fulfils the office of a pump or proboscis rather than that of a funnel, and that the animal employs it, when swimming with its arms on the surface of the water, as a helm, elongating it in front of the widest part of the shell, at the same time that the spiral serves as a prow.

"Reflecting," says Madame Power, "on the delicacy and fragility of the shells, and wishing to trace the cause of their being so rarely seen broken, I determined to touch one whilst its poulp, or animal, was within; and taking it dexterously between my fingers, to learn what degree of flexibility it would admit, I discovered that it was extremely pliant, so much so as to admit of the two extremities of the great curve being brought into contact without breaking; and indeed shells so fragile ought to possess this flexibility, in order that they might not be continually liable to be broken in pieces by the restless and uninterrupted movements of their poulps, as well as by the shocks which they would be likely to suffer in the depths during a stormy sea. In this case it would prove very unfortunate for them, as they are not capable of forming an entire new shell.

"Having ascertained the flexibility of the shell whilst the living animal was within, I immersed some empty ones which had been exposed to the air for some time in fresh water, and, at the end of three days, found them as pliant and flexible as at first.

"As regards the connection between the animal and the shell in which it is housed, I have not found any ligament or muscle which connects them; while the sac is simply held by the turning of the end of the spiral, from which it may be easily separated; and it appears that the tight adhesion of the sac against the internal surface of the ribs of the shell is sufficient to hold it attached. Moreover the external superposition of the sail-arms keeps the shell firmly upon the poulp."

Madame Power states that *Argonauta Argo* in its natural state is to be found in the neighbourhood of Messina, and even in the port, almost all the year through, in larger or smaller numbers. Their true season she considers to be autumnal, or in the months of September, October, and November. It may be, in her opinion, either because the current brings them at that time, or that food is more plentiful, or because it may be the season of their fecundation. They are seen in the most muddy parts of the port and where the anchored boats lie thickest. When the Argonauts are on the surface of the water, if they observe any person, they fold the sail-arms over the shell and stow the rowing-arms inside it: then they sink to the bottom. If they are beneath the surface, they eject ink, like other cephalopods, to make the water turbid, thus gaining time to hide themselves in the mud.

Those in the cage, when closely pursued, would, after ejecting their ink, spirt out water from the tube, and then shrink into the shell, which was covered with the sails. At first the appearance was silvery, but instantly afterwards a purple colour would spread along the suckers over the whole of the keel and spiral, and concentric circles of spots would show themselves upon the two surfaces.

During calms and when the water was quiet, they would, if not conscious of being observed, exhibit their many beauties, rowing along, their full sails tinged with elegant colours, resting the extremities of the sail-arms on the two sides of the shell or embracing the shell with them. Sometimes, when pressed by hunger, they would come almost to the surface of the water, and when Madame Power offered them food, they would snatch it out of her hands and greedily devour it.

With regard to the formation of the shell by the young Argonaut, Madame Power repeated the experiments of Poli in the company of Dr. Anastasio Cocco of Messina and other persons, but nothing more was found than a group of eggs in each individual, similar to millet-

seeds, perfectly white and transparent, attached by filaments of a brilliant gluten to a common stem of the same substance. Three days after the first observation, on visiting an Argonaut, little poulps were found in the shell of the parent, developed, but without shell, and resembling worms, having at the inferior extremity a spot of a brown colour, with some smaller spots disposed laterally. These, when examined by the microscope, were considered to be the viscera of the animal. After the three days the young poulps began to exhibit bud-like prominences, with two rows of obscure points, which were the rudiments of the arms and suckers. The other arms began to be distinguishable some days after the sailing-arms, and on the sixth day they had already formed the first lamina of the shell, which was exceedingly soft, yielding to the least pressure of the finger. The eggs are attached to the interior of the spire, and when excluded remain between the roof of the spire and the mantle of the mother. From these observations Madame Power concludes that the newly-born poulp has no shell. The observations of Poli therefore do not correspond with the experiments made by Madame Power; and the lady adds, with characteristic modesty, "If I were not speaking of so celebrated a man, I should venture to say that the internal membrane of the egg was mistaken by him for the supposed rudiment of the shell."

Madame Power, wishing to discover whether the little poulp could, without extraneous aid, begin to work the structure of its shell, or whether the parent assisted in the original formation, cautiously cut off the spire of divers Argonauts at the time of their fecundation. In the direction of its axis she found in one a little new-born poulp rolled up near the apex. Upon attentive observation she perceived that between it and the bottom of the spire of the parent-shell there was a thin membrane, disposed in the same form as the curve of the spire, and fitted to the rolled-up little poulp, as if the gluten in which the whole infant mollusc was embedded, pressed between it and the end of the spire, became consolidated into a fine membrane in the same form as the spire, and embraced the young poulp.

In September, 1835, Madame Power inclosed in her cage some Argonauts at the time of their fecundation, taking care to examine them every fourth day carefully, for their irritability is such that they die if handled much. They were placed in a basin, and the observer was so posted that they could not see her.

On the 14th Madame Power found in one of the shells a little poulp 14 lines long. Other shells were searched; and in some, little poulps were found, in others none. On the 18th two parent poulps were dead. In the shell of that wherein she had first seen the little poulp she found that it had already passed into the spire. On the 24th, upon examination of this same shell, the little poulp was found already covered with its thin shell, which was 3½ lines in length. This little animal appeared to be completely formed, and its shell had the form of the spire in which it had been framed.

All the experiments made by Madame Power had the same results; her inference is, that the young Argonaut, when excluded from the egg, is naked; that it is progressively developed in the end of the spire of the parent; and that after a certain period it goes on forming the shell.

As far as Madame Power has observed, not more than two or three eggs develop themselves at the same time; and when the young have grown to the length of nine lines, they successively inclose themselves in the spiral of the parent, where the other arms are thrown out in the manner of buds. The young one takes three days to arrive at the length of nine lines, and four in the spiral to develop itself. The parent retains the young one three more days under her, and then ejects it from the shell.

An attempt was made by Madame Power to produce the development of the eggs as far as the production of the young poulp, without the aid of the mother, by suspending them in a fine linen bag in sea-water, which was changed thrice in the day. This attempt failed; the eggs swelled indeed, but it was the tumidity of putrefaction.

Madame Power concludes from this experiment that the glutinous material in which the young are enveloped in the spire of the parent conduces to their development; and this material being evidently a parental secretion, it may be said that without her aid the eggs could not be developed, and the young shell could not have its foundation laid in the end of the spire.

We shall now let Madame Power speak for herself. "In spite of these successful experiments in favour of the shell being the property of the poulp of the Argonaut, I was anxious to be assured of the fact in a manner not hitherto attempted by others. 'If the Argonaut,' said I, 'constructs its own shell, it ought to be able to repair fracture.' Although Signor Ranzani had said that it was not to be believed that these poulps of the Argonaut should be so ill provided with means necessary for the preservation of their existence, that if the first habitation should be broken or lost, they cannot construct another; still I thought, from his mode of expression, that he had never himself made experiments in proof of this. Moreover I, who had made experiments on a hundred of these molluscs, have found that, when they have lost their shell, they are incapable of constructing another, and die; * but I broke in several places the shells of twenty-six individuals, and, to my great satisfaction, found, after thirteen days, the fractures healed in all the survivors, which were not more than three. The newly-secreted portion was stouter than the uninjured part of the shell, but not so white; it looked also a little rough and disturbed, neither did it present the usual risings, and, instead of ribs, it had some longitudinal furrows. Being desirous of observing in what manner the animal operated in repairing the broken shell, I took one the day after the first experiment, and found that the aperture was covered by a thin glutinous lamina, which, somewhat in the manner of a cobweb, unites the two margins of the broken shell. The next day the lamina was, to a certain degree, thickened and more opaque, till, at the expiration of ten or twelve days, the new piece had become quite calcareous. Whilst the Argonaut was in the act of mending the fractures in its shell, I am quite sure that it applied the sails to the shell and wrinkled them upon it, and by this movement I considered that the glutinous secretion which finally became calcareous was deposited."

So far Madame Power has shown that the Argonaut has the power of repairing fractures in the shell, like other *Testacea*, though not exactly by the same means; but she noticed another power, which she states that, as far as she knows, has not been observed in other testaceans. She found that whenever the animal which is going to repair its habitation can find pieces of other Argonaut shells, it takes, by means of its sail-arm, a fitting piece of broken shell and holds it in the fractured place, till it has secreted the material necessary for the firm attachment of the fragment, thus saving the expense and trouble of a secretion for supplying the whole area of the fractured aperture. "After such a series of experiments," says Madame Power, "it seems to be sufficiently proved that the poulp of the Argonaut is the constructor of the shell in which it lives, and out of which it cannot exist long."

Now, though there may appear in the account of these experiments evidence of their having been drawn up by one not deeply versed in zoology, there is an air of truth and sincerity about them that makes them to us as valuable at least as any that could have been the result of the inquiries of a more learned observer. Madame Power indeed has, in our opinion, come to a somewhat hasty conclusion that these animals are hermaphrodites, because all those that were examined by her (more than a hundred) were furnished with eggs; but this inference is evidently not deemed conclusive by her, for she states her intention of making careful anatomical researches on this subject, which she had not enjoyed the opportunity of making when she wrote.

In a second paper, with the title of 'Nuove Osservazione sulle Uovo del Polpo dell' Argonauta Argo,' by the same lady, she makes the following observations on the progressive development of the young Argonaut. The egg was at first white and transparent; no structure was discernible in it. After fifteen days it presented spots of a beautiful red. In ten days more the poulp could be discerned through the epidermis of the egg. Then the poulp began to break through that involucrum, and to the naked eye presented an elliptical form, with the eyes and mouth, and a very transparent membrane which forms the mantle. Towards the mouth some small and almost imperceptible filaments were observed, which Madame Power supposed to be the rudiments of the branchiæ. The poulps were now naked, but in twelve days from that time, on visiting them again, some were found which had already formed their shell, and the parent retained them and nourished them with her gelatinous secretion, as Madame Power had already stated in her Memoir published in the 12th volume of the 'Transactions of the Gioenian Academy.'

Captain Philip Parker King, R.N., during his well-known voyage, met with some specimens of *Argonauta* in a rather curious way; and though he expresses his opinion with much modesty, it is plain what the inclination of that opinion was.

"On our passage from Santos to St. Catherine's, in lat. 28° south, we caught," says Captain King, "a Dolphin (*Coryphæna*), the maw of which I found filled with shells of *Argonauta tuberculosa*,* and all containing the *Octopus Ocythöe* that has been always found as its inhabitant. Most of the specimens were crushed by the narrow passage into the stomach, but the smaller ones were quite perfect, and had been so recently swallowed that I was enabled to preserve several of various sizes containing the animal. To some of them was attached a nidus of eggs, which was deposited between the animal and the spire. The shells varied in size from two-thirds of an inch to two and a half inches in length; each contained an *Octopus*, the bulk and shape of which were so completely adapted to that of the shell, that it seemed as if the shell increased with the animal's growth. When so many learned naturalists have differed so materially as to the character of the inhabitants of the *Argonauta*, it would be presumption in me to express an opinion; I therefore merely mention the fact, and state that in no specimen did there appear to be any connection between the animal and the shell." ('Voyages of the Adventure and Beagle,' vol. i. p. 106.) We had an opportunity of examining the specimens above alluded to soon after Captain King's return, and they bore out in every particular the description given by him.

M. D'Orbigny ('Voyage dans l'Amérique Méridionale') came to a

* Aristotle speaks of the shell as being like a hollow pecten (κτείς), and not as usually adherent to the polypus. He also states that it feeds very frequently near the land, so that it is thrown by the waves upon the sand, when the shell slipping from it, it is caught, and dies on land. ('Hist. Anim.,' iv. 1.)

* *A. rufa* of Owen.

conclusion in favour of the animal being the constructor of the shell, and consequently against the parasitic theory, from observations made by him on *Argonauta hians*.

In 1837, M. Rang, on his return from Algiers, where he had been observing these animals, had an interview with M. De Blainville, who had then the observations which Madame Power had just made in his hands; and, in April of that year, M. De Blainville read his elaborate Report, and afterwards published it, with additional dissertations, in the form of a memoir or letter, in the third number of the 'Annales Françaises et Etrangères d'Anatomie et de Physiologie.' His arguments in favour of parasitism appear to be based on the following data:—1, That the same species of Cephalopod is not always found in the same species of shell. 2, That the natural position of the animal in the shell varies, the back of the animal being sometimes next the outer wall of the shell, sometimes next the involuted spire. 3, That the animal does not occupy the posterior part of the shell. 4, That the form of the animal and of its parts offers no concordance or analogy with the shell. 5, That the shell is too opaque to have permitted the influence of light in the development of the coloured pigment in the mantle of the cephalopod of the Argonaut. 6, That it is very far from being true that the argonaut-shell possesses the flexibility and elasticity requisite to harmonise with the locomotive and respiratory movements of the animal. 7, That the animal suffers no appearance of inconvenience when deprived of its shell. 8, That a cephalopod has been discovered in the Sicilian seas like that which inhabits the Argonaut, but without a shell. These data are designated by Professor Owen, to whose observations we shall presently advert, as false facts, with the exception of the third, which is only partially false, being true when stated with reference to the more mature animal only. The other arguments of M. De Blainville are noticed by Professor Owen as founded on undoubted or admissible facts; but the Professor denies the conclusion drawn by M. De Blainville.

M. Sander Rang in consequence of the appearance of M. De Blainville's memoir or letter, published in Guerin's 'Magasin de Zoologie' a very interesting paper under the title of 'Documents pour servir à l'Histoire Naturelle des Cephalopods Cryptodibranches.' In this memoir M. Rang's observations are confirmatory—1, of Madame Power's statement that the siphon is applied to the part of the shell opposite the involuted spire; 2, of the accuracy of her description of the relative position of the so-called sails of the Argonaut with reference to the shell; 3, of her discovery of the faculty possessed by the animal of repairing the shell, and many other points.

No one will refuse to M. Rang the acknowledgment that he is not only a very accurate observer, but that he is well versed in the natural history and anatomy of the *Mollusca* generally; so that here at least no doubt can be thrown on the observations.

In February, 1839, a highly interesting and valuable series of specimens of the Paper Nautilus (*Argonauta Argo*) consisting of the animals and their shells of varions sizes, of ova in various stages of development, and of fractured shells in different stages of reparation, were exhibited to the Zoological Society of London, and commented on by Professor Owen, to whom they had been transmitted for that purpose by Madame Power, who had formed the collection in Sicily, in 1838. In the course of his comments the Professor went at large into the subject, and in addition to the observations above alluded to with regard to the alleged false facts and admissible facts whereon M. De Blainville had founded his reasoning, combated at great length, and, in our opinion, with signal success, the arguments of those who adhered to what may be termed the parasitic opinion; and recapitulated as follows the evidence which, independently of any preconceived theory or statement, could be deduced from the specimens then on the table.

1. The cephalopod of the Argonaut constantly maintains the same relative position in its shell.

2. The young cephalopod manifests the same concordance between the form of its body and that of the shell, and the same perfect adaptation of the one to the other as do the young of other testaceous molluscs.

3. The young cephalopod entirely fills the cavity of its shell; the fundus of the sac begins to be withdrawn from the apex of the shell only when the ovarium begins to enlarge under the sexual stimulus.

4. The shell of the Argonaut corresponds in size with that of its inhabitant, whatever be the differences of the latter in that respect. (The observations of Poli, of Prevost, of King, and of Owen, are to the same effect.)

5. The shell of the Argonaut possesses all the requisite flexibility and elasticity which the mechanism of respiration and locomotion in the inhabitant requires; it is also permeable to light.

6. The cephalopod inhabiting the Argonaut repairs the fractures of its shell with a material having the same chemical composition as the original shell, and differing in mechanical properties only in being a little more opaque.

7. The repairing material is laid on from without the shell, as it should be according to the theory of the function of the membranous arms as calcifying organs.

8. When the embryo of the Argonaut has reached an advanced stage of development in ovo, neither the membranous arms nor shell are developed.

9. The shell of the Argonaut does not present any defined nucleus.

Professor Owen concluded a most elaborate commentary by stating that he regarded the facts already ascertained to be decisive in proof that the cephalopod was the true fabricator of the shell; and thus, in our opinion, is set at rest—principally by the experiments of Madame Power—a question which had divided the opinions of zoologists from the time of Aristotle, who left the subject with the following acknowledgment:—"But as touching the generation and growth of the shell, nothing is as yet exactly determined."*

M. Rang's account of the locomotion of *Argonauta Argo* is most interesting. When the animal was at rest, and contracted within its shell, it exhibited the appearance figured below.

Argonauta Argo contracted within its shell, and the membrane of the sail-arms partially covering it. The eggs were never seen by M. Rang in the place where they are represented, but much more within the opening. (Rang.)

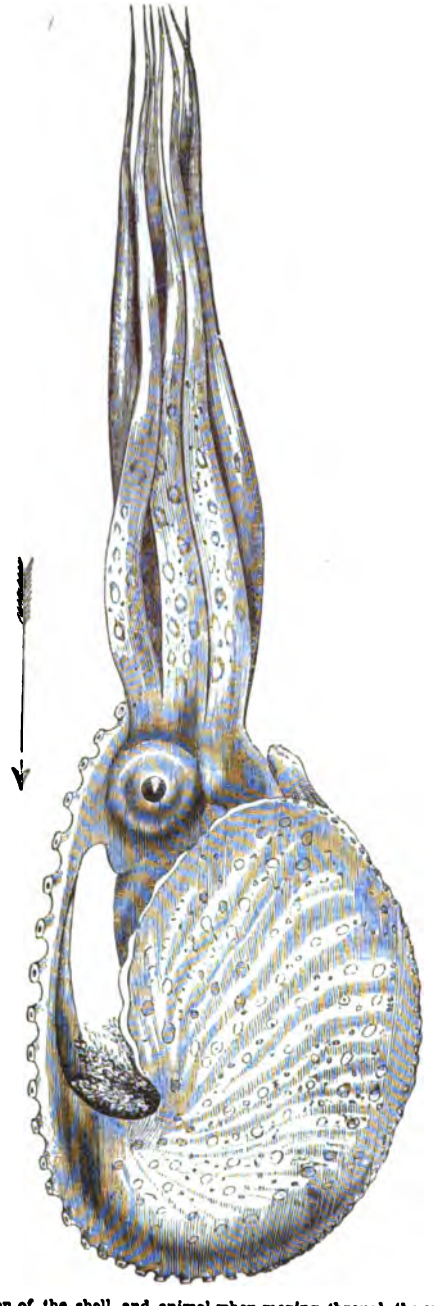
"To return to the description of our poulp," says M. Rang, "which we left contracted within the argonaut-shell, and watching with an attentive eye what took place around it, we saw it extending itself from out its shell, and protruding six of its arms; then it threw itself into violent motion, and travelled over the basin in all directions, often dashing itself against the sides. In these different movements the body leant a little towards the anterior part of the shell; and the long slender arms, very much extended and collected into a close bundle, were carried before it, as well as the tube, which showed itself open and protruded. The locomotion was effected in the ordinary manner of poulps, the movement being backwards by means of the contraction of the sac and the expulsion of water through the siphon. The disposition of the animal and shell is the most favourable for accelerating the motion of the creature. The lightness of the shell; its narrow and keeled form; its width, which is smallest at the part presented first for cleaving the water; the membrane smoothing over all inequalities of the shell; the bundle of arms extending behind so as to offer the least possible resistance; the two arms stretched like a bridge over the cavity where the eggs are, as if to throw off the water from that cavity;—all these adaptations concur to facilitate the gliding of the animal through the medium in which it is to move."

M. Rang thought that he perceived in the movements of the animal, when in open water, that it had its back uppermost, and consequently the tube below, but he did not constantly see it so; he observed it however with more certainty in specimens of poulps whose arms had been deprived of their membranes.

The animal which they had been watching, as above described, fatigued by its efforts in a confined space, and perhaps injured by the shocks which it had sustained in coming in contact with the side of the basin, allowed itself to sink to the bottom, and half contracted itself in order to take repose; soon after which it exhibited another and unexpected spectacle. Fixing some of the acetabula of its fore arms upon the bottom of the basin, it erected itself upon its head, spreading out its disc, and carrying the shell straight above it in the normal position of the shells of gastropods; then, beginning to crawl, it presented the appearance of a pectinibranchiate mollusc, as M. Rang had remarked in the note to the Academy of Sciences. Half drawn back into its shell, the animal appeared to crawl upon its disc, the palmatures of which were a little raised to follow the movements of its arms. The body was hidden in the shell; the siphon, placed in the anterior part of it, was turned forwards; the arms which were at liberty were very much protruded and twisted round, two before and two on each side; the base of the two large arms seemed to prolong backwards the locomotive surface, and then rising along the keel they again covered it with their large membranes, as when the poulp was swimming in deep water. "Thus," continues M. Rang, "this mollusc, at once pelagic and littoral, presents a most singular anomaly; when it swims at the surface of the water having its ventral part lowermost,

* 'Hist. Anim.,' ix. 37; where a detailed account of the locomotion of the Nautilus, its sailing, &c., is given.

and when it crawls along the bottom having it, on the contrary, uppermost; two things which are completely contrary to what we see among the pelagic molluscs on the one hand, and the littoral molluscs on the other."



Disposition of the shell and animal when moving through the water in the direction of the arrow. (Rang.)

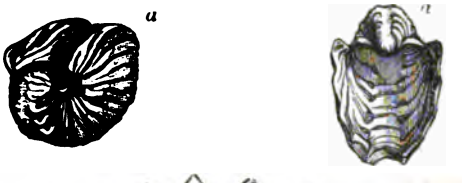
Argonauta Argo, moving on its head at the bottom. (Rang.)

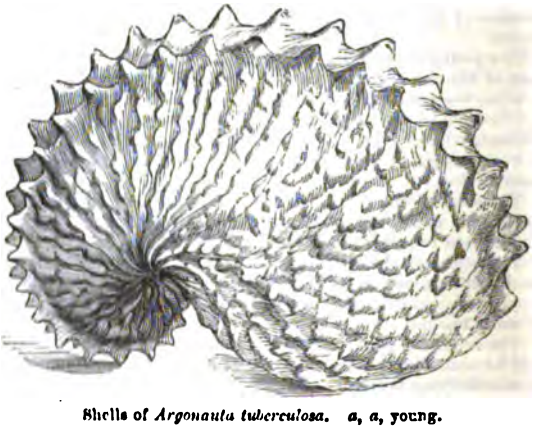
The progress of the animal when moving as last represented was slow, and it worked itself onwards like the gasteropodous molluscs. M. Rang remarks that the reptation was only apparent, for the suckers really caused the motion.

When the poulp was at the point of death it drew in by slow degrees its large arms and their membranes, and contracted them upon themselves and all the other arms, so as to obstruct the opening of the shell. At this moment the shell was moved, and the poulp separated itself from it, not voluntarily but accidentally, for it no longer held it in any way. It appeared at first to become a little reanimated, made some movements in the basin upon its head, then fell from weakness, and soon died. All this passed in less than ten minutes.

A beautiful series of preparations of this animal exists in the museum of the Royal College of Surgeons.

Shells of *Argonauta Argo*. *a*, young.





Shells of *Argonauta tuberculosa*. *a*, *a*, young.

Several species are already known; and the specific characters rest in great measure upon the tuberculosities and rib-like elevations on

the outside of the shell and on the breadth of the keel. The absence or presence of projecting pointed processes at the sides of the aperture near the spiral part cannot safely be relied on as a specific character: we possessed both broad-keeled and narrow-keeled specimens (now in the British Museum), in which the projecting process was present on one side of the shell and absent on the other. They are inhabitants of the seas of warm latitudes, both littoral and pelagic.

Eledone (Aristotle; Leach).—Arms provided with a single series of sessile acetabula.

E. ventricosa (*Octopus ventricosus*, Grant). Body short, round, the eight arms connected at their base by a membrane.

Eledone ventricosa. *a*, Sucker of *Eledone*.

Our cut was taken from a beautiful specimen captured at St. Just, Cornwall, in 1822, and preserved in the Museum of the College of Surgeons, among the preparations illustrative of natural history in spirit, No. 164 A. "Its arms are compressed, and connected at their roots by a thick web, and in the contraction preceding death they have become spirally convoluted in a very elegant manner; the three upper or dorsal pairs describing four gyrations, the ventral pair five; the surface of the integument is slightly wrinkled and granulate; it is of a mottled lilac or livid colour behind, but is smooth and approaches to white on the opposite aspect of the arms." ('Catalogue,' part iv., fasc. 1.)

Octopus (Lam., Πολύπους, Antiq.; and Leach).—Arms provided with a double alternate series of sessile acetabula.

O. vulgaris (*Sepia octopodia*, Linn.; *Sepia octopus*, Gmel. Body short and ovoid, the eight arms connected at their base by a wide membrane.

It is found in the European seas, and has been taken in Great Britain. This is the Eight-Armed Cuttle of Pennant; the Poulp, or Preke, of the English. Professor Owen has given a very good figure of this species, representing it in the act of creeping on the shore, its body being carried vertically in the reverse position with the head downwards, and its back being turned towards the spectator, upon whom it is supposed to be advancing. ('Cyclopædia of Anatomy and Physiology,' vol. i. f. 210.) This is the cephalopod which is said to be luminous in the dark. Linnæus quotes Bartholinus for the statement that one gave out so much light, when the candle was taken away, "ut totum palatium ardere videretur." It has also been alleged that the application of its suckers upon any part of the human body occasions inflammation and subsequent pain.

Three specimens of *Octopus vulgaris* are preserved in spirit. (Mus. Coll. Surg., Nos. 162, 163, 164.)

It was probably a species of *Octopus* that Mr. Beale encountered while searching for shells upon the rocks of the Bonin Islands. He was much astonished at seeing at his feet a most extraordinary looking animal crawling towards the surf, which it had only just left. It was creeping on its eight legs, which, from their soft and flexible nature, bent considerably under the weight of its body; so that it was lifted by the efforts of its tentacula only a small distance from the rocks. It appeared much alarmed at seeing him, and made every effort to escape. Mr. Beale endeavoured to stop it by pressing on one of its legs with his foot; but although he used considerable force for that purpose, its strength was so great that it several times liberated its member, in spite of all the efforts he could employ on the wet and slippery rocks. He then laid hold of one of the tentacles with his hand, and held it firmly, so that the limb appeared as if it would be torn asunder by the united efforts of himself and the creature. He then gave it a powerful jerk, wishing to disengage it from the rocks to which it clung so forcibly by its suckers. This effort it effectually resisted; but the moment after, the apparently enraged animal lifted its head with its large projecting eyes, and, loosing its hold of the rocks, suddenly sprang upon Mr. Beale's arm, which he had previously bared to the shoulder for the purpose of thrusting it into holes in the rocks after shells, and clung with its suckers to it with great power, endeavouring to get its beak, which Mr. Beale could now see between the roots of its arms, in a position to bite. Mr. Beale declares that a sensation of horror pervaded his whole frame when he found that this monstrous animal had fixed itself so firmly on his arm. He describes its cold slimy grasp as extremely sickening, and he loudly called to the captain, who was also searching for shells at some distance, to come and release him from his disgusting assailant. The captain quickly came, and taking Mr. Beale down to the boat, during which time the latter was employed in keeping the beak of the Cuttle away from his hand, quickly released him by destroying his tormentor with the boat-knife, when he disengaged it by portions at a time. Mr. Beale states that this cephalopod must have measured across its expanded arms about four feet, whilst its body was not bigger than a large clenched hand. It was the species called by the whalers Rock-Squid, ('Natural History and Fishery of the Sperm Whale.')

Eight-Armed Cuttle (*Octopus vulgaris*).

"The males of some species of *Octopus* and *Eledone* are similar to the females, but are comparatively scarce. Only the females of many others are known, and every specimen of the Argonaut hitherto examined (amounting to many hundreds) has been of that sex. Dr. Albert Kölliker has suggested that the real males of the Argonaut, and also of *Octopus granulatus*, and *Tremoctopus violaceus*, are the *Hectocotyles*, previously mistaken for Parasitic Worms. The *Hectocotyle* of *Octopus granulatus* was described by Cuvier, who obtained several specimens from Octopods captured in the Mediterranean. It is 5 inches in length, and resembles a detached arm of the *Octopus*; its under surface being bordered with 40 or 50 pairs of alternate suckers.

"The Hectocotyle of *Tremoctopus* was discovered by Dr. Kölliker at Messina in 1842 adhering to the interior of the gill chamber and funnel of the poulp; the body is worm-like, with two rows of suckers on the ventral surface, and an oval appendage at the posterior end. The anterior part of the back is fringed with a double series of branchial filaments. Between the branchiæ are two rows of brown or violet spots, like the pigment cells of the *Tremoctopus*. The suckers closely resemble those of the *Tremoctopus* in miniature. Between the suckers are four or five series of pores, the openings of minute canals passing into the abdominal cavity. The mouth is at the anterior extremity, and is minute and simple; the alimentary canal runs straight through the body nearly filling it. The heart is in the middle of the back, between the branchiæ; it consists of an auricle and a ventricle, and gives origin to two large vessels. There is also an artery and vein on each side, giving branches to the branchial filaments. A nerve extends along the intestine, and one ganglion has

been observed. The oval sac incloses a small but very long convoluted tube, ending in a muscular vas deferens; it contains innumerable *Spermatozoa*. The *Hectocotyle* of the Argonaut was discovered by Chiaje, who considered it a Parasitic Worm, and described it under the name of *Trichocephalus acetabularis;* it was again described by Costa, who regarded it as a "Spermatophore of singular shape," and lastly by Dr. Kölliker.

"It is similar in form to the others, but is only 7 lines in length, and has a filiform appendage in front 6 lines long. It has two rows of alternate suckers, 45 on each side, but no branchiæ. The skin contains numerous changeable spots of red or violet, like that of the Argonaut." (Woodward, *Manual of Mollusca.*)

OCTOPUS. [OCTOPODA.]

OCULINA. [MADREPHYLLIGEA; POLYPIFERA.]

O'CYMUM, a genus of Labiate Plants, remarkable for the fragrance of their leaves, which are used as an ingredient in savoury dishes, on which account some of the species have from time immemorial been objects of very general cultivation. In English gardens they are called Basils, a corruption of Basilisca, the name given to comon Basil by the monkish writers upon plants, in allusion to its regal qualities.

O. Basilicum, Linn., Common Basil, has many varieties, differing in their size, in the form and colour of their leaves, and in minor particulars: in their qualities they are nearly alike. This species is found wild in the hotter parts of the East Indies, where it is a perennial, with a woody root; but in our gardens it is treated as a tender annual, being raised in the spring in a hot-bed, and turned into a warm border when the summer is so far advanced that there is no longer any danger from frost, which is instantly fatal to such plants. Besides this Mr. Bentham enumerates 43 other species ('Labiatarum Genera et Species'), one of which, the *O. viride*, is used as a febrifuge in Sierra Leone. The genus is readily known by its calyx being bent downwards when the fruit is ripe, and then appearing covered as it were by a very large ovate dorsal lobe, and by the stamens being declinate.

OCYPODIDÆ, or OCYPO'DIANS (Milne-Edwards), a tribe of Brachyurous *Crustacea*, placed by M. Milne-Edwards between his Pinnotherians and Gonoplacians.

The tribe has the following characters:—Carapace rhomboidal or trapezoidal, very much elevated anteriorly and depressed posteriorly; the frontal border occupying the whole width, and the front, which is lamellar and bent down to the epistome, extremely narrow; its width does not equal a third of the length of the eyes, nor the half of the width of the buccal frame, which itself is very narrow. The eyes are very long, and the cornea in general is very large. The basilary joint of the internal antennæ is oval, rather large, and placed vertically in the anterior angle of the orbit; the moveable stem of these appendages is extremely small and hidden under the front; the two terminating filaments are very short, large, and hardly annulated, a disposition which is not observed in any of the Crustaceans previously treated of in the system of M. Milne-Edwards, except in the Dotos. The external antennæ are rudimentary, and situated, as they ordinarily are, in an opening of the internal angle of the orbit; their first joint is less than the second, and the third only reaches to the edge of the anterior border of the basilary joint of the internal antennæ. The epistome is continuous with the lower border of the orbit, and the buccal frame is remarkably more narrow anteriorly than it is posteriorly. The external jaw-feet close the mouth completely; the interior border of their lamellar portion is straight; their third joint is very much elongated, and their fourth inserted at the external angle of the preceding. The sternal plastron has a trapezoidal form, the base of which is directed backwards; it is strongly curved in its longitudinal direction, and gives passage to the male organs at a considerable distance from its external border. The anterior feet are generally compressed and of very unequal size; the rest are very long and exhibit no great difference between themselves; the terminating joint is often depressed, but has never the form of a natatory oar. The abdomen, composed ordinarily of seven distinct segments in both sexes, is very narrow. In general it does not cover more than a third of the posterior portion of the sternal plastron of the male, and even in the female leaves that part of the plastron which approaches the base of the feet exposed. In the greater part of the cases, if not always, there are only seven branchiæ on each side of the thorax, five of which only are couched under the vault of the sides, and two reduced to the state of vestiges only, and fixed to the jaw-feet.

Ocypoda arenaria. *a*, under side of the head. Milne-Edwards.

The Ocypodians, as their name implies, are very swift runners, living nearly always on the strand, where they dig holes for themselves.

M. Milne-Edwards, who remarks that this small and very natural group is closely allied to the genera *Doto* and *Mycteris* among the Pinnotherians, thus divides the tribe:—

Tribe of Ocypodians.
- Cornea transparent, very large, oval, occupying at least the half of the length of the ocular peduncles, and commencing very near the base of those stems. — *Ocypoda.*
- Cornea transparent, very small, rounded, not occupying the fourth part of the length of the ocular peduncle, and only commencing close to its extremity. — *Gelasimus.*

Ocypoda (Fabricius).—Carapace rhomboidal or even nearly square, as large behind as before. The front is much longer than it is wide; it does not cover the articulation of the ocular peduncles, and only equals in width the half of the epistome, to the anterior border of which it unites itself. The orbits are very large, not deep; the upper border is much less advanced than the lower. The form of the eyes is very remarkable; the cornea is oval, very large, and extends below within a very small distance of the base of the peduncle; but in general this last is prolonged beyond its extremity, so that the eyes terminate with a kind of horn, the length of which seems to increase with age. The internal antennæ are disposed as stated in the character of the group; the external antennæ are rudimentary; their third joint is not half so long as the second, and their terminal stemlet is scarcely longer than their peduncle. The epistome is very small and presents at its median part a small quadrilateral prolongation which is soldered to the front. The third joint of the external jaw-feet is quadrilateral and much smaller than the preceding. The anterior feet are in general shorter than the rest, and the hand which terminates them is much compressed and very large in comparison with the arm; the difference between the hands of each side is often very great, especially in the male. The succeeding feet are also much compressed, and increase in length up to the fourth pair inclusively. The abdomen is much narrower at its base than the posterior part of the thorax, and in both sexes leaves a considerable portion of the last segments of this part of the body exposed.

The branchia which ordinarily exists on the antepenultimate joint of the sides is wanting in the *Ocypodæ;* the others are directed very obliquely backwards, and the branchial cavity is elevated so as to leave above a great void space which is lined by a membrane more or less spongy. (M. Milne-Edwards.)

So rapid are the *Ocypodæ* in their motions that those who have observed these animals in their native haunts declare that they run so fast that a man can hardly overtake them. They hollow out holes for themselves in the sand of the sea-bank, and remain shut up in their burrows throughout the winter.

They are found in warm climates of both hemispheres.

M. Milne-Edwards records seven recent species, which he separates into two divisions:—

A. Species whose transparent cornea occupies the extremity of the ocular peduncle, and is not overpassed by a styliform prolongation or a terminal tubercle.

O. arenaria, the Sand-Crab of Catesby. Length about two inches; colour yellowish. It is found on the coasts of North America and the Antilles.

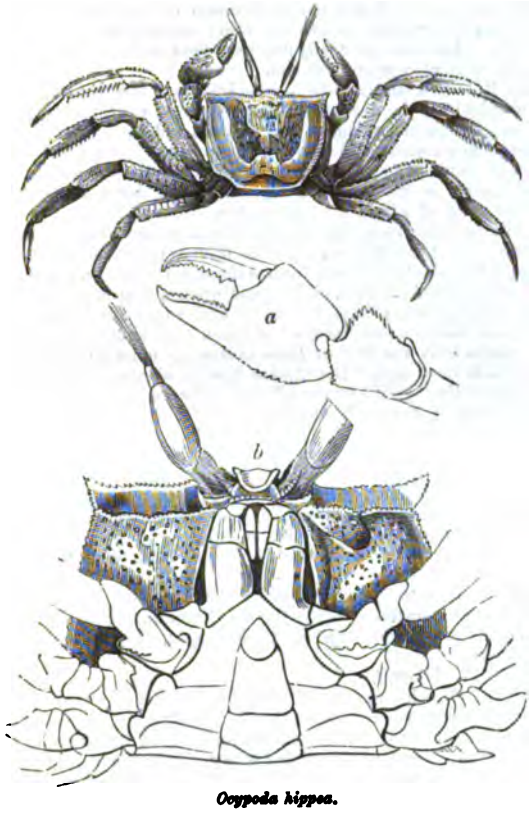
It lives in holes three or four feet deep, which it hollows out in the sand immediately above the level of the wash of the sea. Its general time of quitting the burrow to seek its food is the night, and when pursued it runs with great swiftness, elevating at the same time its claws in a menacing manner. This is their summer life; but towards the end of October they retire inland to hybernate in the earth. When they have found a place proper for their purpose they dig a hole like that which they had occupied on the edge of the sea; and after entering therein stop up the entrance so cleverly that no trace of its existence is left. Then they retire to the bottom, and there remain till the warm weather brings them forth, when they again repair to their marine residences.

B. Species whose eyes carry at their extremity an appendage, in the form of a tubercle, cylinder, or stylet, which overpasses the transparent cornea.

O. hippea. Terminal appendage of the eyes large, short, conical,

and furnished at its extremity with a pencil of long hairs. Length 2 inches, French.

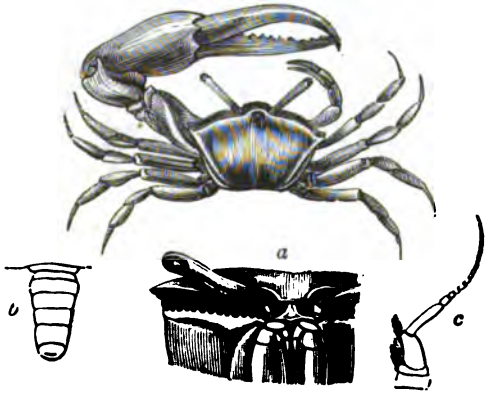
It is found in Syria, Egypt, Cape de Verd, &c.



Ocypoda hippea.

a, pincers; *b*, under side of male in detail. (Milne-Edwards.)

Gelasimus.—Carapace much wider than that of *Ocypoda*, more convex, and much narrower backwards. Stomachal region very small, and genital region generally very large. Disposition of the front and of the internal antennæ nearly the same as in the preceding genus: ocular peduncles, on the contrary, very narrow, and the cornea which terminates them not occupying more than its fifth part; upper border of the orbits much less projecting than the lower; not divided into two portions as in the *Ocypodæ*, and convex nearly throughout its length; external extremity of those cavities largely open, and communicating with a furrow which is obliquely directed behind and downwards. External antennæ much more developed than in the preceding genus. The external jaw-feet have the same form as the *Ocypodæ*. The anterior feet, in general, very small in the female; but, in the male, one of them acquires enormous dimensions. Sometimes it is the right, sometimes the left claw which grows to this great size, being, in certain instances, twice as large as the body. The claws of the smaller anterior foot are enlarged and lamellar towards the end and a little contorted; those of the great anterior foot are arched, elevated, and slightly dentated on the edges.



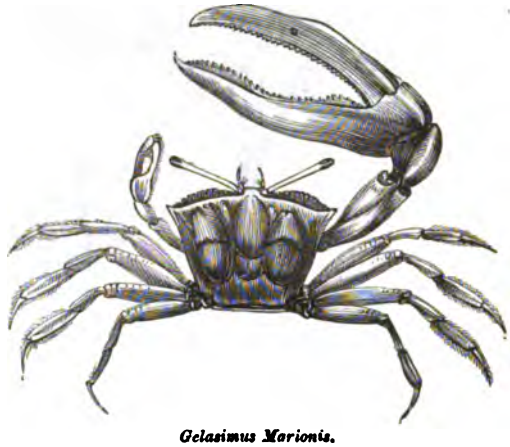
Gelasimus annulipes. (Indian Seas.) Milne-Edwards.

a, under side of head; *b*, abdomen; *c*, antennæ.

M. Milne-Edwards, who gives the above character, states that Mr. Thomas Bell had informed him that some *Gelasimi* have at a certain age, if not always, a stylet at the extremity of the ocular peduncle, on the side of the great claw, whilst the eye of the opposite side always retains the ordinary form. It inhabits the warm countries in both hemispheres.

The *Gelasimi* live in holes near the edge of the sea, in pairs, and the great claw of the male is used to stop the entrance of the hole. The species are numerous.

G. Marionis. Length about 8 lines; width about an inch, French. It is a native of Manilla.



Gelasimus Marionis.

Fossil Ocypodians.—The fossil species which most resembles *Gelasimus Maraçoani* seems to be *G. nitidus*, figured by M. Desmarest in his 'Histoire Naturelle des Crustacés Fossiles,' but the lateral edges of the carapace in the fossil are quite smooth, and the front is terminated by a very short sharp point. Neither the geological nor geographical locality appears to be known. The specimen is in the Paris museum.

OCYPTERUS. [LANIADÆ.]

OCYRÖE. [ACALEPHÆ.]

ODATRIA. [MONITORIDÆ.]

ODERIT, a Mineral. It is probably Black Mica; for, like that substance, it may be split into thin leaves. [MICA.] It is opaque, black, and has very little lustre. Its colour is probably owing to some foreign substance, which may cause the difference between its appearance and that of common mica. It occurs in Sweden.

ODONTIS. [MONODONTA; TROCHIDÆ.]

ODONTOPTERIS. [COAL PLANTS.]

ODOSTO'MIA, Fleming's name for a genus established from several small species of land shells—*Turbo plicatus*, *T. spiralis*, *T. unidentatus*, &c. of Montagu. It has the following characters:—Shell conical; aperture ovate; peristome incomplete retrally, and furnished with a tooth on the pillar. Operculum ovate-acute, subspiral, corneous, transversely striated, placed on a simple lobe. Forbes and Hanley in their 'History of British Mollusca,' describe upwards of 20 species as British. The species are difficult to distinguish.

ŒDE'MERA, a genus of Beetles belonging to the third family of Heteromerous *Coleoptera*, the *Stenelytra*. *Œ. cærulea* is a very common British Insect.

ŒDES. [CULICIDES.]

ŒDICNEMUS. [CHARADRIADÆ.]

ŒNANTHE, a genus of Plants belonging to the natural order *Umbelliferæ*. One of the species, *Œ. pimpinelloides*, appears to have been the Οἰνάνθη of Theophrastus and Dioscorides. The species of this genus are readily known, independently of other characters, by their fruits being, by the contraction of the rigid pedicels, strongly compacted into heads, the upper side of which is muricated by the stiff straight long styles. The fruits have on each face five convex obtuse ridges, of which the marginal ones are a little the largest.

The species are all inhabitants of damp meadows or watery places, and are common in Europe. The most important is *Œ. crocata*, an inhabitant of ditches, banks of rivers, and similar situations. This plant, which Dr. Christison reckons the most energetic of the narcotico-acrid poisonous plants of its class, has a root of many fleshy fingers, looking exactly like a dahlia-root in miniature, but abounding in an orange-coloured fetid juice, which is also plentiful in other parts of the plant, and in which the deleterious qualities reside. The stem grows from two to five feet high, is much branched, round, and hollow; the leaves are of a dark shining green, doubly pinnate, with wedge-shaped leaflets variously and deeply cut; the umbels are large and convex, of many general and a still greater number of partial rays; the bracts of the involucre are variable in number and size; the flowers are white, tinged with purple. Cases of accidental poisoning with this plant, in consequence of its roots being mistaken for ground-nuts,

parsnips, &c., by ignorant people, are common. In general death takes place within three hours and a half of the poison having been administered, and often within the first hour.

Œnanthe crocata.

The other British species are—*Œ. fistulosa*, *Œ. Lachenalii*, *Œ. salvifolia*, *Œ. Phellandrium*, *Œ. fluviatilis*.

ŒNOTHE'RA, a genus of Plants belonging to the natural order *Onagrariæ*, or *Onagraceæ*. It has a 4-cleft calyx; 4 petals; a filiform style, with a clavate or cruciform stigma; linear capsules of 4 cells, with 4 valves; and numerous seeds.

Œ. biennis, Evening Primrose, has ovate-lanceolate flat-toothed leaves; a rough hairy stem; petals longer than the stamens, and about half as long as the tube of the calyx; the flowers are large, numerous, and of a bright yellow-colour. It abounds on the Lancashire coast, and covers several acres of ground near Woodbridge, Suffolk. The roots are eatable, and were formerly taken after dinner to flavour wine, as olives now are; therefore the generic name was changed from *Onagra*, the Ass-Food, to *Œnothera*, the Wine-Trap. This plant was once cultivated for the sake of its tubers, which might in some measure have stood instead of the potato, had they not been superseded by the introduction of the latter. This is the only British species of the genus.

There are 85 species enumerated by Don, growing chiefly in North America. They are handsome border-flowers, and deserve to be cultivated, but are not valuable on account of any properties they possess.

(Don, *Dichlamydeous Plants*; Babington, *Manual of British Botany*; Burnett, *Outlines of Botany*.)

ŒRSTEDTITE, a Mineral, occurring crystallised. Primary form a right square prism. Colour brown. Lustre splendent. Hardness 6·5. Specific gravity 3·628. It is found at Arendal, Norway. The following is its analysis:—

Titaniate of Zirconia	68·965
Silica	19·708
Lime	2·612
Magnesia	2·047
Protoxide of Iron	1·136
Water	5·332
	99·8

ŒSO'PHAGUS, or Gullet, is the canal leading from the pharynx, the short cavity at the back of the mouth, to the stomach. In man it is composed of two layers of muscular fibres, an external longitudinal layer, and an internal, composed of circular fibres, by which the food is propelled towards the stomach, and which are lined by a layer of soft mucous membrane and a moderately thick cuticle continued from that of the lips and mouth. In many animals its interior is beset with numerous firm pointed processes, directed towards the stomach, to prevent any food that has passed through it from returning into the mouth; in the ruminants, on the other hand, it is one of the chief means by which the partially-digested food is brought again to the mouth for the chewing of the cud.

Œ'STRIDÆ, a family of Dipterous Insects of the section *Athericera*, distinguished by the proboscis being either in a rudimentary state or wanting; the palpi are sometimes distinct and occasionally wanting; the antennæ are short, inclosed in a cavity in the fore part of the head; the third joint is usually globular, and the stylet is usually dorsal; the abdomen is generally large; the wings have generally three posterior cells, of which the first is often closed.

It will be seen from the above definition that the *Œstri* of the moderns cannot be the same as the *Œstrus* (Οἶστρος) of the ancient Greeks, a fly, which, we learn from Aristotle ('Hist. Anim.' iv. 4, &c.), Virgil ('Georgics,' iii. 148), Ælian, and others, is armed with a strong tongue (proboscis), pierces the hides and sucks the blood of quadrupeds, and makes a peculiar kind of harsh humming noise. Mr. Bracy Clark states that the *Œstrus Bovis* makes no noise whilst flying, and Mr. W. S. M'Leay says, "the *Œstrus Equi* is also silent in flying, as I have repeatedly myself observed." The absence in some and the rudimentary state of the proboscis in others of the modern *Œstri*, proves that they are not blood-suckers; and this fact is otherwise at variance with the description given by the ancients, their *Œstri* having a strong proboscis, a circumstance which, connected with the blood-sucking habits of the *Tabanidæ*, another family of Dipterous Insects, induces Mr. M'Leay to imagine that the *Œstrus* of the ancients belongs to that group. An ingenious paper on this subject, by the gentleman last mentioned, will be found in the fourteenth volume of the 'Linnean Transactions.' [Bots.]

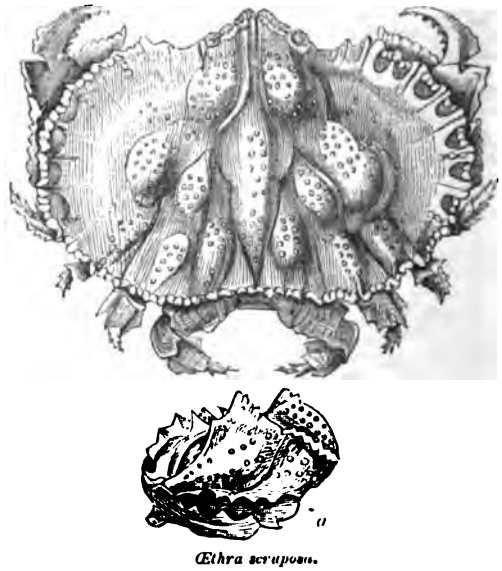
In Macquart's 'Histoire Naturelle des Insectes Diptères,' seven genera are enumerated as belonging to the family *Œstridæ*:—*Cuterebra*, *Hypoderma*, *Œdemagena*, *Cephenemyia*, *Cephalemyia*, *Colax* and *Œstrus*.

ŒSTRUS. [Bots.]

ŒTHRA (Leach), a genus of Brachyurous *Crustacea*, placed by M. Milne-Edwards as the representative of his first division (Canceriens Cryptopodes) of his tribe Cancerians; and indeed his Cryptopod Cancerians are composed of this genus solely. Latreille made *Œthra* and *Calappa* [Calappa] form the family *Cryptopoda*; but M. Milne-Edwards is of opinion that the only character which they have in common with the latter is the existence of lamellar prolongations on the sides of the carapace, dispositions which are also found in certain Leucosians, whilst all the rest of their organisation approaches that of the Crabs.

M. Milne-Edwards is of opinion that this form has great affinity with the genus *Cryptopodia* belonging to the family of Oxyrhyncha, and that it establishes the passage between those Crustaceans and the other Canceriens, at the same time that it approaches *Calappa*, whose natural place is in the family of Oxystomes. It is found in the East Indian and African Seas.

Œ. scruposa may be taken as an example. Its length is 2 to 3 inches. Colour grayish. It is found near the Island of Mauritius, and in the Indian Archipelago.



Œthra scruposa.

a, the right pincer, external view.

OIDEMIA. [Ducks.]

OIDIUM, a genus of Plants belonging to the order of *Fungi*, some of the species of which are found upon the human body and others attack plants. It is known by possessing a simple or branched mycelium, which is very minute and pellucid, aggregated into flocculent masses slightly interwoven and articulated. The sporidia are simple and pellucid, and arise from the joint of the mycelium.

O. albicans, the Thrush-Fungus, is found in the mucous membrane of the mouth, fauces, and œsophagus of sucking children, and also occasionally in grown-up persons in a state of extreme exhaustion. The ulcerations, amidst the discharge of which this fungus is found, are usually called thrush. Although constantly present in this disease the fungus does not appear to produce the disease but to be the result of the changes produced in the mucous membrane. It has been observed that the mucous membrane in this state constantly affords an acid reaction, and this acidity seems necessary to the growth of the fungus. The best account of this fungus will be found in Robin's 'Histoire des Végétaux Parasites.' Several other species of *Oidium* have been described. The fungus found in connection with the recent grape-vine disease is an *Oidium*. [ENTOPHYTA; FUNGI]

OIL-PALM. [ELÆIS.]

OIL-TREE. [BASSIA.]

OILS are substances of organic origin, and are found in both the animal and vegetable kingdoms. They are divided into Fixed and Volatile. The latter are principally products of the vegetable kingdom. The Fixed Oils are composed of carbon, hydrogen, and oxygen. Their general formula is C_{11}, H_{10}, O. They are liquid or solid according to the manner in which their elements are disposed. Most of them are composed of two compounds, a liquid called Olein, and a solid called Margarin, or another called Stearin. According as these solid substances abound in oils, they are liquid or solid at the ordinary temperatures of our atmosphere. Fixed Oil is found in the fat or adipose tissue of animals. [ADIPOSE TISSUE; FAT.]

Fixed Oil is found amongst plants principally in their seeds. In some cases as in the Olive [OLEA] it is yielded by the fruit.

Some families of plants especially abound in oil. Thus among the *Cruciferæ* we have Mustard, Rape, and Colza seed oil, with other species cultivated in Europe, India, and Japan, of which some have of late years been imported into this country. Several of the family of *Compositæ* secrete oil in quantities large enough to render it desirable to cultivate them for this purpose alone, as the sunflower and Jerusalem artichoke, also some species of *Carthamus*, or Bastard Saffron, and also the *Verbesina sativa* of India, now known to be identical with the Abyssinian *Guizotia oleifera*, and of which the oil is known in commerce by the name of Hutsyellow oil. So *Madia sativa* yields Madi oil, and its seeds are said to be more abundant in oil than any plant introduced into Europe. Most of the *Cucurbitaceæ* also, as the Melon, Gourd, Cucumber, and the numerous varieties, cultivated especially in India, contain a large proportion of oil, which is expressed in the East, as it formerly was in Europe. The *Rosaceæ* also store up a large proportion of oil in the kernels of their fruit, as in the Almond, which is particularly valued; so also that of the Apricot, as well as that of the Briançon Apricot, and other species of *Prunus*. In the Himalayas, oil is also expressed from the Apricot kernel, and has been sent to this country of a fine quality.

Among the *Amentaceæ* we have also several species which yield oil of good quality, and in sufficient quantity to repay the expense of expression, as Nut oil, obtained from the Hazel; Beech-Nut oil, from *Fagus sylvatica;* with these may be mentioned Walnut oil, from *Juglans regia*. Besides these, Poppy oil, Ben-Nut oil (*Hyperanthera*), Ground-Nut oil (*Arachis*), Physic-Nut oil (*Jatropha*), are well known. So the cotton-seed yields oil, which is also the case with the seeds of the tea-plant, especially of the species called *Thea oleifera*, and some of the Camellias.

Two species of *Bassia*, *B. longifolia* and *B. latifolia*, both yield oil; another species, *B. butyracea*, yields a vegetable butter, and is commonly known as the Ghee, or Butter-Tree of Almora. [BASSIA]. The native name of this tree is Choonee, and Mr. Traill describes it as not being found in Kumaon, but in the adjoining Goorkhal province of Dotee. [COCOS; CROTON; MYRISTICA; THEOBROMA; OLEA; PAPAVER; BRASSICA; ELÆIS; RICINUS; AMYGDALUS.]

The volatile oils are very numerous in the vegetable kingdom. They are called volatile on account of the ready manner in which they may be volatilised under the influence of heat. The facility with which they are diffused in the atmosphere renders them easy of detection, and it is to this class of substances that plants owe their peculiar odours. Many of them are employed in perfumery, others are used as stimulants in medicine, and some are poisons. Their composition is much more varied than that of the fixed oils, and to the chemist they offer an exceedingly interesting field of research. Many of them have a constitution analogous to the compounds obtained by chemists from the compound radicals. [COMPOUND RADICALS, in ARTS AND SC. DIV.] They are divided by chemists into three groups:—1, those containing only carbon and hydrogen, as oil of turpentine; 2, those containing also oxygen, as oil of cloves; 3, those containing sulphur, as oil of garlic. Many natural orders are characterised by yielding volatile oils. Thus the *Lamiaceæ*, *Myrtaceæ*, and others, embrace species all of which contain volatile oil in their leaves. Many of the *Umbelliferæ* yield a volatile oil in their fruits. The petals are often the seat of these secretions, and especially those most prized as the Rose, the Jasmine, the Heliotrope, and many others.

OKENITE is a Mineral, a variety of *Dysclasite*. It occurs in fibrous masses, having a radiated structure; also imperfectly fibrous, or composed of minute crystals. Its hardness is 4·5 to 5. Colour white. Specific gravity 2·28. It exhibits double refraction. It is found at Disco Island, Greenland. Its analysis by Kobell afforded—

Silica	56·99
Lime	26·35
Water	16·65
	99·99

OLACA'CEÆ, a small natural order of Exogenous Plants, chiefly found within the tropics. Its most important characters are—a small inferior calyx, often becoming enlarged around the ripe fruit, a polypetalous valvate corolla, a small number of hypogynous stamens, partly fertile and partly barren; a 1-celled ovary, with pendulous ovules, indehiscent fruit, and a small embryo amongst a large quantity of albumen. Its affinities are little understood, but are supposed to be greatest with *Pittosporaceæ*, on the one hand, and *Aurantiaceæ*, on the other. The plants are of little importance for useful qualities; one species, *Heisteria coccinea*, is erroneously supposed to yield the Partridge-Wood of cabinet-makers. The fruit of some species is eatable when ripe, though not very pleasant. There are 21 genera and 48 species in this order.

OLD RED-SANDSTONE. By this title English geologists have almost universally designated the variable series of rocks which separate the youngest slates (Transition Rocks) from the mountain-limestone and coal. Messrs. Conybeare and Phillips ('Geology of England and Wales') ranked the Old Red-Sandstone in their Medial Order along with the coal and mountain-limestone; and this classification has been unreservedly followed till within a short period. Sir Roderick Murchison, in his work on the 'Silurian System,' has preferred to separate the Old Red-Sandstone from the superincumbent strata, and to constitute for it an additional system. Since the publication of that work, the same author, in conjunction with Professor Sedgwick, believing that the limestones and slaty and conglomerate rocks of South Devon belong to the same geological period as the true Old Red-Sandstone of Herefordshire, and desirous of improving the nomenclature, has proposed for these variable strata the title of the Devonian System.

The following table and account of this formation is given by Professor Ansted in his 'Elementary Geology':—

Old Red-Sandstone Series.

Herefordshire.	Scotland.
Old Red Conglomerate	Quartzose Yellow Sandstone. Impure Limestone. Gritty Red-Sandstone.
Cornstone	Gray Fissile Sandstone.
Cornstone and Marl	Red and Variegated Sandstone. Bituminous Schist. Coarse Gritty Sandstone. Great Conglomerate.

Devonian Series.

Devonshire.	Belgium.
Calcareous Grit and Impure Limestone	Indurated Shale and Psammite. Calcareous Shale.
Red Flagstone	Lower Limestone of Belgium.
Calcareous Slate and Plymouth Limestone	Hard Siliceous Beds and Conglomerates.

The fossils of this period include many species of corals, Encrinites, and shells. There are also a number of remains of fishes, some of very great interest from the remarkable peculiarities of form and structure which they present. Many of these are small, but others of gigantic proportions. [FISH.]

The Old Red-Sandstone of England and Wales consists of various strata of limestone, marl, and sandstone, alternating with great thicknesses of conglomerate, which often pass upwards into overlying sandstones; and the series is expanded over a considerable portion of our island, rising into lofty mountains, occupying extensive plains, and developed to an enormous thickness.

In North Wales, although the Old Red-Sandstone retains its general character, we find it inferior in thickness and importance to its development in Herefordshire and South Wales. It again increases however as we advance still farther northward into Westmoreland and Cumberland, where it appears as an irregular conglomerate. In this part of England its largest development is near the foot of Ullswater, and it rises into a succession of round-topped hills several hundred feet high, the beds being of great thickness. No true passage is there discernible into the overlying limestones.

The loftiest points occupied by this deposit are the Vans of Caermarthen and Brecon, the former 2590 and the latter 2500 feet above the level of the sea. These hills are made up of a conglomerate composed of white quartz pebbles embedded in a red matrix; and it is this quartzose conglomerate which gives its name to the uppermost group of the formation.

The highest beds of the series do not however always consist of conglomerates, but are more frequently composed of beds of sandstone, hard and finely grained, and alternating with a few imperfectly-exhibited mottled marls. The lower portion capping the escarpment of the Cornstone in Herefordshire furnishes thick beds of valuable building material, and is occasionally quarried for tiles. The upper beds are for the most part less compact, and commencing as a fine comglomerate they afterward become coarser, and alternate with bands of red and green argillaceous marl. Fine examples of the conglomerate beds (attaining near Abergavenny a thickness of 200 feet) may be seen on the banks of the Wye between Ross and Monmouth, and again on the right bank of that beautiful river to the north of Tintern Abbey.

The Cornstone consists of a number of argillaceous marly beds, sometimes alternating with sandstone and sometimes with impure limestone, affording by decompositon the soil of the richest tracts of Herefordshire and Monmouthshire. The lower part of this rock very often contains flaggy beds, some of which are extensively quarried near Downton Hall, the stone being of a greenish colour and highly micaceous, and usually more or less intermixed with party-coloured marls or soft argillaceous sandstones, not so compact as the rock which incloses them. The surface of the sandstone is frequently worn into irregular holes and patches.

But the subdivisions of the sandstones are too entirely local to allow of any lithological character being given which can apply to more than a very limited district. Generally speaking, the impure concretionary limestone, which is more especially denominated Cornstone, appears at intervals in irregular lenticular masses throughout the district, contracting and expanding in the most capricious manner; sometimes replaced by finer and more crystalline limestone, and sometimes alternating with hard flaggy sandstones. Nearly the whole of the central and northern parts of Herefordshire, and the contiguous parts of Shropshire and Worcestershire, are occupied by this formation; and its vast thickness is well displayed in the hills crossed by the new road from Leominster to Hereford. In the northern portion of the range, and near the mouth of the Towey in Caermarthenshire, the limestones are most fully developed, becoming much thicker and also more crystalline than in other parts.

In Scotland the uppermost beds are highly arenaceous, and often consist of sandstone conglomerates. The intermediate calcareous band is barren of fossils, and is of somewhat singular composition, yielding unequally to the weather, and exhibiting a brecciated aspect. It contains masses of chert exceedingly hard, and these, from the manner in which they are incorporated with the rock, appear to have been of contemporaneous origin. The bed is several yards in thickness, and is very persistent, being found both in Moray and in Fife, localities 120 miles apart.

The middle group of the Old Red-Sandstone of Scotland, corresponding to the Cornstone of England, is developed in Forfarshire, in Morayshire, and in the Gray-Sandstone of Balruddery, where the lower beds are absent. It is represented as consisting, for the most part, of rocks of a bluish-gray colour, sometimes, as at Balruddery, resembling the silurian mudstones, at others forming a hard fissile flagstone exported as a paving-stone, and occasionally appearing in beds of friable stratified clay, easily washed away by the sea. The colour however throughout is gray, and in this respect differs essentially from the English contemporaneous beds, which are chiefly red and green marls.

The base of the whole system is represented by Mr. Miller as consisting of an extensive and thick conglomerate rising into a lofty mountain-chain in the county of Caithness, and attaining an elevation of 3500 feet in the hill called Morrheim, but a great thickness of arenaceous strata, containing conglomerates of various magnitude, intervenes between these and the middle beds.

The Devonian Beds present a series so distinct that no relations of mineral or mechanical condition can be traced between them and the Old Red-Sandstones. The upper beds on which the culms of Devonshire repose, consist of coarse red flags and slates, sometimes alternating with or overlaid by other slates and limestones, while the lower beds are to be sought for among the calcareous slates of Cornwall and South Devon. The calcareous slates are occasionally fossiliferous, and are based upon an impure limestone. The Plymouth Limestone in the south, and a group of coarse arenaceous beds in the north of Devon, together with the general series of Cornish rocks, are all included among these calcareous slates. Throughout the whole series fossils occur, but they are very unequally distributed, being locally abundant, although owing to the metamorphic character of many of the beds they are sometimes much altered, and frequently obliterated. (Ansted.)

The Old Red-Sandstone is largely developed in Ireland, and is peculiarly interesting as presenting all those parts of the series which are found in different parts of England.

This formation is well represented in Belgium by a series of beds consisting of 1500 feet of strata. They are principally composed of a yellowish-sandstone alternating with shale and calcareous beds.

The Devonian or Old Red-Sandstones of Russia occupy a tract nearly as large as the whole of the British Islands. They rest conformably upon low plateaux of silurian rocks, and attain a height of from 500 to 900 feet above the sea level.

This formation is repeated with nearly the same mineral characters and organic remains in America. It is found in both North and South America.

The following are the genera of the Invertebrate Fossils found in the Devonian Group, as given by Mr. Tennant in his 'Stratigraphical List of British Fossils':—

Amorphozoa.

Manon cribrosum, Goldf. — *Scyphia turbinata*, Goldf.

Zoophyta.

Amplexus tortuosus, Phil.
Astrea, Blainv., 3 species.
Aulopora conglomerata, Goldf.
Caunopora ramosa, Phil.
Coscinopora placenta, Goldf.
Cyathophyllum, 2 species.
Cystiphyllum, 2 species.
Favosites, 4 species.
Fenestella, 5 species.
Glauconome bipinnata, Phil.
Gorgonia ripisteria, Goldf.
Hemitrypa oculata, Phil.
Millepora gracilis, Phil.
Millepora similis, Phil.
Petraia, 4 species.
Porites pyriformis, Ehrenb.
Stromatopora, 2 species.
Strombodes, 2 species.
Syringopora catenata, Mart.

Echinodermata.

Adelocrinus hystrix, Phil.
Cyathocrinus, 8 species.
Pentatrematites ovalis, Goldf.
Platycrinus, 2 species.
Taxocrinus macrodactylus, Phil.

Crustacea.

Brontes flabellifer, Goldf.
Calymene Sternbergii, Munst.
Harpes macrocephalus, Goldf.
Olenus punctatus, Stein.
Phacops, 3 species.

Conchifera Dimyaria.

Corbula Hennahii, Sow.
Cucullæa, 7 species.
Cypricardia, 2 species.
Megalodon, 2 species.
Modiola, 3 species.
Mytilus Damnoniensis, Phil.
Nucula, 3 species.
Pleurorhyncus, 2 species.
Pullastra, 3 species.
Sanguinolaria, 3 species.

Conchifera Monomyaria.

Avicula, 9 species.
Pecten, 8 species.
Posidonomya, 2 species.
Pterinea, 3 species.

Brachiopoda.

Atrypa, 19 species.
Calceola sandalina, Lam.
Chonetes, 3 species.
Leptæna, 7 species.
Orthis, 16 species.
Productus, 6 species.
Spirifer, 33 species.
Strigocephalus, 3 species.
Terebratula, 31 species.

Gasteropoda.

Acroculia sigmoidalis, Phil.
Buccinum, 4 species.
Euomphalus, 3 species.
Loxonema, 8 species.
Macrocheilus, 3 species.
Murchisonia, 6 species.
Murex harpula, Sow.
Natica, 2 species.
Nerita, 2 species.
Platyceras vetustum, Sow.
Pleurotomaria, 8 species.
Schizostoma, 2 species.
Trochus Bouei, Stein.
Turbo, 3 species.

Heteropoda.

Bellerophon, 8 species. — *Porcellia Woodwardii*, Sow.

Pteropoda.

Orocsis dimidiatum (*Orthoceras, sp.* Sow.).

Cephalopoda.

Clymenia, 7 species.
Cyrtoceras, 12 species.
Goniatites, 11 species.
Nautilus, 2 species.
Orthoceras, 12 species.

OLEA, a genus of Plants, the type of the natural order *Oleaceæ*. It has a 4-cleft corolla, a berry with two brittle 1-seeded cells, one of them generally abortive. The leaves undivided. Flowers greenish, clustered, axillary.

O. Europæa has lanceolate quite entire 2-coloured leaves, with axillary racemes. It grows wild in rocky places in Italy. It differs from most trees, except the Sweet Bay (*Laurus nobilis*), some species of *Cornus*, and a very few others, in yielding a fixed oil from the pericarp; the seed being the source of fixed oils in most plants. The oil which is expressed from the ripe fruit immediately after being collected is most esteemed, and called Virgin Oil, Oleum Provinciale. That which is most highly prized comes from Nice and Genoa. When the oil is extracted by a stronger pressure, or by the aid of heat, or after the olives, having been collected into heaps, have remained till a kind of fermentation has occurred, it is the common Olive Oil, the properties of which vary in proportion as the fermentation has been of long or short duration. An oil of still inferior quality is obtained, when the husk of the olive, after the former treatment, is boiled in water. This kind is employed solely for the preparation of soap.

Virgin Oil is of a very pale-yellow or yellowish-green colour, more limpid when fine than any other fixed oil; inodorous when fresh, but emitting a very peculiar odour when old; taste purely oily but

by age becoming slightly rancid. Common olive-oil is of a deep-greenish or brownish-yellow colour, and an odour and taste more or less subrancid. Its specific gravity is greater than the other. The unripe fruit of the olive is preserved in brine, and eaten frequently at dessert.

The olive flourishes only in warm and comparatively dry parts of the world, as the south of France and Spain, in Italy, Sicily, Syria, and the north of Africa. Humboldt has stated that "the olive flourishes between 36° and 44° N. lat.; wherever the mean annual temperature is from 62·6° to 58·1°, where the mean temperature of the coldest month is not below from 41° to 42·8°, and that of the whole summer from 71·6° to 73·4°." Great cold is injurious to it, as that of 1709 was to the olive-trees of France; and as M. Bové states that the olive thrives in Egypt, and Delile that it contributes to the riches of the Fayoum, which is nearly in the latitude of Cairo, it is evident that it is capable of bearing a greater degree of heat, as is probable indeed from its being a native of Asia, having been cultivated in early times in Syria and Palestine by the ancient Hebrews, and known to them by the name of Zait, and to the Arabs by that of Zaitoon. It is said to have been introduced by the Phocæans into Marseille.

OLEACEÆ, *Oliveworts*, a natural order of Monopetalous Exogenous Plants, with a superior 2-celled ovary, a subvalvate corolla, two stamens, and a fruit with pendulous albuminous seeds. In the artificial collocations of natural orders to be found in books, these plants are usually stationed next *Jasminaceæ*, with which they have been even combined. It is however probable that they have really as much affinity with some of the monopetalous dicarpous orders. Lindley, in his 'Vegetable Kingdom,' arranges them in the Solanal Alliance, and gives their further affinities as with *Aceraceæ*, *Jasminaceæ*, and *Solanaceæ*.

The species of the order best known in this country are, the Olive, or *Olea Europœa* [OLEA]; the Lilac, or *Syringa vulgaris*; the Evergreen Phillyrea of many forms; the Privet, or *Ligustrum*; and the Fringe-Tree, or *Chionanthus*; all corresponding in habit and in sensible properties, which latter are very generally bitter and febrifugal. The bark of the Olive has been extensively used by the French instead of *Cinchona*, and the young fruits of the Common Lilac form an infusion scarcely inferior to gentian.

Olive (*Olea Europœa*).

1, a flower; 2, an ovary divided vertically; 3, a ripe fruit cut in half; 4, a stone divided longitudinally.

The most anomalous genus of the order is the Ash, which, in its most genuine form, has no petals, and in the division called *Ornus* has the petals present, but separate to the base. It is however, in all essential circumstances, the same in structure as the more regular genera; and its relation to the order has been ingeniously proved by the fact that the Olive and the Lilac will both live when grafted upon it. It is from the *Ornus*, or Flowering-Ash, that the bitter-sweet purgative called manna is secreted. [FRAXINUS.]

The order has 24 genera and 130 species.

OLEANDER. [NERIUM.]

OLEGON SPAR, a Mineral consisting of Carbonate of Iron and Manganese. Its primary form is an obtuse rhomboid. Cleavage on the faces of the primary. Its colour is yellow, reddish-brown. Lustre vitreous. Hardness 4·0. Specific gravity 3·745. It is found at Ehrenfriedensdorf. Its analysis by Magnus gives—

Carbonate of Iron	59·99
Carbonate of Manganese	40·66
	——100·65

OLEIN. [ADIPOSE TISSUE; FAT.]

OLIBANUM. [BOSWELLIA.]

OLIGISTE. [IRON.]

OLIGOCLASE, a Mineral occurring crystallised. Its primary form is an oblique rhombic prism. Colour white, yellowish, and greenish-white. Fracture conchoidal, uneven. Hardness 6·0. Transparent, sub-translucent. Specific gravity 2·64 to 2·67. It is found at Danvikszoll near Stockholm, Arendal in Norway, &c. Its analysis by Berzelius gives—

Silica	63·70
Alumina	23·95
Lime	2·05
Magnesia	0·65
Soda	8·11
Potash	1·20
Peroxide of Iron	0·50
	——100·16

OLI'GODON (Boié), a genus of Snakes.

OLIVA. [VOLUTIDÆ.]

OLIVE-OIL. [OLEA.]

OLIVE-TREE. [OLEA.]

OLIVELLA, Mr. Swainson's name for a genus, or rather a sub-genus, separated by him from *Oliva*; and characterised as having two plaits on the columella.

OLIVENITE. [COPPER.]

OLIVINE. [CHRYSOLITE.]

OLYGY'RA. [HELICIDÆ.]

OMALANTHUS, a generic name, proposed for *gnaphalium supinum*.

OMALISUS. [LAMPYRIDÆ.]

OMENTUM is a broad band of membrane connecting two or more of the abdominal viscera. The chief of these membranes is the great omentum, or caul, which forms a large fold connecting the stomach with the transverse arch of the colon; others of less size and importance connect the stomach and liver, and the stomach and spleen. The great omentum always contains some fat surrounding its blood-vessels, so that it looks like a network of fatty tissue, and it is one of the chief seats of the accumulation of fat in corpulent persons, in whom it contributes largely to the peculiar prominence of the abdomen.

OMMASTREPHES, a genus of Cuttle-Fishes belonging to the family *Teuthidæ*. Body fleshy, firm, cylindrical, elongated, flanked near its posterior extremity by two triangular fins. Locomotive apparatus formed of "conical perpendicular pits, each communicating by a narrowed groove with a small horizontal pit, surrounded by a prominent margin, the whole describing a rather prominent triangle, placed at the base of the locomotive tube; and, besides, of a tubercle prolonged into its upper part into a decreasing nose-shaped crest; and lastly, of little horizontal inferior crests placed on the inner margin of the body." Eyes very large, opening widely exteriorly, and provided with a lachrymal sinus; arms 10, like those of *Loligo*; pen corneous, flexible, elongated, as long as the body, terminating at its lower extremity in a hollow simple cup.

The Cuttle-Fishes of this genus closely resemble those belonging to *Loligo*. Besides the character just given, they may generally be distinguished by the short rhomboidal termination of the body, formed by the fins, combined with the hinder extremity.

The species are mostly pelagic, and some of them are gregarious. They seem to be distributed all over the world. They are called Flying Squids by fishermen. (Forbes and Hanley.)

The following species have been taken on the British coasts:—

O. sagittatus (*Sepia Loligo*, Linnæus), with an elongated body; peduncles of tentacular arms without suckers; extremities of their clubs covered with closely-set rows of numerous minute suckers. This species is very rare on the British coast, but Messrs. Forbes and Hanley record two instances of its recent capture. M. D'Orbigny regards the *Loligo Piscatorum*, *L. Harpago*, *L. illecebrosa*, and *L. Coindetii* as founded on this species.

O. todarus (*Loligo sagittata*, Lam.), Delle Chiaje. It has an elongated body, and the peduncles of the tentacula provided with suckers throughout their length. This squid is often called in British catalogues *Loligo sagittata*. It is frequently found on the coasts of Great Britain. It has been made the subject of an elaborate memoir on the anatomy of its nervous system by Mr. Albany Hancock.

O. Eblana (Ball), has a short body; suckers confined to the clubs of the tentacles, minute, and 4-ranked at their extremities. It has been found in Dublin Bay, and was first described by Dr. R. Ball of Dublin.

(Forbes and Hanley, *History of British Mollusca*).

OMPHALEA, a genus of Plants belonging to the natural order *Euphorbiaceæ*. The seeds of one of the species are said to be eatable when the embryo is extracted, but if this is not done, they are too cathartic for food. On the authority of Mr. W. M'Leay, Dr. Lindley

says this nut is most delicious and wholesome, and that it is known by the name of Cob-Nut or Hog-Nut in Jamaica. Other euphorbiaceous seeds have the same properties.

O. triandra is a Guyana plant with a white juice, which turns black on drying, and is then used as ink.

(Lindley, *Vegetable Kingdom.*)

ONAGER. [EQUIDÆ.]

ONAGGA. [EQUIDÆ.]

ONAGRA. [ŒNOTHERA.]

ONAGRA'CEÆ, *Onagrads*, a natural order of Polypetalous Exogenous Plants, which, in their more complete condition, are certainly known by their inferior ovary, and by all the parts of the flower being four, or a constant multiple of that number. Thus in the plant now figured (*Jussiæa grandiflora*) there are four sepals, four petals, twice four stamens, four stigmas, four cells to the ovary, and the fruit when ripe bursts into four valves. The species characterised by this peculiarity are chiefly herbaceous plants, inhabiting the more temperate parts of the world, and have white, yellow, or red flowers, such, for example, as the great genus of Œnotheras, or Evening Primroses, and the Epilobiums, which are so common as wild plants. It is only in the *Fuchsia*, which has a succulent fruit, and forms an approach to *Myrtaceæ*, that a woody structure is met with. [FUCHSIA.]

Jussiæa grandiflora.

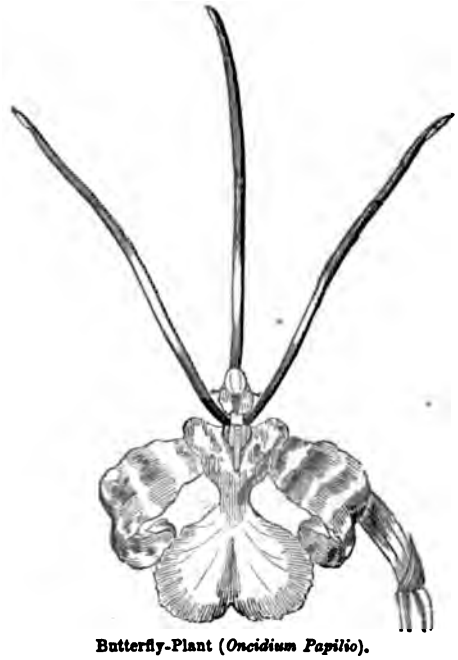
1, a fruit nearly ripe, and surmounted by its four sepals; 2, a transverse section of the same, to show the four cells.

But although genuine *Onagraceæ* are thus plainly limited, botanists admit into the order other plants which do not possess the character proper to the order, and which are regarded as imperfect states of it. Thus *Hippuris*, which has only one stamen, no petals, and a 1-celled ovary, is regarded as a case of degradation from the Onagraceous type; and *Lopezia*, with only one perfect stamen, one imperfect stamen, and two petals, is considered another but less degraded condition of the order. [HALORAGACEÆ.]

A large proportion of Onagraceous plants are ornamental, and consist of common garden flowers, especially the species *Œnothera*, *Godetia*, *Epilobium*, and *Fuchsia*; but they possess no useful qualities. [CIRCÆA; ŒNOTHERA; EPILOBIUM.]

The order contains 28 genera and 450 species.

ONCI'DIUM is a very large genus of tropical and subtropical *Orchidaceæ*, found in the western hemisphere, where the species are common, especially in Mexico and some of the West Indian islands, Brazil, and Peru. They have usually yellow flowers spotted with a rich reddish-brown; sometimes the blossoms are purple, and more rarely white. They belong to the Vandeous section of their order [ORCHIDACEÆ], and are known by their labellum being broad, more or less lobed, distinct from the column, and furnished at the base with a tuberculated disc, which usually presents some grotesque appearance. Their sepals and petals are spreading, their column has a membranous ear on each side, and they have two pollen masses attached to a long caudicula. The most remarkable species is the Butterfly-Plant, so called in consequence of the supposed resemblance of its flowers to some insect upon the wing. This is found in Trinidad, growing on the branches of trees, and bears a long, jointed, compressed, spotted scape, from the apex of which swings lightly a large yellow and brown flower, whose labellum is compared to the body of an insect, the column to its head, a pair of processes arising from the column to short antennæ, and the long narrow sepals and petals to legs. It is now common in hot-houses.



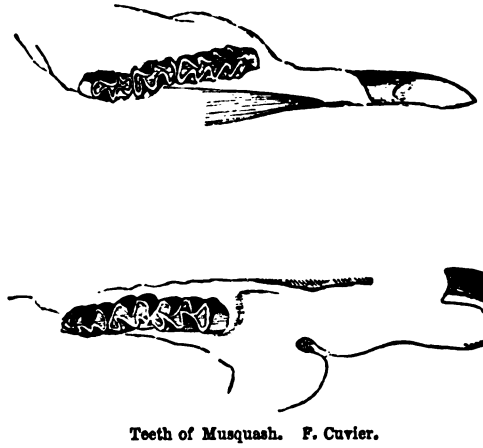
Butterfly-Plant (*Oncidium Papilio*).

ONDATRA (Lacépède), a genus of Mammalian Animals belonging to the family *Castoridæ*. Ondathra is the native name of the Musquash, which has been adopted as its generic designation. The only species of this genus is the Musquash of America. Of this animal Sir John Richardson gives the following synonyms:—

Rat-Musqué of Sagard Theodat; *Castor Zibethicus* of Linnæus; L'Ondatra of Buffon; Musk-Rat of Lawson; Musk-Beaver of Pennant; *Mus Zibethicus* of Linnæus and Gmelin; *Fiber Zibethicus* of Sabine and Harlan; Musk-Rat of Godman; Musquash, Watsuss, or Wachusk, also Peesquaw-Tupeyew (the animal that sits on the ice in a round form), of the Cree Indians.

In a tract which has for its title, 'A Perfect Description of Virginia,' 1649, we find among the "Beasts great and small . . . a Muske-Rat, so called for his great sweetnesse and shape."

Dental Formula:—Incisors, $\frac{2}{2}$; Molars, $\frac{3-3}{3-3} = 16$.



Teeth of Musquash. F. Cuvier.

The head is short. Body thick and rather flat; legs very short hind feet large, not webbed. Dark umber-brown above; sides, anterior part of belly, middle of breast, lateral part of neck and cheeks, shining yellowish-brown; chin, throat, sides of the chest, and posterior part of the abdomen, ash-gray; tail compressed, convex on the sides, with its acute edges in a vertical plane, covered with a thin sleek coat of short hairs, which allow a number of small roundish scales, well separated from each other, and which as well as the hair are dusky-brown, to appear through them; acute margins of the tail (which is rather thicker in the middle than at the root, and tapers gradually from its middle to its extremity, which is not acute) covered with a close line of longer hairs dark-brown on the upper edge and soiled white on the under one. Length of head and body 14 inches; of the tail, 8 inches 6 lines.

The fur, which much resembles that of the beaver, but is shorter

resists the water during the life of the animal, but is easily wetted immediately after death.

Musquash (*Castor Zibethicus*).

Charlevoix states that the Musk-Rat takes the field in March, at which time its food consists of bits of wood, which it peels before it eats them. After the dissolving of the snows he says that it lives upon the roots of nettles, and afterwards on the stalks and leaves of that plant. In summer it feeds on strawberries, &c., to which succeed the autumnal fruits. During this time he states that the male and female are rarely seen asunder. According to the same author they separate in winter, when each takes up its lodgings apart in some hole or in the hollow of a tree, without any provision; and the Indians declared that not the least morsel of anything is eaten by them whilst the cold continues. "They likewise," adds Charlevoix, "build cabins nearly in the form of those of the beavers, but far from being so well executed. As to their place of abode, it is always by the water-side, so that they have no need to build causeways. . . . The flesh is tolerably good eating, except in the time of rut, at which season it is impossible to cure it of a relish of musk, which is far from being as agreeable to the taste as it is to the scent."

The habitations of the Musquashes, and the mode of hunting them, are thus described by Sir John Richardson:—"In the autumn, before the shallow lakes and swamps freeze over, the Musquash builds its house of mud, giving it a conical form, and a sufficient base to raise the chamber above the water. The chosen spot is generally amongst long grass, which is incorporated with the walls of the house, from the mud being deposited amongst it; but the animal does not appear to make any kind of composition or mortar by tempering the mud and grass together. There is however a dry bed of grass deposited in the chamber. The entrance is under water. When ice forms over the surface of the swamp the Musquash makes breathing holes through it, and protects them from the frost by a covering of mud. In severe winters however these holes freeze up in spite of their coverings, and many of the animals die. It is to be remarked that the small grassy lakes selected by the Musquash for its residence are never so firmly frozen nor covered with such thick ice as deeper and clearer water. The Indians kill these animals by spearing them through the walls of their houses, making their approach with great caution, for the Musquashes take to the water when alarmed by a sound on the ice. An experienced hunter is so well acquainted with the direction of the chamber and the position in which its inmates lie, that he can transfix four or five at a time. As soon as, from the motion of the spear, it is evident that the animal is struck, the house is broken down, and it is taken out. The principal seasons for taking the Musquash are—the autumn before the snow falls, and the spring after it has disappeared, but while the ice is still entire. In the winter time the depth of snow prevents the houses and breathing-holes from being seen. One of the first operations of the hunter is to stop all the holes with the exception of one, at which he stations himself to spear the animals that have escaped being struck in their houses, and come hither to breathe. In the summer the Musquash burrows in the banks of the lakes, making branched canals many yards in extent, and forming its nest in a chamber at the extremity, in which the young are brought forth. When its house is attacked in the autumn it retreats to these passages, but in the spring they are frozen up. The Musquash is a watchful but not a very shy animal. It will come very near to a boat or canoe, but dives instantly on perceiving the flash of a gun. It may be frequently seen sitting on the shores of small muddy islands in a rounded form, and not easily to be distinguished from a piece of earth, until on the approach of danger it suddenly plunges into the water. In the act of diving, when surprised, it gives a smart blow to the water with its tail."

Sir John Richardson records three varieties besides that above described:—

1. The Black Musquash, rare.
2. The Pied Musquash, with dark blackish-brown patches on a white ground.
3. The White Musquash (*Fiber Zibethicus-albus*, Sabine). This albino is not unfrequent.

According to Hearne, the Musquash is easily tamed, soon becomes attached, and is cleanly and playful.

The fur is used in hat-making, and upwards of one million of skins are imported into this country every year.

ONION. [ALLIUM.]

ONISCIA. [ENTOMOSTOMATA.]

ONISCODA. [ISOPODA.]

ONISCUS. [ISOPODA.]

ONOBRY'CHIS (from *ὄνος*, an ass, and *βρύχω*, to gnash the teeth), a genus of Plants belonging to the natural order *Leguminosæ*. It has a calyx with 5 nearly equal subulate teeth; the keel obliquely truncate, longer than the wings; the pod 1-celled, compressed, indehiscent, 1-seeded, upper suture straight, lower curved, toothed, winged or crested. The species of this genus are natives of Europe or Asia, with unequally pinnate leaves, and axillary elongated pedicles having spikes of flowers red or white at their tops. The most common, as well as only British species is *O. sativa*, Common Sainfoin. [SAINFOIN, in ARTS AND SC. DIV.] About forty other species have been described, but none of them possess useful properties. Many are showy plants when in bloom, and are adapted for flower-borders or rockwork. They may be propagated by seeds. (Babington, *Manual of British Botany.*)

O'NONIS (from *ὄνος*, an ass, and *ὄνημι*, to delight, some of the species being said to be grateful to asses), a genus of Plants belonging to the natural order *Leguminosæ*. It has a 5-cleft campanulate calyx, narrow segments, the lower ones longer. The keel is beaked, the style filiform and ascending, the stigma terminal and subcapitate.

O. arvensis, Trailing Rest-Harrow, has a procumbent uniformly hairy stem, axillary stalked solitary flowers, broadly oblong leaflets, ovate pods shorter than the calyx. It is usually without spines. The stems root at their base, and the seeds are tubercular and scabrous.

O. antiquorum has an erect or ascending stem, bigariously hairy; axillary solitary stalked flowers, oblong leaflets, and ovate erect pods longer than the calyx. It is doubted by many botanists as to this being the true *O. antiquorum*. Koch and Reichenbach both describe quite a different plant, with smooth seeds.

O. reclinata has a viscid pubescent stem, axillary flowers with one-flowered pedicels shorter than the leaf-flower, a pod without bracts, the corolla about equal to the calyx, obovate cuneate leaflets serrated at the lip, ovate stipules, and cylindrical reflexed pods. It is found in sandy places in Galloway and the Channel Isles, and in the south of France by the sea coast.

There are 107 species of this genus described, but none of them are used in medicine or the arts. They are chiefly natives of Europe; about twelve species are found in Africa, and a few on the coast of Asia.

(Babington, *Manual of British Botany.*)

ONOPORDUM, a genus of Plants belonging to the natural order *Compositæ*. It has a honeycombed receptacle, a 4-ribbed fruit, and an imbricated involucre, with simple spinous pointed scales.

O. Acanthium, Cotton-Thistle, has an erect many-headed stem, elliptic oblong leaves, woolly on both sides; serrate, spinous, and decurrent; the outer involucral scales lanceolate, subulate, recurved, and spreading. The stem is from 4 to 5 feet high; woolly, with broad spinous wings; the involucre nearly globose, large, and somewhat cottony; the scales fringed with spinous teeth; the florets are purple. This plant is found on waste ground in Great Britain and Spain. Another name for the same species is Wild Artichoke, or Alcachofa of the Spaniards, on account of the fleshy receptacle being once cultivated as an esculent vegetable. The expressed juice of this plant is said by Eller to be a serviceable application to cancer of the breast, and to cleanse foul ulcers; and a decoction of the root, which is astringent, has been used to restrain discharges from the mucous membranes. The seeds are oleiferous; and M. Durand reports, as the result of experiments, that 22 lbs. of onopordum heads will yield 12 lbs. of seeds, from which 3 lbs. of oil fit for burning may be extracted by heat.

(Babington, *Manual of British Botany;* Burnett, *Outlines of Botany.*)

ONOSMA (from *ὄνος*, an ass, and *ὀσμή*, smell; grateful to the ass), a genus of Plants belonging to the natural order *Boraginaceæ*. It has a 5-parted calyx, a tubularly campanulate corolla, and a naked throat. The anthers are sagittate, and connected together by the bases of the lobes. The nuts are ovate, strong, and fixed to the bottom of the calyx, unperforated at the base. The species are small scabrous canescent plants, with crowded lanceolate or linear leaves, and terminal racemes of large yellow secund and usually drooping flowers.

O. Emodi has lanceolate triple-nerved leaves, less hairy beneath, terminal solitary racemes, linear bracts, not half so long as the flowers; the calyx is 5-cornered with ovate segments, a ventricose 5-keeled corolla contracted towards the mouth, and the anthers longer than the filaments. It is a native of Nepaul, in Gosaingsthan, where it is called by the natives Maharanga. The root is branched, of a dark purple colour, and is used in dyeing.

O. echinatum is a hispid plant, covered with white pungent hairs. It has terminal racemes and pedicellate flowers. The corolla is yellow, a little longer than the calyx, tubularly campanulate with reflexed teeth.

O. tinctorium is a native of Tauria, in the vicinity of the Bosporus. The root is simple, blackish, and covered with a red pigment, which stains paper a violet colour.

All the species of this genus, which exceed thirty in number, are extremely handsome when in blossom, but are not valuable on account of any peculiar properties. Most of them are natives of rocks and sandy places in Europe and Asia, and answer well to grow in rock-work or wall tops. They are short-lived, and apt to rot. They do well however in pots among other alpine plants.

(Don, *Dichlamydeous Plants.*)

ONYGENA, a genus of *Fungi* found on horny substances.

ONYX. [AGATE.]

OOLITE, the characteristic rock of one of the great systems of secondary strata. [GEOLOGY.] One of the purest examples of Oolite is the fine yellow freestone of Ketton in Northamptonshire, which is wholly composed of round grains of concretionary structure, adherent by their contiguous surfaces, so as to form a stone easily wrought with the chisel, and of a durable quality. The Bath free-stone is another example, where the grains (often hollow) are connected by interposed calcareous matter; the Portland stone resembles the former, but contains disseminated or aggregated silex; and not to extend the catalogue, much of the Lincolnshire freestone is Oolite, of which the round grains are firmly compacted in a general basis of crystallised carbonate of lime. The resemblance of the grains to small ova, or the roe of fishes, has given origin to the English term Oolite (from the Greek ὠόν, an egg), and the German Rogenstein, or roestone.

Limestones possessing the oolitic character occur in different parts of the series of strata, but nowhere very abundantly except between the lias and the greensands. Specimens may be found in the mountain-limestone at Clifton, Kirkby Lonsdale, &c., and in the magnesian limestone of Yorkshire and Derbyshire; and in this latter case the grains, large and distinct, show obviously the concentric lamination which belongs to certain oolites called Pisolites, and which may be detected in nearly all with the aid of the microscope.

At one time it was supposed that the little round masses which are so characteristic of this formation were portions of limestone which had gathered round various forms of minute fossil animals. It was suggested that these organisms were probably *Foraminifera*. Recent microscopic investigations have however shown that these little round bodies are purely inorganic, and that they are formed in the same manner as the larger nodules of the magnesian limestone. [MAGNESIAN LIMESTONE.]

The oolitic deposits are divided naturally in England into three parts, the Upper Oolite resting on the Kimmeridge Clay, the Middle Oolite representing the Oxford Clay covered by the Coral Rag, while the Lower Oolite is more varied, being composed of numerous bands of clay, sand, and limestone.

The *Upper Oolites*, called on the continent the Portlandian Group, are, so far as the British Islands are concerned, almost entirely confined in their development to the south of England, only that stratum of clay which usually forms the base of the group being exhibited in Yorkshire, in the vale of Pickering.

The group of strata containing the Portland stone, and exhibited in Portland Island, includes several layers of coarse earthy limestone, which rest on a bed of siliceous sand, mixed with green particles. This is called the Portland Sand, and sometimes attains a thickness of as much as 80 feet in the west of the island, and forms a complete passage into the underlying clay.

Above the coarse limestones of the lower part, which usually consist of alternate hard and soft layers to a thickness of 50 or 60 feet, there are three beds of serviceable stone, interstratified with clayey or siliceous bands. Fossils occur in all these strata; but they are rare in those beds of the stone which are worked to advantage for economical purposes.

In the upper part of the Portland series there occurs a very interesting bed, about a foot in thickness, of a dark-brown substance, containing much earthy lignite. This bed, called the Dirt-Bed, seems to be made up of black loam, which at some distant period nourished the roots of trees, fragments of whose stems are now found fossilised around it. Wherever the dirt-bed is laid open to extract the subjacent building-stone these remains of trees occur, and they are placed at such distances from one another as trees growing in a modern forest.

It results from the circumstances of this deposit, that the surface of the Portland stone, at the termination of the Oolitic period, must have been for some time dry land, and covered with a forest; and we have a kind of measure even of the duration of this period in the thickness of the dirt-bed, which has accumulated more than a foot of black earth, loaded with the wreck of its former vegetation. "The regular and uniform preservation also of this thin bed over a distance of so many miles, shows that the change from dry land to the state of a fresh-water lake or estuary (which the nature of the overlying rock proves to have succeeded the period of dry land) was not accompanied by any violent denudation or rush of water, since the loose earth, together with the trees which lay prostrate on its surface, must inevitably have been swept away had any such violent catastrophe then taken place."

The *Kimmeridge Clay* is of a blue, slaty, or grayish-yellow colour. It frequently contains a considerable quantity of selenite, or crystallised sulphate of lime. It usually effervesces with acids, and exhibits in tolerable abundance both vegetable and animal impressions, although its fossils are rarely in such good condition as to be preservable in a collection. It is a bed of great thickness; horizontal, or nearly so, in its stratification; extremely persistent in its peculiar mineral and fossil characters, but not very extensively developed either in England or on the continent. The name, Kimmeridge Clay, has been applied to it because it is well exhibited at Kimmeridge Bay, and near the village bearing the same name in the Isle of Purbeck.

At this spot there are also found, alternating with the clay, certain beds of highly bituminous shale, occasionally used for fuel, and locally known as the Kimmeridge Coal. There are many beds of lignite found in the Oolites, but these are perhaps the most remarkable, next to those of the lowest Oolitic deposits of Yorkshire and North America.

Among the foreign rocks of this part of the oolitic period are—1st, the Calcaire de Blangy, on the coast of Normandy; 2nd, the upper beds of the Jura, in Switzerland; and 3rd, the Solenhofen beds.

On the banks of the Donetz, in southern Russia, there are beds of Oolitic Limestone of light-yellow colour, which appear to belong to this division of the secondary series.

The *Middle Oolites* consist for the most part of a thick bed of clay, called the *Oxford Clay*, widely expanded throughout England, and met with also in the same form on the Continent, and a series of overlying limestones, chiefly remarkable for the abundant remains of coral found in them.

The upper beds of the Middle Oolitic Series are partly calcareous and partly sandy, the former consisting chiefly of a very interesting group of corals known under the name of Coral-Rag, and the latter, the sandy beds, or calcareous grits, often more or less intermixed with calcareous matter, and containing thin laminæ of clay sometimes passing into irregular bands of hard and tough marly rock. This calcareous matter seems entirely due to the presence of crushed and decomposed organic remains.

It is chiefly in Wiltshire, near the towns of Calne and Steeple Ashton, and in the surrounding neighbourhood, that the corals of the Coral-Rag are found in greater abundance and perfection; and this part of our island, at the time of the deposit, has clearly existed in the condition of a coral island in an open sea. The thickness of the bed is about 40 feet; large portions of it are frequently made up of the remains of a single species, and an earthy calcareous freestone, sometimes used as a building-stone, and full of fragments of shells, rests immediately upon it, and is surmounted by a fine-grained ferruginous sandstone, slightly oolitic in structure, and containing a few fossils, marking the close of the Middle Oolitic period.

In the north of England the contemporaneous bed is a calcareous deposit, also containing corals, but (as at Malton, in Yorkshire) including a considerable proportion of the fossil remains of shells, both bivalves and univalves. The bed never loses its coralline character, and may perhaps represent an imperfect coral reef, once extending from the south-west of England to what is now the right bank of the Humber.

The *Oxford Clay* is a very important member of the oolitic series, attaining a thickness of not less than 500 feet, and spreading over a great part of England—more especially occupying the fen-districts in the counties of Cambridge and Lincoln, which appear to be partly caused by the union of this bed with the Kimmeridge Clay, producing a wide expanse of flat and undrained country. The same deposits are well seen at Weymouth; and they cover an important part of the East Riding of Yorkshire. The stratification throughout is nearly horizontal and undisturbed, being conformable with that of the formations immediately above and below it.

The appearance of the Oxford Clay is that of a stiff pale-blue argillaceous bed, containing a large proportion of calcareous matter, and a more or less abundant mixture of iron pyrites. Numerous organic remains are found in it, which are sometimes preserved in the clay itself, but more frequently form a nucleus, about which iron pyrites have aggregated. Those preserved in the clay have been generally found in a very rotten condition.

The *Lower Oolites* admit of considerable subdivision in the British Islands, but the details seem to be rather of local than general interest; and though partially extending to Normandy, are by no means universal in other parts of Europe. [GEOLOGY.]

1. The Cornbrash (the uppermost bed) consists of a variable thickness of clays and sandstones, which ultimately pass into a thin rubbly stone, tough and occasionally crystalline.

2. The Forest Marble, which consists of carbonate of lime.

3. The Great Oolite, consisting of a variable series of coarse shelly limestones.

4. The Bradford Clay, consisting of a pale-greenish clay, containing a small proportion of calcareous matter and inclosing thin slabs of tough brownish limestone.

5. The Great Oolite is separated from the next bed, containing amongst them the clay used in the manufacture of cloth under the name of Fuller's Earth, and also a thin calcareous flag-stone known as the Stonesfield Slate. The latter is remarkable for containing the remains of Marsupiate Animals. [MARSUPIATA.]

6. The Inferior Oolite is the last of the series of oolitic limestones. It is employed to a great extent as a building material. Its representative in France is the Caen Limestone.

The oolitic system embraces also the formation called Lias. In England it consists of a series of strata in which an argillaceous character predominates throughout; it also contains limestone mixed with clay. It seems to form four principal members, which are thus described by Professor Ansted.

"The Upper Lias, or Alum-Shale, is best seen at Whitby, and on the Yorkshire coast, and it attains there a considerable thickness. It consists of three distinct parts: the lower division including soft shales, extremely fossiliferous, which are separated from the uppermost series, also composed of incoherent slaty beds, by an intermediate stratum of hard shale, about 30 feet thick, containing a quantity of the mineral called jet, and also occasionally large fragments of the bitumenised wood of coniferous trees. The jet itself is but a peculiar form of carbon, and there can be little doubt that it is of organic origin. It is in the upper shales of the lias, both on the coast of Yorkshire and at Lyme Regis, that there have been found the most remarkable and interesting of those fossil remains of extinct animals, for which the formation is so celebrated. The presence of alternate bands of tolerably hard limestone and soft shale is usually characteristic of the lias in the different parts of England where it is most developed. The dark bluish-gray colour, united with the singular riband-like structure, is more particularly remarkable in the upper beds of the formation, and is well seen at Lyme Regis, Whitby, and Barrow-upon-Soar, in Leicestershire.

"The principal locality of the middle beds of the lias is the neighbourhood of Cheltenham, where the marlstone of Dumbleton Hill is crowded with interesting organic remains. It is made up of alternating layers of coloured clays and sands, which are occasionally calcareous, and of beds of impure limestone.

"This part of the series is also represented in the north of England, where it has an average thickness of about 130 feet, and consists of sandy shales, of which the upper portions are distinguished by the presence of several bands of argillaceous irony nodules.

"Lower Lias Shale.—The great mass of the lower division of the Lias is found in the middle of England, and consists of thick beds of dark coloured and finely laminated shale, in which are calcareous bands and concretions. These form the base of the series, and graduate downwards into a whitish sandstone, belonging to the uppermost beds of the New Red-Sandstone system. The transition is different again in the south of England; and at Lyme Regis marls of a light-bluish colour represent the upper beds of the New Red-Sandstone and pass into the Lias Limestone by a succession of dark slaty marls, which are overlaid by a number of gray calcareous beds, and these again by other slaty marls of the upper series. The Marlstone and Upper Lias Shales are not present in this part of the deposit in their ordinary form.

"The lowest portion of the Liassic System occasionally consists of a very thin bed, in some places entirely made up of the fragments of fossil bodies (chiefly the remains of fish), but sometimes passing into a white micaceous sandstone, still recognisable as the same bed. This bed was first observed underlying a small patch of Lias, near the town of Aust (situated on the left bank of the Severn, nearly opposite the mouth of the Wye); but it has since been recognised at Axmouth, in Devonshire, and in other parts of England farther north, having a total range of upwards of 100 miles. It is rarely more than 2 or 3 inches in thickness, but invariably occupies the same geological position, and is for the most part so exclusively composed of organic remains, that a long period must have been required for its formation. In some parts of the country, and especially in Gloucestershire and Worcestershire, the passage of the Lias into the underlying beds of New Red-Sandstone is marked by the presence of calcareous flagstones, called Lower Lias Limestones; and these usually alternate with laminated shales, the whole in that case forming together the lowest deposits of Lias.

"On the Continent the Lias is frequently found, and the upper beds resemble those developed in England; the middle however are usually more calcareous, and the lower more sandy, and these latter sometimes, as in Belgium, pass insensibly into the upper New Red-Sandstone. The town of Luxemburg is built upon a hard sandstone of this kind, and these beds pass into the rock called Arkose, a peculiar and often metalliferous metamorphosed deposit, occurring where the Lias sands come in contact with crystalline rocks. Fossils have been found in South America, and also in Northern India, attributed to the period we are now considering.

"The Lias is a formation exceedingly rich in fossils; and amongst them are representatives of all the principal natural groups. Corals however are exceedingly rare, and of small size. Encrinites are numerous and abundant, especially the Pentacrinite, which attached itself to floating wood. Radiated animals of other kinds characterise parts of the deposits, and of these the *Diadema* is an example. Insects and Crustaceans have been frequently found. Star-Fishes are common in the marlstone.

"Both univalve and bivalve shells of various kinds are characteristic either of the whole deposit or of different beds. The *Spirifer* is one of the later species of a genus represented far more abundantly in more ancient deposits, while the *Plicatula* and *Plagiostoma* are among the ancient representatives of more recent forms. The *Pecten* is an example of a similar kind; and the *Ammonite* and *Belemnite* are eminently characteristic cephalopodous shells, infinitely abundant during the Lias, and scarcely less so for a great part of the oolitic period. Above 170 species of *Mollusca* have been described from the British localities only, of which as many as 70 are Ammonites.

"Fishes' remains are common in some parts of the Lias, and as many as 60 species in all have been described; of these many resemble the shark, but none seem to have attained very gigantic proportions. This however was not the case with the Reptiles, which during the period in question, were equally remarkable for their large size, voracious habits, and incredible abundance. Many species belonging to natural orders of these animals long since lost, were then widely dispersed; and many other species existed of genera now common in distant parts of the world. The Flying Reptile [PTERODACTYL] is a striking instance of anomalous structure. The swimming and indeed strictly marine monsters named *Ichthyosaurus* and *Plesiosaurus*, are other examples." [ICHTHYOSAURUS; PLESIOSAURUS.]

The following is a list of the Fossil Genera found in the Oolitic Beds:—

Plantæ.

Alethopteris, 2 species.
Araucarites peregrinus, Presl.
Bensonia ovata, Buck.
Brachyphyllum mammillare, Lindl.
Bucklandia squamosa, Brong.
Carpolithes, 3 species.
Cyclopteris, 2 species.
Dictyophyllum rugosum, Lindl.
Equisetites, 2 species.
Lilia lanceolata, Buckm.
Lycopodites, 2 species.
Naiadea, 2 species.
Neuropteris recentior, Lindl.
Otopteris, 2 species.
Pachypteris, 2 species.
Pecopteris, 11 species.
Peuce, 2 species.
Phlebopteris, 2 species.
Polypodites, 2 species.
Polystichites Murrayana, Presl.
Pterophyllum, 4 species.
Salicites longifolius, Buckm.
Solenites, 2 species.
Sphæreda paradoxa, Lindl.
Sphænopteris, 6 species.
Sphærococcites, 2 species.
Stricklandia acuminata, Buckm.
Strobilites elongata, Lindl.
Tæniopteris, 3 species.
Thuytes, 4 species.
Tympanophora, 2 species.
Zamites, 6 species.

Amorphozoa.

Spongia, 7 species.

Zoophyta.

Alecto dichotoma, Lamx.
Aspendesia cristata, Lamx.
Agaricia lobata, Goldf.
Astrea, 5 species.
Caryophyllia, 2 species.
Ceriopora clavata, Goldf.
Chrysaora, 2 species.
Cricopora, 2 species.
Diastopora, 3 species.
Eunomia radiata, Lamx.
Fungia orbulites, Lamx.
Heteropora, 2 species.
Idmonea triquetra, Lamx.
Intricaria Bajocensis, Bronn.
Lithodendron elegans, Goldf.
Madrepora limbata, Goldf.
Meandrina Soemmeringii, Goldf.
Millepora, 2 species.
Montlivaltia caryophyllata, Lam.
Terebellaria ramosissima, Lamx.
Theonoa clathrata, Lamx.
Turbinolia dispar, Phil.

Echinodermata. [ECHINODERMATA.]

Annelida.

Serpula, 17 species.
Vermilia sulcata, Sow.
Vermicularia, 5 species.

Cirripedia.

Pollicipes, 3 species.

Insecta. [INSECTA.]

Crustacea.

Astacus, 4 species.

Conchifera Monomyaria.

Amphidesma, 3 species.
Anatina undulata, Sow. sp.
Arca, 9 species.
Astarte, 16 species.
Cardinia, 12 species.
Cardium, 12 species.
Corbis, 3 species.
Corbula, 4 species.
Cucullæa, 14 species.
Cypricardia solida, Lycett.
Cytherea, 2 species.
Gastrochæna tortuosa, Sow.
Gresslya Anglica, Ag.
Hippopodium ponderosum, Sow.
Isocardia, 11 species.
Lucina, 4 species.
Lutraria, 5 species.
Lysianassa, 4 species.
Mactromya Cardioides, Phil. sp.
Modiola, 17 species.
Mya, 3 species.
Myoconcha crassa, Sow.
Mytilus, 4 species.
Nucula, 11 species.
Opis, 2 species.
Panopæa, 3 species.
Pectunculus, 2 species.
Pholadomya, 19 species.
Pholas, 2 species.
Pinna, 8 species.
Psammobia lævigata, Phil.
Pullastra (?), 4 species.

Conchifera Monomyaria.

Sphæra Madridi (*Cardium*), Arch.
Sanguinolaria, 8 species.
Tellina ampliata, Phil.
Thetis varicosa (*Venus*), Sow.
Thracia depressa, Sow. sp.
Trigonia, 13 species.
Unio distortus, Bean.
Venus Nuculæformis, Roemer.

Monomyaria.

Anomia, 2 species.
Avicula, 16 species.
Crenatula, 2 species.
Gervillia, 10 species.
Gryphæa, 14 species.
Inoceramus, 3 species.
Lima, 6 species.
Limea duplicata, Goldf.
Monotis decussata, Munst.
Ostrea, 19 species.
Pecten, 31 species.
Perna, 2 species.
Plagiostoma, 16 species.
Plicatula, 3 species.
Spondylus comptus, Goldf.

Brachiopoda.

Crania antiquior, Jelly.
Lingula Beani, Phil.
Orbicula, 4 species.
Spirifer, 5 species.
Terebratula, 43 species.

Gasteropoda.

Actæon, 2 species.
Buccinum, 4 species.
Bulla (?), 3 species.
Cirrus, 5 species.
Dentalium, 3 species.
Delphinula coronata, Flem.
Emarginula, 2 species.
Littorina, 4 species.
Murex Haccanensis, Phil.
Natica, 10 species.
Nerinæa, 6 species.
Nerita, 5 species.
Patella, 5 species.
Phasianella cincta, Phil.
Pileolus, 2 species.
Pleurotomaria, 11 species.
Rimula clathrata, Sow. sp.
Rissoa, 4 species.
Rostellaria, 3 species.
Rotella, 4 species.
Solarium calyx, Phil.
Terebra, 8 species.
Trochotoma sulcata, Lycett.
Trochus, 10 species.
Turbo, 4 species.
Turritella, 2 species.

Cephalopoda. [CEPHALOPODA.]

Pisces. [FISH.]

(Ansted, *Elementary Geology*; Tennant, *Stratigraphical List of British Fossils*).

OOLITIC SYSTEM. [OOLITE.]

OPAL. Of this mineral, which is essentially a hydrate of silica, there are mentioned by Mr. Brooke, in the 'Encyclopædia Metropolitana,' eleven varieties, and nearly as many are described by Phillips.

Precious Opal, or *Noble Opal*.—This mineral is white, bluish, or yellowish-white, and exhibits a beautiful variety or play of colours, as blue, green, yellow, and red, several of which appear together. Fracture conchoidal, with a vitreous or resinous lustre; it is easily broken, but scratches glass. Specific gravity 2·06 to 2·09. Infusible by the blow-pipe, but becomes opaque and loses water. The most beautiful specimens occur in Hungary, but it has also been found in Saxony, South America, &c. Analysis of the Hungarian opal by Klaproth:—

Silica	90
Water	10
	—100

Fire-Opal.—In this the internal reflection is bright red. It occurs with the Precious Opal in Hungary, and has also been found in Cornwall.

Hydrophane.—It is usually opaque, but is rendered transparent, and exhibits the iridescent colours of the Precious Opal by immersion in water. According to Klaproth it contains a little alumina in addition to silica and water.

Common Opal.—This is of various shades of colour, as white, green, yellow, and red; but is entirely destitute of the play of colours exhibited by the Noble Opal. In other properties they greatly resemble each other. It is stated to contain a little oxide of iron mixed with the silica and water. It is found chiefly in Hungary and Saxony, but specimens have also been discovered in Cornwall.

Semi-Opal.—This is more opaque than the Common Opal, and is dull. It occurs either white, gray, yellow, brown, or green. It is found in the same places as the foregoing.

Wood-Opal, so called from its showing the woody structure. It occurs of several tints of white, gray, brown, and black. It is generally harder than the Semi-Opal, but does not materially differ from it in other properties. It occurs in Hungary and in Transylvania.

Cacholong is white opaque opal; harder than the Common Opal; dull; brittle; fracture flat conchoidal. Specific gravity 2·2. Infusible before the blow-pipe. It is found on the banks of the river Cach in Bucharia, in loose masses. It occurs also in the Faroe Islands, Greenland, and Iceland.

Opal Jasper, Ferruginous Opal.—Opaque, or but feebly transparent on the edges. Colour generally deep shades of red, yellow, and gray. Fracture flat conchoidal. It appears to be a silicate of iron with water. It occurs in Hungary, Siberia, &c. Klaproth's analysis of a variety from Telkebanya gave—

Silica	43·5
Oxide of Iron	47·0
Water	7·5
	—98·0

Menilite.—It occurs in irregular or reniform masses. Colour usually smoke-brown. Opaque, or slightly translucent. It occurs at Menil-Montant, and St. Ouen near Paris, in beds of adhesive slate. According to Klaproth it consists of—

Silica	85·5
Alumina	1·0
Water, Inflammable Matter, and traces of Lime and Iron	11·0
	—97·5

Hyalite, Muller's Glass.—It occurs in small globular and botryoidal forms. Lustre vitreous. Brittle, but scratches glass. Specific gravity about 2·4. Infusible by the blow-pipe. It occurs in amygdaloid, near Frankfurt-on-the-Maine, in Hungary, &c. According to Bucholz it consists of—

Silica, with a trace of Alumina	92·0
Water	6·3
	—98·3

Geyserite, Siliceous Sinter.—This mineral is white, or yellowish or grayish-white. Brittle. Specific gravity about 1·807. Infusible per se by the blow-pipe. It is deposited by the hot-springs of Iceland and elsewhere. According to Klaproth it consists of—

Silica	98·0
Alumina	1·5
Iron	·5
	—100

OPEN-BEAK. [HIANS.]

OPERCULIFERA, one of the families of *Polypiaria Membranacea* of De Blainville, also called *Escharieæ*.

OPER'CULUM (Malacology), the plates or pieces which protect the apertures or exposed parts of certain Molluscs. In many of the Testaceous Gastropods it becomes a cover or door, which fits the aperture of the shell more or less accurately when the animal has retired within it. Opercula of this kind vary much in structure and shape. Thus they are sometimes horny, as in *Trochus* and *Murex*; sometimes shelly, nay almost stony, as in *Turbo*; and in construction they are for the most part either spiral, concentric, or unguiculated.

In Botany this term is chiefly used for the cap which forms the upper extremity of the theca, or sporangium, of a moss, covering over the peristome, and usually falling off when the spores are ready for dispersion. It has also been applied to the lid which covers in the Pitcher of *Nepenthes*, where it is the lobe of a modified leaf.

OPHIDIA, an order of Reptiles without feet, and consequently, as Cuvier observes, more deserving the name of Reptiles than any other order.

According to Cuvier, the order *Ophidia* consists of the genus *Anguis* [BLINDWORM], of True Serpents, and Naked Serpents. Cuvier's second family, or that of the True Serpents, comprehends the genera which have no sternum nor any vestige of a shoulder-blade, but whose ribs still embrace a great part of the circumference of the trunk, and the body of whose vertebræ are also articulated by means of a convex surface which is received into a socket or concavity of that vertebra which succeeds it. They want the third eyelid and the tympanum; but the ossiculum auditûs exists under the skin, and its shaft or handle (so to speak) passes behind the tympanic bone. Many have vestiges of a posterior member under the skin, and the extremity of this rudiment of a limb shows itself externally in the form of a small hook. [BOIDÆ.]

Those serpents to which the names of Doubles Marcheurs, or *Amphisbænidæ* [AMPHISBÆNA; TYPHLOPS], have been given, have the lower jaw carried, as in the Tortoises [CHELONIA] and Lizards [SAURIA], by a tympanic bone which is articulated directly with the cranium, the two branches of that jaw soldered anteriorly, and those of the upper jaw fixed to the cranium and the intermaxillary bone, so that their mouth cannot be dilated, as in Cuvier's next tribe (the Serpents properly so called), and their head is of uniform size with their body; a form and structure which enable them to make progress equally well in both directions, head or tail foremost. The bony frame of the orbit is incomplete backwards, and their eye is very small. Their body is covered with scales, the anus very near its extremity, the trachea long, and the heart placed very far backwards. Of this tribe no venomous species are known.

The Serpents, properly so called, have the tympanic bone, or pedicle of the lower jaw, moveable, and nearly always suspended to another bone analogous to the mastoidian, attached to the cranium by muscles and ligaments which permit its mobility: the branches of this jaw are not united to each other except by ligaments, nor are those of the upper jaw united to the intermaxillary bone in any other manner, so that they can be more or less separated; a conformation which gives these animals the power of dilating their mouth to such an extent as to enable them to swallow bodies larger than themselves. Their palatine arches participate in this mobility, and are armed with pointed teeth curved backwards—the most marked and constant character of this tribe. Their trachea is very long; their heart situated very far

backwards; and the greater number have only one very long lung, with the vestige of a second. These serpents, says Cuvier, in continuation, are divided into venomous and non-venomous; and the former are subdivided into venomous with many maxillary teeth, and venomous with isolated fangs. In the non-venomous, the branches of the upper jaws are furnished throughout their length, as well as those of the lower jaw and of the palatine branches, with fixed teeth which are not pierced: there are therefore four nearly equal rows of these teeth in the upper part of the mouth, and two in the lower. [BOIDÆ.] Those which have the mastoidian bones comprised in the cranium, the orbit incomplete backwards, and the tongue thick and short, much resemble the *Amphisbænidæ* in the cylindrical form of their head and body, and have, Cuvier observes, been united to the Orvets [ORVET], in consequence of the smallness of their scales.

The Venomous Serpents with isolated fangs present a very peculiar structure in their organs of manducation. Their superior maxillary bones are very small, carried on a long pedicle analogous to the external pterygoid apophysis of the sphenoid bone, and very moveable: here is fixed a pointed tooth, pierced with a small canal which gives issue to a liquor secreted by a considerable gland situated under the eye. It is this liquor which, when shed into the wound made by the bite of the serpent, carries havock into the body of the wounded animal, and produces effects more or less fatal according to the species which has inflicted the wound. This fang is concealed in a fold of the gum when the serpent does not wish to use it; and there are behind it many germs destined to fix themselves in their turn, in order to replace it if it should be broken in the wound it makes. Naturalists, Cuvier remarks, have named these teeth crochets mobiles, or moveable fangs; but it is, properly speaking, the maxillary bone that moves: that bone carries no other teeth, so that, in the Venomous Serpents, only two rows of palatine teeth are seen in the roof of the mouth. All the venomous species bring forth their young alive, in consequence of the egg being hatched internally before it is laid, whence their general name of Vipers, a contraction of *Vivipares*.

These deadly serpents with isolated fangs, though they present external characters of the same nature as the preceding group, have, the greater number of them at least, very dilatable jaws and a very extensible tongue. Their head, wide behind, has generally a ferocious aspect, which announces in some degree their malevolent nature. [VIPERIDÆ.]

A third tribe has the jaws organised and armed nearly as in the Non-Venomous Serpents, but the species have the first of their maxillary teeth greater than the others, and pierced so as to conduct the venom in the same manner as is effected in the Venomous Serpents with isolated fangs. Such are the *Bungari* and *Hydri*. [HYDRIDÆ; NAIA.]

The serpents, with one exception (*Deirodon*, to which we shall presently more particularly call attention), subsist on living prey; and, whether non-venomous or venomous, have their teeth, as might be expected, admirably constructed and arranged for the purpose of securing their prey and assisting in deglutition.

Professor Owen, in his valuable and copiously-illustrated 'Odontography,' observes that the order *Ophidia*, as it is characterised in the system of Cuvier, requires to be divided into two sections according to the nature of the food and the consequent modification of the jaws and teeth. Certain species, he observes, which subsist on worms, insects, and other small invertebrate animals, have the tympanic pedicle of the lower jaw immediately and immoveably articulated to the walls of the cranium; the lateral branches of the lower jaw are fixed together at the symphysis, and are opposed by the usual vertical movement to a similarly complete maxillary arch above: these, as we have above seen, belong to the genera *Amphisbæna* and *Anguis*, Linn. The rest of the Ophidians, observes the Professor, which form the typical members, and by far the greatest proportion of the order, prey upon living animals, frequently of much greater diameter than their own; and the maxillary apparatus is, as we have also above seen, conformably and peculiarly modified to permit of the requisite distension of the soft parts surrounding the mouth and the transmission of the prey to the digestive cavity.

But the mechanism by means of which this distension is accomplished, and which is in fact a dislocation of adapted parts which return to their original positions when the act of deglutition is accomplished, requires, to be well understood, a more particular description than the general account above given, and we proceed to that presented by Professor Owen, as the best and clearest known to us.

The two superior maxillary bones have, he observes, their anterior extremities joined by an elastic and yielding fibrous tissue with the small and single intermaxillary bone: the symphysial extremities of the lower maxillary rami are connected together by a similar tissue, allowing of a still wider lateral separation. The opposite or posterior extremity of each ramus is articulated to a long and moveable vertical pedicle formed by the tympanic or quadrate bone, which is itself attached to the extremity of a horizontal pedicle formed by the mastoid bone, so connected as also to allow of a certain yielding movement upon the cranium. The palatine and pterygoid bones have similarly loose and moveable articulations, and concur with the other dentigerous bones of the mouth in yielding to the pressure of large bodies with which the teeth may have grappled.

Professor Owen first describes the dental peculiarities of the true serpents, which, as he remarks, swallow their food whole, whether they prey on living animals, as is the case in almost every species, or feed on the eggs of birds, as does *Deirodon scaber*, Owen (*Coluber scaber*, Linn.) With the exception of this and some congeneric species, in which the teeth of the ordinary bones of the mouth are so minute as to have been deemed wanting, the maxillary and premandibular bones in all true Ophidians are, he observes, formidably armed with sharp pointed teeth; there is on each side of the palate a row of similar teeth supported by the palatine and pterygoid bones: in the great Pythons and some species of *Boa*, he adds, the intermaxillary bone also supports teeth. But whatever be their position, all the teeth, according to the Professor, present a simple conical form, the cone being long, slender, and terminated by an acute apex, and the tooth is either straight, or more commonly bent a little beyond the base, or simply recurved, or with a slight sigmoid inflection. Thus the teeth are adapted for piercing, tearing, and holding, not for dividing or bruising. Certain teeth in some species are traversed by a longitudinal groove, as above noticed, for conveying an acrid saliva into the wounds which they inflict; in others, two or more teeth are longitudinally perforated for transmitting venom. These poison-fangs, he remarks, are always confined to the superior maxillaries, as we have already stated, and are generally placed near the anterior extremity of those bones.

Professor Owen notices in the first instance the serpents whose teeth are all simple and solid, where the pulp which occupies the basal cavity is calcified.

After this the teeth of the poisonous serpents are described, and Professor Owen calls attention to the fact that in certain genera of non-venomous serpents, as in *Dryophis*, *Dipsas*, and *Bucephalus*, in which the superior maxillary teeth increase in size towards the posterior part of the bone, the large terminal teeth of the series are traversed along their anterior and convex side by a longitudinal groove. In the *Bucephalus Capensis* the two or three posterior maxillary teeth present this structure, and are much larger than the anterior teeth or those of the palatine or premandibular series; they add materially therefore, he observes, to the power of retaining the prey, and may conduct into the wounds which they inflict an acrid saliva, but they are not in connection with the duct of an express poison-gland. The long grooved fangs are either firmly fixed to the maxillary bones, or are slightly moveable, according to their period of growth; they are concealed by a sheath of thick and soft gum, and their points are directed backwards. The sheath also contains loose recumbent grooved teeth, ready to succeed those in place.

In most of the Colubers each maxillary and premandibular bone includes from 20 to 25 teeth: they are less numerous in the genera *Tortrix* and *Homalopsis*, and are reduced to a still smaller number in the poisonous serpents, in the typical genera of which the short maxillary bone supports only a single perforated fang.

The transition to the poisonous serpents, which was begun in the *Bucephali* and allied genera with grooved maxillary teeth, is, according to Professor Owen, completed by the poisonous serpents of the genera *Pelamys*, *Hydrophis*, *Elaps*, *Bungarus*, and *Hamadryas*, which latter genus, as its cervical integument can be expanded into a hood, constitutes an immediate link between the *Bungarus* and *Naja*.

The structure of the venom-fangs of serpents, and the machinery by which their deadly agency is brought to bear against those who are so unfortunate as to be the objects of their attacks, are so interesting, that we subjoin the following remarks in the author's own words:—

"The superior maxillary bone diminishes in length with the decreasing number of teeth which it supports. The transverse or external pterygoid bone elongates in the same ratio, so as to retain its position as an abutment against the shortened maxillary, and the muscles implanted into this external pterygoid style communicate through it to the maxillary bone the hinge-like movements backwards and forwards upon the ginglymoid articulations, connecting that bone with the anterior frontal and palatine bones. As the fully-developed poison-fangs are attached by the same firm basal anchylosis to shallow maxillary sockets, which forms the characteristic mode of attachment of the simple or solid teeth, they necessarily follow all the movements of the superior maxillary bone; when the external pterygoid is retracted, the superior maxillary rotates backwards, and the poison-fang is concealed in the lax mucous gum, with its point turned backwards: when the muscles draw forward the external pterygoid, the superior maxillary bone is pushed forwards, and the recumbent fang withdrawn from its concealment and erected.

"In this power of changing the direction of a large tooth, so that it may not impede the passage of food through the mouth, we may perceive an analogy between the Viper and the Lophius; but in the fish the movement is confined to the tooth alone, and is dependent on the mere physical property of the elastic medium of attachment. In the serpent the tooth has no independent motion, but rotates with the jaw, whose movements are governed by muscular actions. In the fish the great teeth are erect, except when pressed down by some extraneous force; in the serpent the habitual position of the fang is the recumbent one, and its erection takes place only when the envenomed blow is to be struck.

"The peculiar structure of the poison-fang was first described by

Fontana, as it exists in the Viper, and subsequently received additional elucidation by Mr. Smith's careful examinations of the fangs of the *Hydrus*, *Naja*, and *Crotalus*, and by Mr. Clift's illustrative drawings appended to Mr. Smith's paper. A true idea of the structure of a poison-fang will be formed by supposing the crown of a simple tooth, as that of a *Boa*, to be pressed flat, and its edges to be then bent towards each other, and soldered together so as to form a hollow cylinder open at both ends. The flattening of the fang, and its inflection around the poison-duct, commence immediately above the base, and the suture of the inflected margins runs along the anterior and convex side of the recurved fang; the poison-canal is thus in front of the pulp-cavity. The basal aperture of the poison-canal is oblique, and its opposite outlet is still more so, presenting the form of a narrow elliptical longitudinal fissure, terminating at a short distance from the apex of the fang.

"The character most commonly adduced from the dental system, as distinguishing the venomous from the non-venomous serpents, is, that the former have two, the latter four, rows of teeth in the upper jaw; the two outer or maxillary rows being wanting in the venomous species, and their place being supplied by the single poison-fang. The exceptions to this rule are however too numerous for its value as a distinguishing character in a question of such practical moment as the venomous or non-venomous properties of a serpent. In all the family of Marine Serpents the poison-fang is only the foremost of a row of fixed maxillary teeth. In the *Hydrophis striatus* there are four teeth, and in *Hydrophis schistosa* five teeth, behind the venom-fang, of rather smaller size than it; the Two-Coloured Sea-Snake (*Pelamys bicolor*) has also five maxillary teeth in addition to the perforated one. The poison-fang in this genus is relatively smaller than in the venomous serpents of the land, but presents the same peculiar structure. The poison-gland presents a correspondingly small development; it is pyriform, and its structure, according to Dr. Cantor ('Zool. Trans.,' vol. ii. p. 304), is minutely cellular; it is covered by the aponeurotic expansion of the articulo-maxillaris, and transmits a straight duct horizontally to the basal opening of the venom-fang. It is a curious fact that the smaller non-venomous teeth of the poisonous serpents all present a trace of the structure of the functional venom-fang, being more or less deeply grooved along the convex anterior side; and in the *Hydrus* this groove commences by a depression analogous to the oblique basal aperture of the poison-canal in the true fang.

"The colubriform poisonous serpents of the land have comparatively short venom-fangs, but they are larger than those of the pelagic serpents; and behind the venom-fangs there are likewise some smaller grooved teeth in the maxillary bones; there are three such teeth in the *Bungarus Pama*, and five in the *Bungarus annulatus*. In the *Hamadryas*, or Great Hooded Poisonous Tree-Snake of India, the venom-fang is relatively as large as in typical poisonous serpents, but three or four smaller grooved teeth are implanted behind it on the maxillary bone.

"In the most deadly venom-snakes, as the Viper (*Berus*), the Puff-Adder (*Vipera*), the Asps or Hooded Snakes (*Naja*), the Rattle-Snakes (*Crotalus*), and the Cophias and Fer-de-Lance (*Trigonocephalus*), the poison-fangs acquire their largest size, and are associated only with their successors. These are clustered in greater or less number behind them, presenting the same structure, but of a size proportionate to their degree of development, and further differing in being loosely imbedded in the thick and wide mucous gum, which likewise conceals the fixed and functional fang in its ordinary position of retraction and repose. This fang is more strongly curved backwards than the ordinary teeth, but its acute and slender apex is frequently bent slightly in the contrary direction, as in the Rattle-Snake.

"The mechanism by which the short maxillary bone and the poison-fang are rotated backwards and forwards upon the ginglymoid joint that connects the maxillary with the præfrontal and palatine bones has already been noticed; and as some description of the secreting apparatus to which the peculiar modification of the venom-fang is subservient might here be expected, I have selected for its illustration the accurate figure which Professor Müller has given of the salivary and poison-glands in the *Trigonocephalus lanceolatus*, in his great work on the glandular system. ('De Glandularum Scernentium Structura Penitiori,' fol., tab. vi. fig. 1, p. 55.)

"The poison-glands occupy the sides of the posterior half of the head; each consists of a number of elongated narrow lobes, extending from the main duct which runs along the lower border of the gland upwards and slightly backwards. Each lobe gives off lobules throughout its extent, thus presenting a pinnatifid structure; and each lobule is subdivided into smaller secerning cæca, which constitute the ultimate structure of the gland. The whole gland is surrounded by a double aponeurotic capsule, of which the outermost and strongest layer is in connection with the muscles by whose contraction the several cæca and lobes of the gland are compressed and emptied of their secretion. This is then conveyed by the duct to the basal aperture of the poison-canal of the fang. We may suppose, that as the analogous lachrymal and salivary glands in other animals are most active during particular emotions, so the rage which stimulates the venom-snake to use its deadly weapon must be accompanied with an increased secretion and great distension of the poison-glands; and as the action of the compressing muscles is contemporaneous with the blow by which the serpent inflicts its wound, the poison is at the same moment injected with force into the wound from the apical outlet of the perforated fang.

"The duct which conveys the poison, although it runs through the centre of a great part of the tooth, is nevertheless, as we have seen, really on the outside of the tooth, the canal in which it is lodged and protected being formed by a longitudinal inflection of the parietes of the pulp-cavity or true internal canal of the tooth. This inflection commences a little beyond the base of the tooth, where its nature is readily appreciated, as the poison-duct there rests in a slight groove or longitudinal indentation on the convex side of the fang; as it proceeds it sinks deeper into the substance of the tooth, and the sides of the groove meet and seem to coalesce, so that the trace of the inflected fold ceases in some species to be perceptible to the naked eye; and the fang appears, as it is commonly described, to be perforated by the duct of the poison-fang.

"From the real nature of the poison-canal, it follows that the transverse section of the tooth varies in form in different parts of the tooth; at the base it is oblong, with a large pulp-cavity of a corresponding form, with an entering notch at the anterior surface; farther on, the transverse section presents the form of a horse-shoe, and the pulp-cavity that of a crescent, the horns of which extend into the sides of the deep cavity of the poison-fang. A little beyond this part the section of the tooth itself is crescentic, with the horns obtuse and in contact, so as to circumscribe the poison-canal; and along the whole of the middle four-sixths of the tooth the section shows the dentine of the fang inclosing the poison-cavity, and having its own centre or pulp-canal, in the form of a crescentic fissure situated close to the concave border of the inflected surface of the tooth. The pulp-cavity disappears, and the poison-canal again assumes the form of a groove near the apex of the fang, and terminates on the anterior surface in an elongated fissure.

"If the end of each inflected fold of cement in the tooth of the *Labyrinthodon* were dilated sufficiently to contain a tube, that tooth might convey the ducts of fifty poison-glands deeply imbedded in its substance, and yet all of them actually on the outside of the tooth itself; it is the existence of a single fold of the same kind, but more simple, inasmuch as it is straight instead of wavy, which forms the complication of the viper's fang subservient to the completion of its peculiar offensive weapon.

"The venom-fangs of the Viper, Rattle-Snake, and Fer-de-Lance are coated only with a thin layer of a subtransparent and minutely cellular cement. The disposition of the calcigerous tubes is obedient to the general law of verticality to the external surface of the tooth. Since the inflected surface of the tooth can be exposed to no other pressure than that of the turgescent duct with which it is in contact, the tubes which proceed to that surface, while maintaining their usual relation of the right angle to it, are extremely short, and the layer of dentine separating the poison-tube from the pulp-cavity is proportionally thin. The calcigerous tubes that radiate from the opposite side of the pulp-cavity to the exposed surface of the tooth are disproportionately long.

"The pulp-cavity, following the form of the tooth itself, presents in a transverse section of this part the form of a fissure describing four-fifths of a circle; the fissure is widest at the middle and at the two extremities; the exterior calcigerous tubes, in quitting the pulp-cavity, form a graceful curve, the convexity being turned towards the nearest horn of the crescent; at the middle of the pulp-fissure the tubes proceed straight to the opposite surface; and at the two extremities of the crescent the central tubes are nearly straight, while the lateral ones radiate in graceful curves which become bolder as they diverge from the central and straighter tubes. Throughout the greater part of the tooth the calcigerous tubes describe their various inflections in a plane transverse to the axis of the tooth; but towards the apex they begin gradually to rise from that plane; and as the pulp-cavity reassumes, with the tooth itself, the simple conical form beyond the termination of the poison-canal, the calcigerous tubes extend to equal distances from the linear remnant of the pulp-cavity, which has again passed to the centre of the tooth, and those tubes which are continued from its extremity pass to the apex of the fang in a line parallel with the axis of the tooth. The calcigerous tubes present secondary curvatures of a slightly wavy character, which become more marked and irregular near their termination. In whatever part of the section an entire tube could be clearly traced to its termination, it formed an anastomotic loop at the periphery of the dentine with an adjoining tube. The calcigerous tubes present a diameter of the 1-18,000th of an inch, and they are separated by interspaces equal to four of their own diameters. Each calcigerous tube gives off many primary branches in its course, but is rarely seen to divide dichotomously until it begins to form its irregular sinuosities near the periphery of the tooth. In the transverse section, the primary branches are sent off from the concave side of the tube, at an acute angle with the trunk; the secondary smaller and more numerous branches proceed from the same side of the main tube or of its primary branches, at a less acute angle, into the clear uniting substance; they are remarkably parallel with each other and straight. In old poison-fangs the pulp-cavity or fissure is obliterated by ossification of the remains of the pulp.

"The external layer of cement is very thin where it covers the crown of the tooth; it is best seen at the line of union of the co-adapted margins of the inflected tooth. At this part the cement is more abundant in the viper's tooth, and its transparency permits a bristle inserted into the poison-canal to be seen through it. The layer which coats the inflected surface of the fang is thinner than the outer one, which, from its transparency, has been regarded as enamel. There is however no trace of true enamel upon the teeth of the poisonous serpents, any more than upon those of the innocuous species. The cells of the cement are more minute and inconspicuous in the poison-fang than in the simple teeth of the Python and Boa.

"The teeth of all Ophidians are developed and completed in the original seat of the tooth-germs in all animals, namely, the mucous membrane or gum covering the alveolar border of the dentigerous bones. This gum presents the same lax tissue and is as abundantly developed as in the Pike, Lophius, and many other fishes, in which it likewise serves as the nidus and locality for the complete development of the teeth.

"The primitive dental papilla in the common harmless snake very soon sinks into the substance of the gum and becomes inclosed by a capsule. As soon as the deposition of the calcareous salts commences in the apex of the papilla, the capsule covering that part becomes ossified and adherent to the dentine, and the tooth begins to pierce and emerge from the gum, before its mould, the pulp, is half completed. Fresh layers of cells are successively added to the base of the pulp, and converted by their confluence and calcification into the tubular dentine, until the full size of the tooth is attained, when its situation in the gum is gradually changed, and its base becomes anchylosed to the shallow cavity of the alveolar surface of the bone.

"In the posterior part of the large mucous sheath of the poison-fang, the successors of this tooth are always to be found in different stages of development; the pulp is at first a simple papilla, and when it has sunk into the gum the succeeding portion presents a depression along its inferior surface, as it lies horizontally, with the apex directed backwards; the capsule adheres to this inflected surface of the pulp. But how the cylindrical cavity of the dilated fold is occupied in the loose growing poison-fang, and by what contrivance it is brought into the same relation with the severed duct of the poison-gland as the displaced fang which it succeeds, is not yet clearly understood."

From the consideration of the teeth we proceed to that of the other organs of nutrition. The os hyoides in the Ophidians bears a strong resemblance to that of some species of Saurians [IGUANA; DRACONINA]; but the anterior part is double, and the two long osseous filaments which form it terminate in pointed cartilages, which introduce themselves, parallel, into the fleshy tissue of the tongue, and are separated by the hypoglossal muscle. The modifications of the muscles of the jaws are varied, and admirably adapted to the purpose assigned to them. Some are appointed to work the venom-fangs by carrying forward the external pterygoid and superior maxillary bones; others again are employed in the separation, approximation, and adjustment of the mandibular bones and the whole of the maxillary articulation; nor are those which act upon the tongue and os hyoides less complicated; whilst the peculiar muscles which come from the vertebræ and ribs all assist in the process of deglutition. The mobility of the tongue of the serpents must have struck every observer, and they have been seen to lap water with it. Serpents cannot be said to have any true pharynx; for the nostrils, as well as the glottis, open in the mouth, and the œsophagus commences immediately after the termination of the jaws; and is capable of great extension, so as to be capable of receiving prey of a very large diameter entire. The stomach is a continuation of the œsophagus, and the intestines are very short, and with but little flexure. The vent or cloaca opens by a transverse slit towards the end of the abdomen, above the origin of the tail, which is often very long. The liver consists of only one lobe of an elongated form, placed on the right, or in the mesial region, in front of the long œsophagus, and accompanies the stomach, furnishing distinct hepatic and cystic canals. The bile is greenish or brown, and the cystic canal comes direct from the liver. The spleen is not large, and is situated on the right near the insertion of the ductus choledochus. The pancreas is situated immediately under the junction of the intestine with the stomachal sac beneath the peritoneum.

The absorbent powers of the intestines of serpents are great. Messrs. Duméril and Bibron advert to the state of their dejections as a proof of this. They offer, to use their expression, the dry extract of the animal entire, of which only the parts that could not be liquefied remain unaltered, and absolutely in the same situation that they occupied in the carcass of the animal before it had passed through the whole length of the digestive tube. If, for instance, a rat has undergone this process, one may recognise in the dry and shapeless mass the place occupied by the muzzle of the animal, the long whiskers of its cheeks, the down which covered the delicate cartilages of its ears, the hairs of various lengths and colours which correspond with those of the back, the belly, and, above all, the tail; and, finally, even the claws, which remain in their pristine state of integrity. All that was flesh or soft matter in the body has been completely absorbed; the earthy salt, nevertheless, which gave, by means of its union with the gelatin, consistence to the bones, still indicates by its presence, and especially by its colour, the place they occupied. Dissolution, compression, and absorption have done their work upon this desiccated mass, which still however contains the elements of nourishment for the larvæ of the insects of the family *Dermestidæ*.

In the fæces of the Python which a few years ago devoured its companion in the Gardens of the Zoological Society of London, there were entire scales of the digested serpent.

There are several interesting preparations of the anatomy of these organs in the Museum of the Royal College of Surgeons.

There is no great difference between the heart of serpents and that of Saurians. In the Museum of the Royal College of Surgeons (No. 917 B), the heart of a *Python Tigris* is prepared to show the internal structure as well as the outward form. Professor Owen, who made this preparation, observes that the blood of the general system is collected into a large elongated sinus, formed by the union of the inferior with the right superior cava. The left superior cava winds round the back of the left auricle, receives the coronary veins, and terminates in the lower part of the orifice, which leads from the above sinus to the right auricle. This orifice is protected by two semilunar valves. The whole of the inner surface of the auricle, with the exception of these valves and the opposite valve of the foramen ovale, is reticulated with delicate muscular fasciculi. The left auricle receives the blood from a single pulmonary vein, and has a similar reticulated muscular structure: there is no valve at the termination of the vein in this auricle. The blood enters the posterior or aortic division of the ventricle by two crescentic apertures, which are each provided with a single semilunar valve, extended from each side of the septum of the auricular orifices. The irregular form and small size of the aortic chamber is displayed by the removal of the posterior parietes of the ventricle. On the opposite side the pulmonary chamber is exposed; and the Professor remarks in continuation, that it is of a larger size, of a more regular oval form, and with a smoother surface. The fleshy septum, extending from the base of the ventricle to the space between the roots of the pulmonary and systemic arteries, is incomplete at its upper and anterior part, and there leaves a communication between the pulmonary and aortic chambers: these also, he remarks, intercommunicate by several round apertures of different sizes near the apex of the ventricle, which serve to thoroughly blend together the two kinds of blood before they are expelled thus mixed along the three arteries which separately arise from the ventricles. In this preparation the origins of the pulmonary artery and left aorta only are shown, and they are each provided with a pair of semilunar valves. The carotid arteries are given off from the right aorta, which afterwards unites with the left aorta at some distance below the heart. The gland analogous to the thymus gland is also preserved: its structure is cellular. White bristles are passed through the systemic veins, sinus, and auricle; and a black one through the pulmonic vein and auricle. The two branches of the pulmonary artery which go to the two separated lungs are distinguished by black bristles, which also indicate the situations of the two ducti arteriosi. ('Catalogue,' vol. ii.)

The mode of respiration in the serpents is thus effected:—the glottis, which has two lips, and represents a very simple larynx, opens in the mouth behind the sheath of the tongue; by means of the muscles of the os hyoides, which push it, it is raised so as to be presented in a dilated state behind the back nostrils. The vacuum caused by the action of the ribs in the belly tends to dilate the lung, which, through the medium of the trachea, immediately admits the air which is introduced during an inspiration: this is slow, continuing for some seconds. This air, when it has performed its office, and has been deprived of its oxygen, is expelled in the same manner, but by an inverse mechanism, which is entirely due to the action of the muscles which tend to approximate the ribs to each other. When it is expelled rather briskly, a sort of vibration or hissing is heard. The respiration being voluntarily accelerated or retarded, the chemical and vital actions which result from it must be naturally excited or abated by that cause. (Dum. and Bibr.)

As connected with the faculty of respiration, it will be expected that something should be said relative to the voice of serpents, whose hissing has become proverbial. Messrs. Duméril and Bibron state that they hardly think that these reptiles can, as has been said of some colubers, produce hissings (sifflemens) or piercing sounds (sons bien aigus); for although their lungs have great capacity, and can furnish air for a long time, Messrs. Duméril and Bibron state that they could never hear more than a sort of blowing (soufflement) such as would result from the rapid issue of a current of air through a simple pipe—that of a quill for instance. White, however, who was a very good observer, in speaking of the faculty which snakes have of 'stinking se defendendo,' remarks, in his 'Selborne,' that he knew a gentleman who kept a tame snake, which was in its person as sweet as any animal, while in good humour and unalarmed; but as soon as a stranger or a dog or cat came in, it fell to hissing, and filled the room with such nauseous effluvia as rendered it hardly supportable. These offensive emanations came, no doubt, from the fetid anal glands, which seem, as White observes, to be given to certain serpents as a defence. We, at one time, narrowly watched the habits of serpents, pythons in particular, and have seen them excited in various ways; but we never remember to have heard them hiss, in the popular acceptation of the term.

Serpents are destitute of a urinary bladder, but they possess kidneys. They are oviparous ovoviviparous.

The shell of the egg in the oviparous serpents, although cretaceous, is soft, like the eggs of the common hen, when she has not enough calcareous matter in her aliments, called soft eggs. They are often more than 30 in number, and are connected by a sort of viscous matter which coagulates and joins them in a kind of chain, as is well known to those who have found the eggs of our British common snake in dunghills. Their colour is ordinarily yellowish or grayish-white. The yoke or vitellus is absorbed by the embryo; and an abdominal cicatrice indicates the umbilicus in the young.

Brain, Nervous System, and Senses.—The cranium of the Serpents is small in proportion to the other parts, elongated, and narrow; the internal cavity is small. The surface of the brain is nearly smooth, and without sinuosities or circumvolutions. The lobes are distinct, and the whole mass is elongated. The mass of the spinal marrow, compared with the brain, is much more voluminous than the latter. The anterior lobes are rather slender, and the nerves destined for the sense of smelling are elongated, and, as it were, pediculated.

Touch.—This sense can hardly exist in a high state of development among the reptiles of this order; though there is no doubt a sufficient degree of it to regulate the progression of the animal, and to indicate to the constricting serpents and those which live in trees the nature of the surfaces with which their bodies are brought into contact.

Taste.—The tongue in serpents is nearly always cylindrical, deeply bifid at its free extremity, and very narrow. It can be protruded from the mouth, and rapidly vibrated in all directions, and is always moist. The sheath into which it is received can be elongated or contracted. As an organ of taste it cannot be very susceptible. The prey is swallowed entire, and under circumstances which give little or no opportunity for the gustatory exercise of the tongue.

Smell.—The evidence derived from the structure of this organ, and from their habits, does not justify the conclusion that the sense of smelling is very acute in serpents.

Hearing.—In the serpents there is no external auditory meatus, nor any appearance of a tympanum; but there is a guttural canal which leads from the pharynx to the tympanic cavity, and there may be observed a single ossiculum auditûs, which is elongated and widened at its two ends. In other respects the internal ear is organised like that of the Saurians. Such a structure does not indicate the enjoyment of a very acute sense of hearing, and the 'deaf adder' is become almost proverbial; but that serpents have a perception of sounds, sufficient at least to warn them of the approach of their enemies or their prey, and something more, may be concluded from the attention that many of them pay to musical sounds. [NAIA.]

Sight.—The eyes of the serpent are generally very small, and there is a remarkable peculiarity in the disposition of those organs, for the transparent cornea apparently forms part of the skin and epidermis with which it is detached at each moult. There is no appearance of a tunica conjunctiva; but on dissection it has been found behind the cornea, and occupies the place of eyelids; the sac which this mucous membrane forms receives the tears, and conducts them into the nostrils. There being no eyelid, the eye of the serpent always appears to be fixed and on the watch. The sac above mentioned permits the globe of the eye however to be moved under the anterior part or epidermic cornea. Some serpents, *Trigonocephali* and *Crotali* for instance, have above the eye external cavities, which have been considered as lachrymatory sinuses, like those of the Ruminants: their only analogy however appears to be that of locality, for they receive no tears, and their cavity is always dry. Vision, excepting for some time previous to the change of skin or moult, when it is evidently less perfect, seems to be sufficiently acute in this order.

Serpents can creep, glide, grasp, suspend themselves, erect themselves, leap, dart, bound, swim, and dive. [LOCOMOTION IN ANIMALS.]

Cold latitudes do not agree with the *Ophidia*; it is in warm climates that their numbers, their venom, and their volume attain their maximum.

The following list of the distribution of the species of *Ophidia* is given by Dr. J. E. Gray in his 'Catalogue of Snakes' in the British Museum. In this list the *Colubridæ* are not included :—

EUROPE.

Vipera aspis.
V. Ammodytes.
Pelias Berus.
Eryx Jaculus.

ASIA AND ITS ISLANDS.

Trimesurus viridis.
T. albolabris. China.
T. carinatus.
T. purpureus.
T. maculatus. Borneo.
T. subannulatus. Philippines.
T. Philippensis.
T. strigatus. Ceylon.
T. Sumatranus. Sumatra.
T. formosus. Borneo.
T. Ceylonensis. Ceylon.
Parias flavomaculatus. Philippines.
P. ornatus. Philippines.
P. variegatus. Philippines.
Megæra trigonocephala. Ceylon.
Atropos acontia. Java.
Trigonocephalus Halys. Tartary.
T. Blomhoffii. Japan.
T. rhodostoma. Java.
T. hypnale. Ceylon.
T. zara.
Daboia elegans.
D. Russellii.
D. Xanthina. Xanthus.
Echis carinata.
Pelamis bicolor.
P. ornata.
Lapemis curtus.
L. Hardwickii.
Aturia ornata.
A. Belcheri.
A. Lapemoides.
Microcephalophis gracilis.
Enhydrina Bengalensis.
E. Valakadyen.
Hydrophis obscura.
H. Lindsayii.
H. fasciata.
H. nigrocincta.
H. subcincta.
H. sublævis.
H. mentalis.
H. spiralis.
H. subannulata.
H. aspera.
H. cærulescens.
Chitulia inornata.
C. fasciata.
C. schistosa.
Kerilia Jerdonii.
Hydrus annulatus.
Tomogaster Eydouxii.
Cherydrus granulatus.
C. annulatus.
Acrochordus Javanicus. Java.
Cerberus cinereus.
C. acutus. Borneo.
C. unicolor. Philippines.
Feranis Sieboldii.
Homalopsis buccata.
H. Hardwickii.
Phytolopsis punctata.
Tropidophis schistosus.
Myron trivittatus (?).
Hypsirhina plumbea.
H. Hardwickii.
H. Aer.
H. bilineata.
H. Chinensis.
H. Bennettii.
Fordonia leucobalia.
F. unicolor.
Raclitia Indica.
Miralia alternans.
Xenodermus Javanicus. Java.
Python reticulatus.
P. molurus.
Liasis amethystina. New Ireland.
L. Macklotii.
Nardoa Schlegelii.
Cliftia fusca.
Enygrus carinatus.
Cuscria elegans.
Gongylophis conica.
Clothonia Johnii.
Cylindrophis melanota.
C. rufa.
C. maculata.

AUSTRALIA.

Acanthophis antarctica.
Hydrophis doliata.
H. ocellata.
Hydrus major.
Stephanohydra fusca.
Cerberus australis.
Myron Richardsonii.
Morelia spilotes.
M. variegata.
Liasis Childrenii.
L. olivacea.
Nardoa Gilbertii.
Enygrus Bibroni. Isle of Viti.
Bolyeria multicarinata.

AFRICA.

Megæra trigonocephala (?).
Clotho nasicornis.
C. arietans.
C. lateristriga.
C. Atropos.
C. inornata.
C. Mauritanica.
C. cornuta.
Cerastes Hasselquistii.
C. Ritchii.
Echis arenicola.
Sepedon Hæmachates.
Causus rhombeatus.
Prosymna meleagris.
Hortulia Natalensis.
H. Sebæ.
H. regia.
Sanzinia Madagascariensis.
Pelophilus Madagascariensis.
Casarea Dussumieri.
Eryx Jaculus.
E. Thebaicus.

AMERICA.

North America.

Craspedocephalus atrox.
Lachesis mutus.
Cenchris contortrix.
C. atrofuscus.
C. piscivorus.
Crotalophorus miliarius.
C. tergeminus.
C. Kirtlandi.
Uropsophus durissus.
Crotalus horridus.
Helicops carinaacaudus.
Farancia fasciata.
Dimades plicatilis.
Abastor erythrogrammus.
Ficimia olivacea.
Charina Bottæ.

Tropical America.

Craspedocephalus Brasiliensis.
C. lanceolatus.
C. atrox.
C. elegans (?).
C. bilineatus.
Lachesis mutus.
L. pictus. Peru.
Crotalus horridus.
Uranops angulatus.
Hydrops Martii.
Hygina fasciata.
Gerarda bicolor.
Hipistes fasciatus.
Epicrates angulifer.
E. Cenchria.
E. maurus.
Xiphosoma caninum.
Corallus hortulanus.
Boa constrictor.
B. diviniloqua.
B. imperator.
B. equea.
Eunectes murinus.
Chilabothrus inornatus.
Ungalia melanura.
U. maculata.
Tortrix Scytale.

The following is Dr. J. E. Gray's arrangement of the Snakes (*Ophidia*) :—Mouth dilatable, all the facial bones movable. Jaws toothed: lower jaw-bones only united by ligaments in front. Eyes without eyelids. External ears none. Tongue very long, retractile into a sheath at its base; the apex forked, very long, slender, tapering. Limbs none or only rudimentary, in the form of spurs on the side of the vent. (Meyer, 'Acta Acad. Nat. Cur.,' xii.) The body of each vertebra articulated by a convex facet, fitting into a concavity in the front of the following one. The palatine arches mobile, and armed with acute recurved teeth. The windpipe is very long. One of the lungs very large; the other very small or rudimentary. The heart in the hinder part of the body. The mastoid bone is detached in all except the genus *Tortrix* of Oppell.

Ophidia, Rafin., 'Anal. Nat.,' 76, 1815. *Ophidii pars*, Oppell., 'Rept.,' 47. *Ophidii*, Gray, 'Ann. Phil.,' 1825, 204. *Serpents proprement dit*, Cuvier, 'R. A.,' ii. 69; ed. 2, ii. 7, 74. *Serpentia gulones* Merrem, 'Tent.,' 81. *Ophidii*, section 2, Bibron. *Serpentes Theciglossi*, Wagler, 'Syst. Amph.,' 165.

Synopsis of the Families.

Sub-Order I. *Viperinæ*. Jaws weak; upper toothless, with fangs in front; lower toothed. Ventral shields broad, band-like. Head large behind; crown flat, generally covered with scales, rarely with shields. Hinder limbs not developed. Eyes lateral. Nostrils apical, lateral.

1. *Crotalidæ*. Face with a large pit on each side, placed between the eye and the nostril. [CROTALIDÆ.]
2. *Viperidæ*. Face without any pit on the cheek. [VIPERIDÆ.]

Sub-Order II. *Colubrinæ*. Jaws strong, both toothed, sometimes with some fangs in front or grooved teeth behind. Head moderate or indistinct; crown often covered with regular shields.

Section I. Belly covered with narrow elongate shields or scales, nearly resembling those of the back.

3. *Hydridæ*. Vent without any spurs like rudimentary feet. Nostrils superior, valvular. Eyes superior; pupil round. Tail often compressed. Belly covered with narrow shields or with scales like those of the back, the central series sometimes united together in pairs, forming a narrow 6-sided shield. [HYDRIDÆ.]
4. *Boidæ*. Vent with spur-like rudimentary feet on each side. Eyes and nostrils lateral. Tail conical, generally prehensile. Ventral shield narrow, transverse, band-like. [BOIDÆ.]

Section II. Belly covered with broad band-like shields. Vent without any spur-like feet. Tail conical, tapering.

5. *Colubridæ*. Nostrils apical, lateral, open. Head generally shielded.

The species of *Colubridæ*, the largest family of *Ophidia*, have not yet (1855) been arranged in the British Museum Catalogue. [REPTILES.]

Fossil Serpents.—Professor Owen, in a paper published in the 'Transactions of the Geological Society of London' (vol. vi., 2nd series), describes some fossils found in the London Clay referrible to an order of reptiles which appears to have been very sparingly represented in the fauna of former periods of the history of the earth.

"Vertebræ," observes the Professor, "joined enarthrodially by a deep anterior transversely-oblong cup and a corresponding prominent posterior ball, and further articulated by two projecting flat oblique processes, wedged like the carpenter's tenon into a mortice excavated in the anterior oblique processes of the succeeding vertebra; supporting moreover, on either side of the fore part of the body, an oblong convexity for the moveable articulation of the rib,—belong unequivocally to a reptile of the Ophidian Order."

Professor Owen then states that there is a group of about thirty vertebræ of this description, with a number of long and slender ribs having expanded concave vertebral extremities, cemented irregularly together by a mass of indurated clay, among the fossils left by John Hunter, and now in the Museum of the Royal College of Surgeons; and that a portion of the spinal column of apparently the same species of serpent, measuring 18 inches in length, and including 28 vertebræ, and a smaller group of 7 vertebræ, and a few detached ones, are in the museum of Mr. Bowerbank. The whole of these specimens are from the Isle of Sheppey.

The vertebræ in each specimen are described as presenting the same conformation and nearly the same size, and as being as large as those of a boa constrictor ten feet in length. They belong, it is stated to the ordinary dorsal or costal series, but differ from the vertebræ of both *Boa* and *Python* in their superior length, as compared with their breadth and height. The ridge continued from the lower anterior to the lower posterior processes on each side is stated to be less developed in the fossil Ophidian. The oblique processes themselves do not extend so far outwards; and the spinous process is narrower in its antero-posterior extent, but longer.

Professor Owen observes, that in the first two of the above-mentioned differences the fossil agrees with the Linnæan genus *Coluber* and its sub-genera, but differs from the *Crotalus;* in the remaining points it differs from *Crotalus*, *Coluber*, *Naia*, and *Trigonocephalus*. The long and comparatively narrow spine, the outward and backward prolongation of the upper angle of the posterior oblique processes, the uniform convexity of the costal protuberance, the uneven or finely-wrinkled external surface of the superior arch of the vertebra, are characters which distinguish the Ophidian vertebræ described by Professor Owen from those of any other genus of the order with which he had been able to compare them; and he therefore proposes to designate the species provisionally by the name of *Palæophis toliapicus*. The ribs, as in all land-serpents, were hollow.

In some respects, as the configuration of the under surface of the body of the vertebræ, and in the anterior tubercle upon this surface, Professor Owen found that the fossils agreed with the *Boæ* and Pythons more nearly than with the Colubers, in which the under surface of the abdominal vertebræ are traversed by a median longitudinal ridge; and he observes that in none of the differences above noted can there be inferred any obstacle to the practice of the same arts of entrapping and modes of destroying a living and struggling prey. The largest of these Ophidiolites in Mr. Bowerbank's collection exhibits a portion of the vertebral column suddenly bent upon itself, and indicating the usual lateral flexibility of the spine.

"If," says Professor Owen, in conclusion, "we may suppose the species to have had the same number of vertebræ as the existing Boas, it must have exceeded eleven feet in length, and such dimensions would indicate that the species was not provided with poison-fangs. Serpents of these dimensions exist in the present day only in warm or tropical regions, and their food is by no means restricted to animals of the cold-blooded classes. The remains of birds and *Mammalia* are those which are most commonly found in the alimentary canal of such as are brought to this country dead; and living birds or quadrupeds also constitute the favourite food of the Pythons and Boas of similar dimensions, which are exhibited in our menageries. If therefore there had not been obtained direct evidence of both birds and mammals in the London Clay, I should have felt persuaded that they must have co-existed with serpents of such dimensions as the species of which the dorsal vertebræ are here described." ('Description of some Ophidiolites (*Palæophis toliapicus*) from the London Clay at Sheppey, indicative of an Extinct Species of Serpent.')

A small *Palæophis* has also been discovered in the Eocene sand underlying the red crag of Suffolk, where the remains of a fossil monkey were found. Another species of *Palæophis* exists in the collection of Mr. Dixon at Worthing, from the Eocene (London) Clay at Bracklesham, which must have belonged to a boa-like serpent upwards of twenty feet in length.

OPHI'DIUM (from *ὄφις*, a snake), a genus of Malacopterygious Fishes belonging to the Eel Tribe. The species have smooth heads; long slender bodies, margined by the united dorsal, anal, and caudal fins; the jaws, palate, and pharynx are all furnished with teeth; the branchial aperture is large. The species vary in form and colour, and in the presence, absence, and number of filamentous appendages or beards attached to the under jaw. Two species inhabit the British seas, but are both very rare. In the Mediterranean the Bearded Ophidium is common, and is used for food.

OPHIOCOMA, a genus of Animals belonging to the order *Echinodermata*, to the family *Ophiuridæ*, and to the tribe *Ophiuræ*. The rays are simple, squamose, not prolonged into the disc superiorly, and separated at their origins beneath by small pentangular plates. The species are called Brittle-Stars on account of their fragility. They are very difficult to preserve. Professor E. Forbes recommends their being placed in fresh-water as soon as caught, which quickly destroys them; and after they have been in it an hour or so, to dip them rapidly in boiling water. They are then to be dried in the sun, or in a current of air. The following are the British species of this genus recorded by Mr. Forbes in his 'History of British Star-Fishes:'—

O. neglecta, Gray Brittle-Star. Disc round, flat, imbricated with small smooth scales; two oblong parallel touching plates opposite the origin of each ray; upper ray-scales square; lateral ray-plates bearing four or five spines each, which are equal in length to the breadth of the ray. This species is not uncommon on all parts of the British coast.

O. Ballii, Ball's Brittle-Star, was first discovered in Ireland by Dr. Ball.

O. punctata (Forbes), Dotted Brittle-Star. This species, first described by Edward Forbes, was found by Henry Goodair in the stomach of a cod.

O. filiformis, Thread-Rayed Brittle-Star. The rays are very long and filiform. It is a rare species in Great Britain.

O. brachiata, the Long-Armed Brittle-Star. This also is a rare species.

O. granulata, Granulated Brittle-Star. The rays are covered over with minute spines.

O. Bellis, Daisy Brittle-Star. It is not uncommon on many parts of our coast, and is to be found under stones at low tide.

O. Goodsiri, named after Dr. Goodsir, who took it from a cod's stomach taken off Anstruther in Fifeshire.

O. rosula, Common Brittle-Star. Disc rounded, convex, covered with spines of various lengths; two large triangular parallel plates opposite the origin of each ray; upper ray-scales triangular, carinated, imbricated; lateral ray-plates bearing five spines each, which are much longer than the breadth of the ray. This is the most common of our British Brittle-Stars.

O. minuta, Sand Brittle-Star. This is smaller than the last, and is found buried in the sand.

(E. Forbes, *A History of British Star-Fishes.*)

OPHIOCE'PHALUS (from *ὄφις*, a snake, and *κεφαλή*, head), a genus of Fishes belonging to the division of *Acanthopterygii*, characterised by having labyrinthiform pharyngeals, and capable of living for a long time out of the water. The species inhabit India and China. [ANABAS.]

OPHIO'DES, Wagler's name for a genus of Scincoidean Lizards (*Pygopus*, Spix; *Bipes*, part. Cuvier; and *Pygodactylus*, Fitzinger and Wagler—according to Messrs. Duméril and Bibron).

OPHIOGLOSSACEÆ, *Adders' Tongues*, a natural order of Acrogenous Plants, belonging to the alliance Filicales. They have an erect or pendulous stem, with a cavity in the middle instead of pith, and two or three woody bundles placed round it in a ring; the stalks of the leaves and the stem become blended together below; the leaves have netted veins; the spore-cases are collected into a spike formed out of the sides of a contracted leaf, 2-valved, without any trace of an elastic ring; spores resembling fine powder.

These plants are a transition from Ferns to *Lycopodiaceæ*. The species are most abundant in the islands of tropical Asia. They occur however in the West Indies and in the tropical parts of Africa, at the Cape, and in Tasmania. They are of little or no known use. The following genera with about 25 species belong to this order:—*Ophioglossum, Ophiodema, Helminthostachys, Botrychium.*

OPHIOGLOSSUM (from ὄφις, a snake, and γλῶσσα, the tongue), a genus of Plants belonging to the natural order *Ophioglossaceæ*. The thecæ are connate, disposed in a simple distichous spike attached to an undivided frond.

O. vulgatum, Adder's Tongue, is the only British species. It has an ovate obtuse frond, and is from 4 to 12 inches in height; the spike is club-shaped, usually rather longer than the frond, sometimes very long. This plant is generally distributed over England, and in many places is exceedingly common, covering large plots of ground, and is highly injurious to the crop of grass. It is less frequent in Wales, Scotland, and Ireland. It is a common plant on the continent of Europe, and is said to occur in Africa and North America. Like most singular-looking plants, it has been used in medicine. Ray recommended an ointment composed of oil and Adder's-Tongue. Gerarde says that the "Adder's-Tongue is dry in the third degree. The leaves of Adder's-Tongue stamped in a stone mortar, and boiled in oyle-olive vnto the consumption of the juice and until the herbes be dry and parched, and then strained, will yeeld a most excellent greene oyle, or rather a balsame, for greene wounds comparable to oyle of St. John's Wort, if it do not far surpass it by many degrees, whose beauty is such that very many artists have thought the same to be mixed with verdigria." Lightfoot says that the common people in Scotland make an ointment of the green leaves, and use it as a vulnerary. It is also used in the same way in many parts of England.

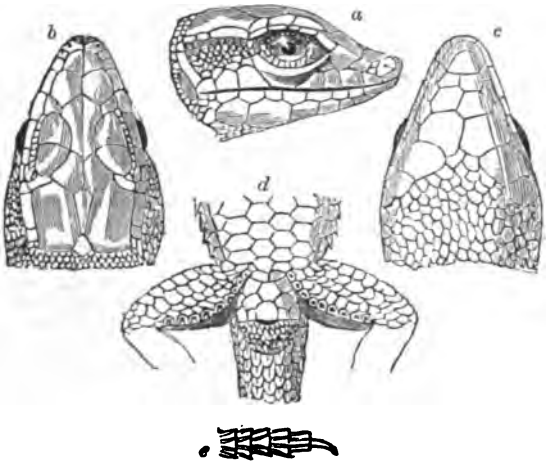
(Newman, *British Ferns;* Babington, *Manual of British Botany.*)

OPHIO'MORUS, a genus of Reptiles established by Messrs. Duméril and Bibron for a form placed by them in their first sub-family (Saurophthalmes) of Scincoidean Lizards.

OPHIOPHTHALMES, the named assigned by Messrs. Duméril and Bibron to their second sub-family of Scincoidean Lizards, having all naked eyes, but only one of them (*Gymnophthalmus quadrilineatus*) being completely without the eyelid.

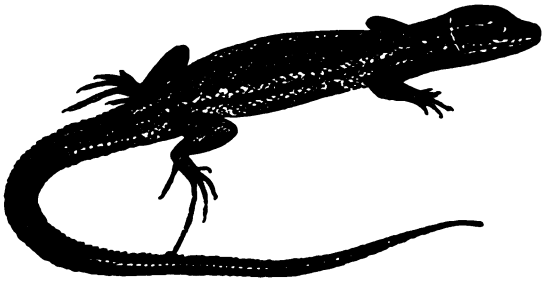
O'PHIOPS, a genus of Reptiles belonging to the Lacertians (Pristidactyle Cœlodonts of Messrs. Duméril and Bibron; *Amystes* of Wiegmann).

The tongue is arrow-headed in shape, moderately long, notched at the end, covered with imbricated squamiform papillæ; intermaxillary teeth conical, simple; maxillary teeth rather compressed, the anterior simple, the posterior tricuspidate; two slightly convex naso-rostral plates, between which is opened the nostril situated on the line of the canthus rostralis; no eyelids; a tympanic membrane extended within the auricular opening; no scaly collar under the neck; a small fold in front of each shoulder; ventral lamellæ quadrilateral, smooth, and disposed quincuncially; femoral pores; feet with five toes slightly compressed, carinated below, but not dentilated laterally; tail cyclotetragonal at its root, but rounded throughout the rest of its length.



a, Head of *Ophiops* (profile); *b*, the same, seen from above; *c*, throat and lower jaw; *d*, lower part of the body, interior surface of the thighs, &c.; *e*, under side of a posterior toe.

O. elegans, Ménestriés; *Amystes Ehrenbergii*, Wiegmann. Olive or bronzed above; two yellowish lines extend along each side of the trunk; each of these yellowish or whitish lines separates two rows of black spots, which are small and very distinct in young individuals, but are more or less dilated and confused in adults; white below. It is a native of Smyrna and Bakou.



Ophiops elegans.

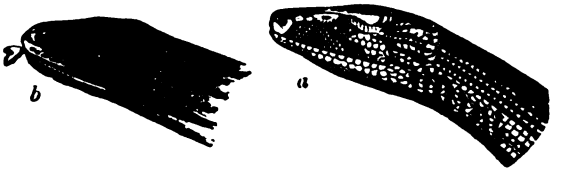
OPHIO'XYLON (from ὄφις, a serpent, and ξύλον, wood, because it has a twisted root and stems), a genus of Plants belonging to the natural order *Apocynaceæ*. It has a 5-cleft permanent calyx, a funnel-shaped corolla with a long tube, thickest in the middle, and a 5-cleft oblique limb. The anthers are subsessile, inserted into the middle of the tube. The ovary is double, each lobe with one ovule, a filiform inclosed style and a capitate stigma. The drupes are baccate, black, about the size of a pea, twin, or solitary by abortion, each containing a 1-seeded wrinkled nut.

O. serpentinum, Serpentine Snake-Wood, is a native of the East Indies. In rich soil it becomes a climbing plant, but in poor soil it is a small erect shrub. The leaves are in threes or fives; they are short-stalked, oblong, pointed, wavy, and smooth. The peduncles are long, smooth, round, sometimes nearly erect, somtimes drooping. The pedicels and calyces are of a bright-red colour, and the corollas white. In India the root of this plant is employed by the Telinga physicians as a remedy in may diseases.

(Lindley, *Flora Medica;* Burnett, *Outlines of Botany.*)

OPHISAURUS (Daudin), a genus of Reptiles (*Hyalinus* of Merrem) nearly allied to the Scheltopusiks (*Pseudopus*, Merrem), and, according to Cuvier, one of the sub-genera of the *Anguidæ*. It has the tongue arrow-headed in shape, notched triangularly in front, free for one third of its extent anteriorly, which part has granular papillæ, whilst the other two posterior thirds exhibit filiform papillæ. Many rows of palatal teeth. Intermaxillary teeth conical; maxillary teeth subcylindrical, simple. Nostrils lateral, each with its opening in a single plate. External orifice of the ear very small. Eyelids; cephalic plates numerous. Body serpentiform. No vestige of limbs externally. Two rather deep lateral furrows. No fold across the lower surface of the neck.

This form is one of those transitions by which nature passes from one type to another. The animal, in effect, has the head of a Lizard on a serpentine body. There appears to be but one species, namely, *Anguis ventralis*, Linn. (*Cœcilia maculata*, Catesby), the Glass-Snake. The colour is yellowish-green, spotted with black above. Tail longer than the body. Head very small, and the tongue of a singular form, according to Catesby.

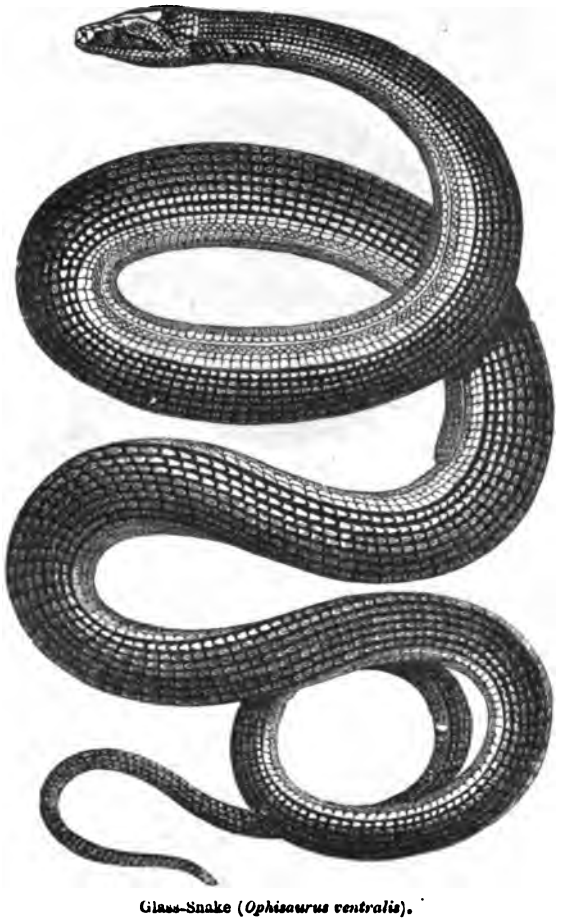


a, Head of *Ophisaurus ventralis*; *b*, head of the same from Catesby, showing the tongue.

It is probable that this species is subject to slight variations of colour. Catesby says that the "upper part of the body is of a colour blended brown and green, most regularly and elegantly spotted with yellow; the belly yellow, the undermost part of which is brightest. Their skin is very smooth and shining, with smaller scales more closely connected, and of a different structure from other serpents." General length about 18 inches.

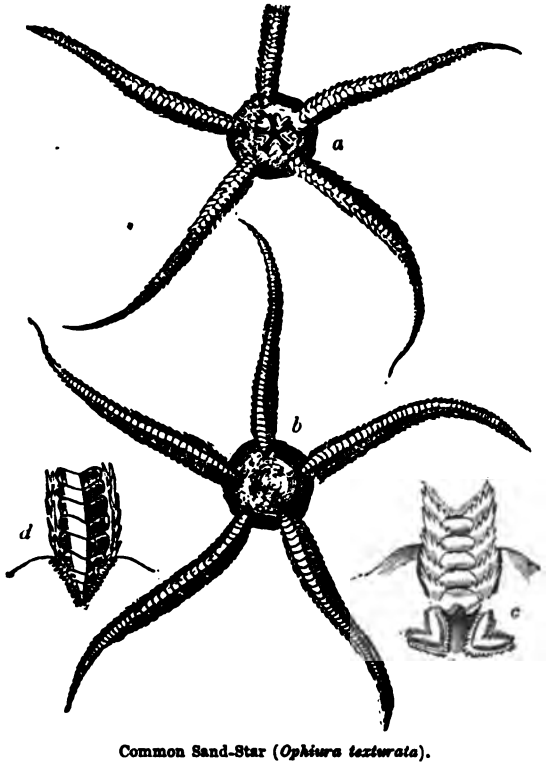
The fragility of this animal equals if it does not exceed that of the Blindworm; and hence, probably, its name of Serpent de Verre, or Glass-Snake. The author last quoted says, "a small blow with a stick will cause the body to separate, not only at the place struck, but at two or three other places; the muscles being articulated in a singular manner, quite through to the vertebræ. They are generally said to be harmless." There is no doubt that the species is innocuous.

It is found in the southern United States. Catesby states that the Glass-Snakes appear earlier in the spring than any other serpent, and that they are numerous in the sandy woods of Virginia and Carolina.



Glass-Snake (*Ophisaurus ventralis*).

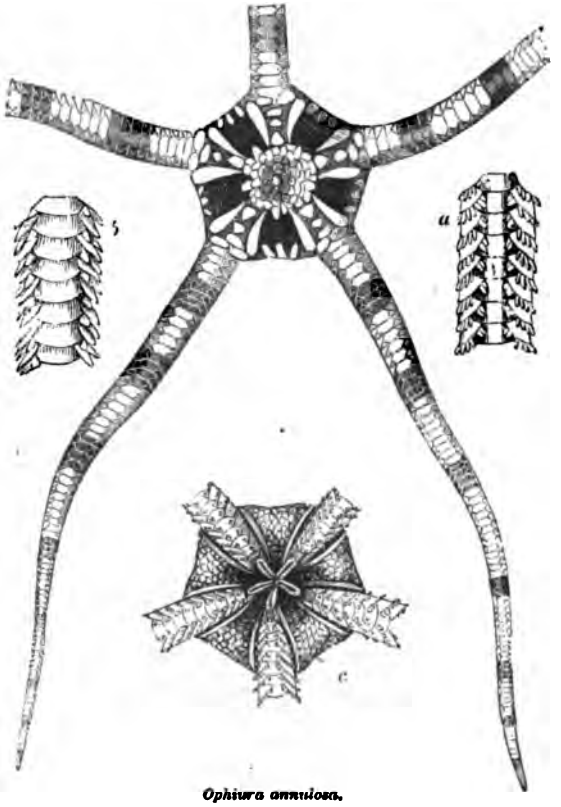
OPHIU'RA, a genus of Invertebrate Animals belonging to the family *Echinodermata*. It has the body discoid, depressed, rather



Common Sand-Star (*Ophiura texturata*).

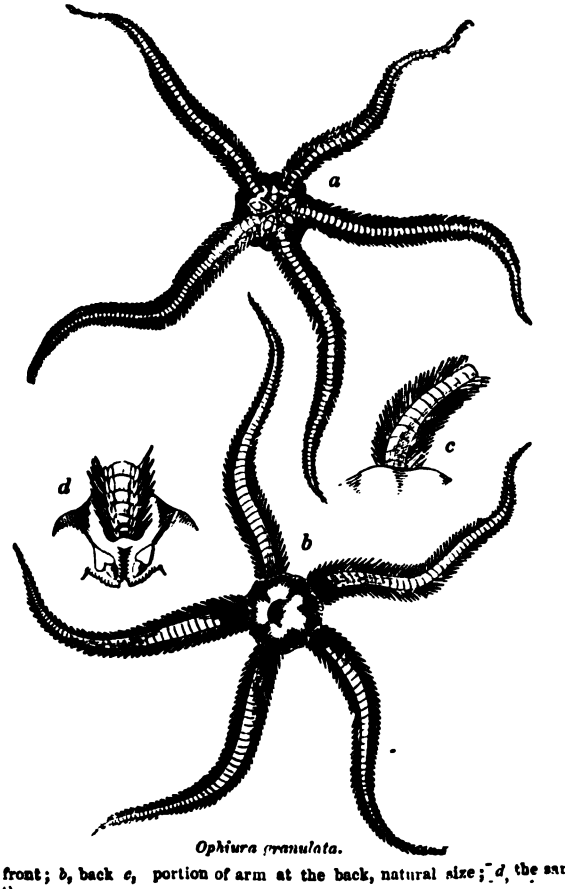
a, front; *b*, back; *c*, portion of centre and arm magnified (front); *d*, the same (back).

small, subquinquelobate, covered with a coriaceous skin, and provided at its circumference with five simple, very long, very slender, squamous



Ophiura annulosa.

View of back (principal figure). *a*, portion of arm (under side), magnified; *b*, the same (upper side); *c*, front view of centre.



Ophiura granulata.

a, front; *b*, back *c*, portion of arm at the back, natural size; *d*, the same (front).

rays, without any trace of an inferior furrow, but always accompanied laterally with spines more or less moveable, and with two rows only of large cirrhi, or suckers, one on each side below. Mouth in the midst of five very short alita, not exceeding the demi-diameter of the body, and furnished with a few papilliform suckers (eight), and on the edges with five groups of scales, which are often dentiform. Orifices of the ovaries very large, in the shape of a slit on each side of the root of the rays. No madreporiform tubercle. (De Blainville.)

O. texturata (*Stella lacertosa*, Link.), Common Sand-Star. It is of a brownish or brownish-white colour; rays smoothly subulate; the scales on the lower surface disposed trifariously; the papillæ of the sides very small and adpressed.

It is found in the European Seas. Lamarck adds the Atlantic Ocean. It was taken very abundantly in the trawl in Davis's Strait in Sir Edward Parry's first voyage; and occurs sometimes in immense numbers on the British coasts.

O. albida (E. Forbes), the Lesser Sand-Star, is a smaller species, also found on the British coast. It is of a white colour when it is dried.

O. annulosa. Brownish, rays long, smoothly subulate, spinous at the sides, the spines annulose, and subadpressed; back of the disc echinulate.

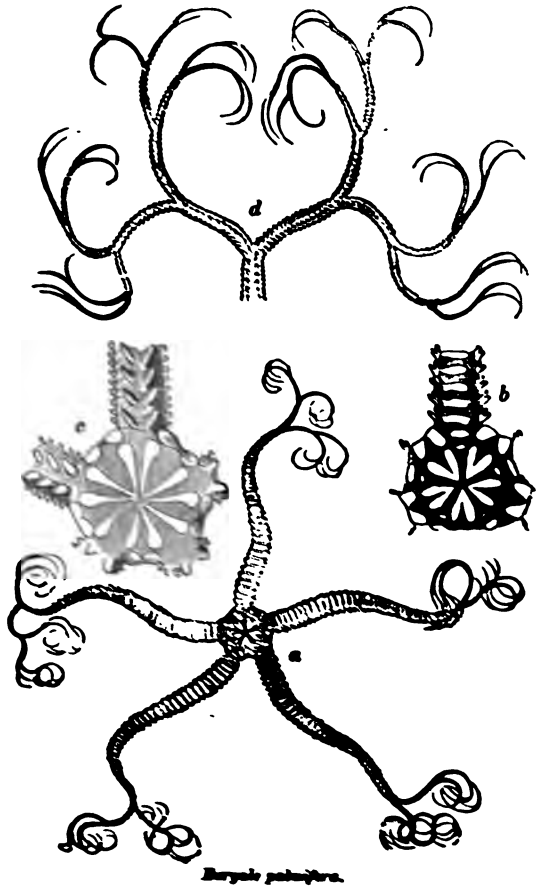
It is found in Australasia; first made known apparently by the voyage of Péron and Le Sueur.

O. granulata (*Ophiura echinata*, Lam., *Stella granulata*, Link.). Blackish; disc granulated above; rays echinato-spinose; spines thick, rather longer than the width of the rays. It is found in the European Seas, those of the West Indies, the Atlantic, &c.

The *Ophiura* swim and creep often with much facility in all directions, agitating the appendages of the arms in a serpent-like manner.

Euryale (*Astrophyton*, Link.; *Gorgonocephalus*, Leach), is a genus which De Blainville included with *Ophiura* in his family *Asterophidea*. It has the body regular, depressed, rather small, pentagonal, provided with five appendages or rays rounded above, flattened below, dividing, dichotomising, and attenuating more and more to the extremities, which are cirrhous. Mouth at the centre of five converging furrows, in form of holes, not extending to the circumference of the body, and bordered with papilliform suckers. (De Blainv.)

E. palmifera. Rays simple below, dichotomo-palmate at the apex; back muricated with two rows of tubercules.

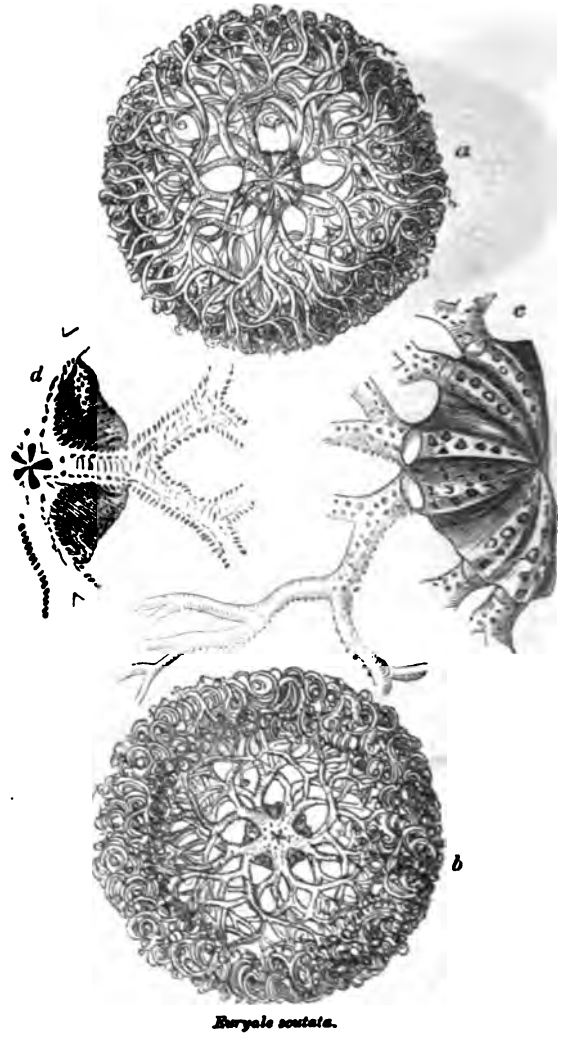


Euryale palmifera.

a, front view; *b*, centre and part of arm (front), natural size; *c*, the same (back), natural size; *d*, extremity of one arm, natural size.

E. scutata (*E. verrucosum*, Lam.; *Astrophyton scutatum*, Link.; *Astrophyton Caput Medusæ*, Linn.). Disc wide, radiated above with warty ribs; rays beneath planulate, bifariously papillose; papillæ very small and submarginal.

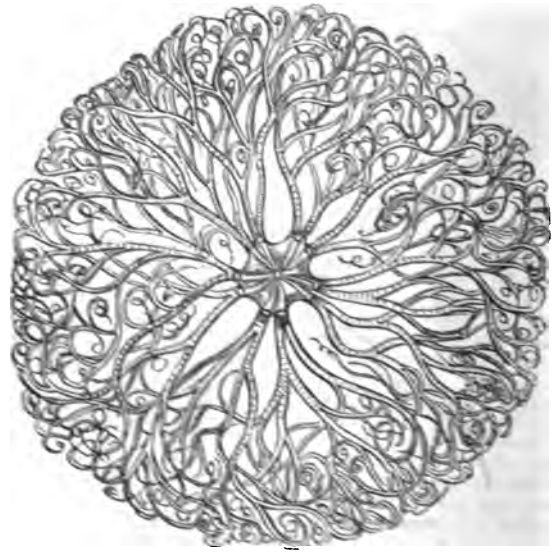
It is found in the Indian seas and those of the North. It has also been taken on the coasts of Scotland. (Forbes, 'British Star-Fishes.')



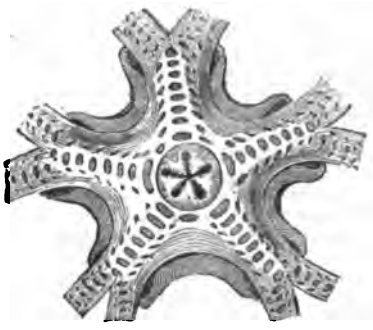
Euryale scutata.

a, back; *b*, front; *c*, central portion of back, natural size; *d*, the same (front), natural size.

E. costosa (*Astrophyton costosum*, Link.). Back of the disc with ten



Euryale costosa.



Euryale costosa.
Centre (front), natural size.

unarmed ribs in pairs, truncate at the apex; rays dichotomous, very ramose, and transversely rugose. It is found in the seas of America.

Though the species do not appear to be numerous, the form seems to be numerous in all seas. [ECHINODERMATA.]

OPHRYOESSA. [IGUANIDÆ.]

OPHRYS, a genus of Plants belonging to the natural order *Orchidaceæ*. It has a patent perianth, a variously-lobed lip without a spur. The glands of the stalks of the pollen masses each in a distinct pouch.

O. apifera, Bee-Orchis, has a tumid 5-lobed lip, the two lower lobes prominent and with a hairy base, the two intermediate reflexed, truncate, terminal, acute, elongated and reflexed; the anthers with a hooked point, the petals oblong, bluntish, downy. It is about a foot high, and has large, few, and rather distant flowers. The sepals are whitish tinged with purple. The lip is velvety, brown, variegated with yellow. It is one of the handsomest species of orchidaceous plants, native of Great Britain, and grows on chalky calcareous soils.

O. arachnites, late Spider-Orchis, is distinguished by a terminal inflexed flat rather heart-shaped appendage, and deltoid downy petals. The sepals are pink, the lip dark purple variegated with yellow and velvety, the appendage green, never reflexed. It is found on chalk downs near Folkstone and Sittingbourne in Kent.

O. aranifera, Spider-Orchis, has 3 obscure lobes, the middle lobe large, emarginate, without an appendage, the petals linear and glabrous. This species is smaller than the preceding, and with fewer flowers. The petals and sepals are green and quite glabrous. The lip is of a dark brown colour, hairy, and covered with pale or yellowish lines. It is found in chalky places in Kent and Sussex.

O. muscifera, Fly-Orchis, has an oblong trifid lip with a large pale spot in the centre, the middle lobe is elongated, bifid, the anthers short and obtuse, and the petals filiform. It is a slender plant and grows about a foot high. The petals are very narrow, and of a purple colour, the sepals green, and the lip of a purplish-brown colour, the spot in the centre of a bluish tinge. It is found in damp calcareous thickets and pastures in Great Britain.

(Babington, *Manual of British Botany.*)

OPISTHOCOMUS. [CRACIDÆ.]

OPIUM. [PAPAVER.]

OPLURUS. [IGUANIDÆ.]

OPOPANAX, a genus of Plants belonging to the natural order *Umbelliferæ*; it has an obsolete calyx, roundish entire petals rolled inwards, with a rather acute lobe; compressed fruit with a dilated convex border, bipinnate leaves with unequally cordate segments, crenated and obtuse. The umbels are compound; the involucre both universal and partial, and the flowers yellow.

O. Chironum is a native of the south of Europe and Asia Minor, on dry hills, margins of fields, and thickets. It is a plant 6 or 7 feet high, of a dull-yellowish colour, and resembling a parsnip. The stem is strongly furrowed; the leaves from 1 to 2 feet long, or more, flat, bipinnate, with ovate cordate leaflets, which are usually oblique at the base, often confluent, and surrounded by a cartilaginous crenated border. The calyx is inconspicuous, the styles rather short and stout. Although this plant is a native of the south of Europe, the resinous gum which exudes from the stalk or root when wounded is brought from the Levant and East Indies in roundish drops of a reddish-yellow colour, with specks of white. It is supposed to be an emmenagogue, but it is seldom used; it is similar in its effects to assafœtida. This is a plant of easy culture, and may be propagated either by seeds or dividing at the root.

(Don, *Dichlamydeous Plants;* Lindley, *Flora Medica.*)

OPORINIA, a genus of Plants belonging to the natural order *Compositæ*. It has a subimbricated involucre, the exterior scales much smaller in several rows, a punctured receptacle, attenuated uniform fruit; the pappus of all the fruit in one row, feathery, dilated at the base.

O. autumnalis has radical leaves, linear, lanceolate, toothed, or pinnatifid, nearly glabrous; stalk branched, scaly, and thickened upwards, the involucre glabrous or hairy. This is the *Apargia autumnalis* of Smith and the *Leontodon autumnalis* of Koch. It is a native of Great Britain in meadows and pastures and on lofty mountains.

(Babington, *Manual of British Botany.*)

OPOSSUM. [DIDELPHINA; MARSUPIATA.]

OPU'NTIA, a genus of Plants belonging to the natural order *Cactacea*. In the gardens the species are called Indian Figs, and are remarkable for their stems consisting of flat joints, broader at the upper than the lower end, but which eventually lose that appearance, becoming both cylindrical and continuous. On one of them, *O. cochenillifera*, the cochineal insect is fed, and others yield a pleasant sub-acid fruit, which is eaten in hot countries. The lavas of Ætna are in some places covered with the spiny bushes of *O. vulgaris*, whose large purple juicy fruits are carried for sale to the neighbouring markets. It is however only a naturalised plant, its native country being South America within the tropics.

O. Tuna has been figured in Dillenius's 'Hortus Elthamensis,' tab. 380, and is the original of what Linnæus called *Cactus Tuna;* it has been since called *Cactus Bonplandii* by Mr. Kunth. It differs from the two following in the long whitish spines that arm it, in its very broad oval joints, its fully-expanded flower, which resembles that of *O. Hernandezii*, except that it is larger. This is the sort which in the Jardin-des-Plantes at Paris nourishes the wild cochineal: it was brought from Peru by Dombey, and according to Humboldt is in much esteem in that country as the food of a valuable sort of cochineal.

ORANG-UTAN, or ORANG-OUTANG, names by which the *Pithecus Satyrus* of Geoffroy (*Simia Satyrus* of Linnæus), the Red Orang, is now generally designated. [APE; CHIMPANZEE.] The following are its generic characters:—

Muzzle large, elongated, somewhat rounded anteriorly; forehead sloping backwards; slight supraciliary ridges, but strong sagittal and lambdoidal crests. Facial angle 30°. Auricles small. Twelve pairs of ribs; bones of the sternum in a double alternate row. Arms reaching to the ankle-joint. No ligamentum teres in the hip joint. Feet long and narrow; hallux not extending to the end of the metacarpal bone of the adjoining toe; often wanting the ungueal phalanx and nail. Canines very large, their apices extending beyond the intervals of the opposite teeth. Intermaxillary bones anchylosed to the maxillaries during the second or permanent dentition. Height under five feet. It is an inhabitant of the islands of Borneo and Sumatra. (Owen.)

Side view of the skeletons of *Pithecus Satyrus*, young and adult. (From Owen.)

Professor Owen remarks that the young individual exhibits the anthropoid character in the relative smallness of the face to the cranium, resulting from the state of dentition, but that it corresponds with the adult skeleton in the number of ribs and in the relative proportions of the upper and lower extremities. With regard to the number of vertebræ, he observes that the figure of the adult skeleton, which was taken by permission of the board of curators from the specimen in the Museum of the Royal College of Surgeons, exhibits

the abnormal number of five lumbar vertebræ instead of four, which is the number existing in the trunk of the mature Orang preserved in the Museum of the Zoological Society of London, and in the Skeleton in the Museum of Comparative Anatomy in the Jardin-des-Plantes. The form of the living animal, and its habits in captivity, have been made familiar by several specimens which have been kept in the Gardens of the Zoological Society in the Regent's Park.

ORANGE. [CITRUS.]

ORANGE-LILY. [LILIUM.]

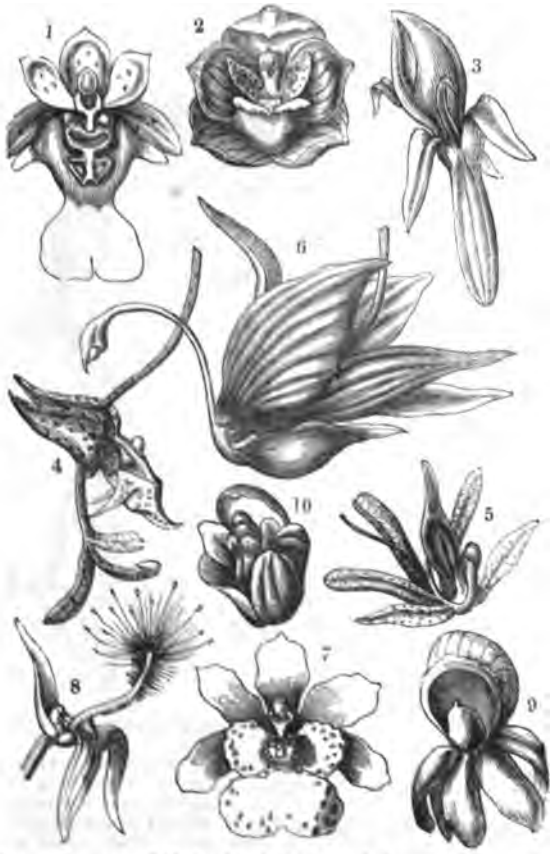
ORANGE TRIBE. [AURANTIACEÆ.]

ORBICULA. [BRACHIOPODA.]

ORBITOLITES. [MILLEPORIDÆ.]

ORCA. [CETACEA.]

ORCHIDA'CEÆ, a natural order of Endogenous Plants, with the stamens and style consolidated into a central column, and with an inferior ovary: they constitute the whole of the class *Gynandria monandria* of the Linnæan classification. There is no order of plants the structure of whose flowers is so anomalous as regards the relation borne to each other by the parts of reproduction, or so singular in respect to the form of the floral envelopes. [ONCIDIUM.] Unlike other endogenous plants, the calyx and corolla are not similar to each other in form, texture, and colour; neither have they any similitude to the changes of outline that are met with in such irregular flowers as are produced in other parts of the vegetable creation. On the contrary, by an excessive development and singular conformation of one of the petals called the labellum or lip, and by irregularities either of form, size, or direction of the other sepals and petals, by the peculiar adhesion of these parts to each other, and by the occasional suppression of a portion of them, flowers are produced so grotesque in form that it is no longer with the vegetable kingdom that they can be compared, but we are forced to search for resemblances in the animal world. Hence we have such names among our native plants as the Bee, Fly, Man, Lizard, and Butterfly Orchis, and appellations of the like nature in foreign countries. Of these things some idea may be formed by the annexed cut, where 1 represents *Oncidium raniferum*, or the Frog-Oncidium, so called because its lip bears at its base the figure of a frog couchant; 2, *Peristeria elata*, the Spirito Santo Plant of Panama, in whose flower we find the likeness of a dove in the act of descending upon the lip; 3, *Prescottia colorans*, whose lip is a fleshy hood; 4, *Gongora fulva*; 5, *Cirrhæa tristis*; 6, *Cycnoches ventricosum*, singularly like a swan, the arched column forming the head and neck; 7, *Oncidium pulvinatum*; 8, *Bolbophyllum barbigerum*; 9, *Catasetum viride*; and 10, *Peristeria cerina*.



In consequence of their singular forms, their gay colours, and the delicious fragrance of many of these plants, they have of late years been cultivated with great zeal, both in this country and abroad. [EPIPHYTES.]

Orchidaceous plants inhabit all parts of the world, except those which are excessively dry or excessively cold, both of which appear uncongenial to their nature, and they are most abundant in such as have an equable mild climate, moist and warm during the greater part of the year. Thus we have not a single species from Melville Island, or Nova Zembla, or from the upper regions of northern mountains, nor from the deserts of Africa; and the whole province of Mendoza, one of the dry western states of South America, produces but one, and that in a marsh. On the contrary, the woods of Brazil and equatorial America, of the lower ranges of the Himalayas, and of the Indian Archipelago, possess countless myriads of these productions. In general in hot countries the species are epiphytes, inhabiting the branches of trees, or the sides of rocks and stones, to which they cling by means of long twisting fleshy roots; and terrestrial species, that is to say, such as grow exclusively in the ground, are rare and unknown: in colder countries, on the contrary, the former are unknown and the latter only represent the order. Thus in North America, where Orchidaceous Plants are plentiful, the epiphytal species are almost unknown, a single species only occurring in Florida upon the branches of the *Magnolia*. Some of them are true parasites, deriving their food from the roots of trees upon which they grow. In this country we have two cases of the kind, one the *Neottia Nidus-Avis*, or Bird's-Nest Orchis, a brownish scaly plant springing up occasionally in woods, and the other the *Corallorhiza innata*, or Coral-Root, an occasional but very uncommon inhabitant of marshes.

The roots are of the following kinds:—Firstly, annual slender fibres, simple or branched, of a succulent nature, incapable of extension, and burrowing under ground, as in the genus *Orchis*. Secondly, annual fleshy tubercles, round or oblong, simple or divided, as in the various species of the same genus; they are always combined with the first, and appear, from their containing amylaceous granules in large quantity, to be intended as receptacles of matter fit for the nutrition of the plant. Tubercles of this kind have always a bud at their extremity, and may be considered the principal inferior prolongation of the axis. Thirdly, fleshy, simple, or branched perennial bodies, much entangled, tortuous, and irregular in form, as in *Corallorhiza*, *Neottia*, &c., or nearly simple and resembling tubers, as in *Gastrodia*. And fourthly, perennial round shoots, simple or a little branched, capable of extension, protruded from the stem into the air, adapted to adhering to other bodies, and formed of a woody and vascular axis covered with cellular tissue, of which the subcutaneous layer is often green and composed of large reticulated cells. The points of these roots are usually green, but sometimes red or yellow. In a very few instances of leafless species, as *Chiloschista usneoides*, they become entirely green, and then appear to perform the functions of leaves.

The stem is found in its most simple state in the terrestrial *Ophrydeæ*, where it is only a growing point, surrounded by scales and constituting a leaf-bud when at rest, which eventually grows into a secondary stem or branch, on which the leaves and flowers are developed. This kind of stem usually forms every year a lateral bud with a tubercular root at its lower end, and, having unfolded its flowers and ripened its fruit, perishes, to be succeeded by the stem belonging to the lateral bud previously prepared; hence those species to which this kind of stem belongs have always a pair of tubercles, one shrivelling and in progress of exhaustion, the other swelling and in progress of completion.

The leaves are very uncertain in their appearance: usually they are sheathing at the base, and membranous; but in *Vanilleæ* they are hard, stalked, articulated with the stem, and have no trace of a sheath. Frequently they are leathery and veinless, as frequently they are membranous and strongly ribbed, and both these conditions occur in the same genus, as in *Maxillaria* and *Cypripedium*. In a large number of the epiphytal species the leaves are notched unequally at the apex, a singular structure which has not yet been noticed in those with membranous leaves.

Their floral envelopes are constructed irregularly upon a ternary type, and consist of three exterior and three interior pieces. The exterior pieces are usually nearly equal, and less brightly coloured than the interior; but the two lateral ones are often of a somewhat different form from the other, which is anterior as the flower is placed upon the inflorescence when young, but which often becomes posterior when the flower is expanded, in consequence of the flower-stalk being twisted or curved; these parts are occasionally united by their edges into a long tube, as in *Masdevallia*, or the lateral ones adhere to the unguis of the lip in various degrees, or two of them are consolidated into one, as in *Corycium* and many other genera. Occasionally the intermediate piece is prolonged at the back or base into one or two hollow spurs, as in the genera *Satyrium* and *Disa*; still more rarely the lateral pieces are also spurred, as in *Disperis*. Various other less important modifications of the exterior pieces occur, but in all cases the whole number, three, is present. The interior pieces are usually three, never more; but in the instances of *Monomeria* and *Aviceps*, the intermediate one only is present. They are generally unequal, the two lateral pieces corresponding in form and size, while that between them, called the lip, is of some other form and size: in the genus *Thelymitra* however, and in *Paxtonia*, they are all alike. Nothing can be more variable than the proportions they bear to each

other and to the exterior pieces. It is only a few of their modifications which it seems important to notice. The lateral pieces are occasionally bifid, as in certain species of *Habenaria;* in *Megaclinium falcatum* they are glandular at the apex; in most cases they are distinct from the column; but in *Lepanthes, Gongora, Disa,* and some others, they are adnate to that organ; in no instance are they spurred or saccate. The lip is either distinct from the column or united to it, stalked at its base, or dilated there, and often extended into a bag or spur, which is sometimes, as in certain species of the genus *Epidendrum*, consolidated with the ovary; very rarely it has two spurs, as in *Diplocentrum*. In the instances of *Camarotis* and *Acropera* it is saccate at the point. Its form is infinitely varied, the extremes of variation being *Paxtonia* for simplicity, and *Coryanthes* or *Stanhopea* for complexity. These and all other complicated forms may, without difficulty, be reduced to a 3-lobed type, the simple form of which is found in *Maxillaria, Bletia,* and many Cattleyas. The lip is often so slightly articulated with the column as to swing to and fro upon the least disturbance, on which account it sometimes seems as if it were endowed with a power of spontaneous motion: this is particularly apparent in certain species of *Pterostylis*. There is a frequent tendency in the lip to produce tubercles or lamellæ upon its surface; the latter are always confined to the veins, the former are principally found near the base of the lip, and do not appear to have any relation to the veins: it is in the genus *Oncidium, Eria,* and *Zygopetalum* that these bodies, the use of which is unknown, are most conspicuous. Not unfrequently the lip is hairy, convex, and so marked and coloured as to bear no little resemblance to an insect.

It is usual to call the exterior series of floral envelopes calyx, and the interior corolla; but the analogy of *Marantaceæ* renders it probable that the so-called petals are a row of outer sterile stamens. This however is a point upon which it is not here necessary to enlarge.

The centre of the flower is occupied by a body called the column, which is formed by the consolidation of the style and true stamens. In the greater part of the order there is but one stamen present, and it is in that case placed opposite the intermediate sepal, and consequently alternate with the lateral petals: when, as in *Cypripedium*, there are two stamens present, then the usual stamen remains in its customary position, in a sterile state; and the two perfect stamens are additional, and placed right and left of it. It is supposed that in those species which have but one anther there are two other stamens present in an incomplete condition, and consolidated with the other; and from the evidence offered by monstrous formations, it is thought that such sterile stamens are represented in *Orchis* and its allies by two tubercles, one on each side of the column; in *Burlingtonia* by two auricles near the apex of the column; and by other signs in other cases. (Bauer, 'Illustrations of Orchidaceous Plants,' 4to., London, 1830-1838, with forty plates, in 4to.)

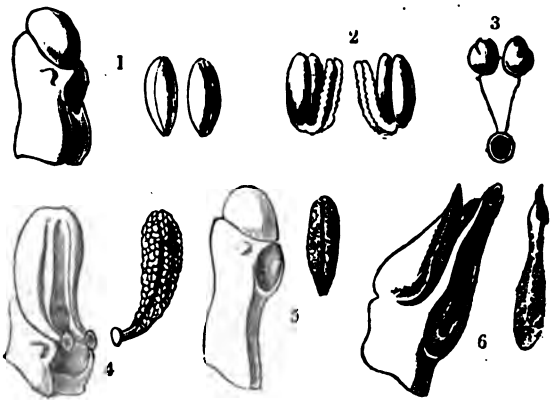
In the greater part of the order a single anther terminates the column. This is usually two-celled, but often has its cells divided into two or four other cavities by the extension of the endothecium between the lobes of the pollen masses, or is occasionally more or less completely one-celled by the absorption of the connective. In *Ophrydeæ* it is erect, with a distinct connective, and with the bases of the cells either parallel or diverging, and then its cells dehisce along their face. In *Neottieæ* it is also erect, but appears to be dorsal instead of terminal, in consequence of the stigma being placed before it for its whole length. In the remainder of the order it falls prone upon the head of the column, or the clinandrium, like a lid, and often is easily detached. Sometimes this kind of anther originates from the margin of the clinandrium; sometimes from within the margin, in which case it is occasionally covered as by a hood, as in *Cryptarrhena* and other genera.

The pollen consists of lenticular or spheroidal grains, either single or cohering in pairs, threes, or fours, or in larger masses in indefinite number. The grains are usually held together by an elastic filamentous substance, which in all *Ophrydeæ* and many others forms an axis round which the grains or masses of grains are arranged, and which in a very large part of the order assumes the appearance of a strap or caudicula. This body either contracts an adhesion with a gland originating on the margin of the stigma, as in *Ophrydeæ, Neottieæ,* and *Vandeæ*, or it is folded upon the pollen masses, as in *Epidendreæ*, or it terminates in an amorphous dilatation, as in many *Malaxideæ*. In all cases it consists of cellular tissue, sometimes very lax and large, and thin-sided, as in *Polystachya ramulosa*, more generally very compact, tough, and thick-sided; towards the end, which adheres to the stigmatic gland, the tissue becomes elongated, but otherwise it is more or less lenticular. In *Ophrydeæ* the caudicula is extended towards the base of the anther-cells; but in all the other divisions of the order the caudicula, when present, is lengthened in the direction of the apex of the cells.

The differences in the structure of the column, anther, and pollen now explained, furnish botanists with the best means of classifying the order, and of breaking it up into sub-orders, in the following manner:—

1. *Malaxideæ* (*fig.* 1), anther opercular; pollen waxy, with neither caudicula nor gland.
2. *Epidendreæ* (*fig.* 2), anther opercular; pollen waxy, with the caudicula folded back upon the pollen grains, and no gland.
3. *Vandeæ* (*fig.* 3), anther opercular; pollen waxy, with a membrano-cartilaginous caudicula and gland.

4. *Ophrydeæ* (*fig.* 4), anther erect; pollen sectile or granular.
5. *Arethuseæ* (*fig.* 5), anther opercular; pollen granular or powdery.
6. *Neottieæ* (*fig.* 6), anther dorsal; pollen powdery.
7. *Cypripedieæ*, anthers two, separated by a broad sterile lobe.



The ovary adheres firmly to the tube of the calyx, and is often so twisted, when the flower is about to expand, that its back, with the floral envelopes belonging to it, is turned to the front. It consists of three perfect carpels, stationed alternately with the stamens opposite the petals, and bearing the placentæ in their axis, and of three other pieces alternate with the first, destitute of placentæ, and eventually separating from them when the fruit is ripe.

The stigma is a viscid excavation in front of the anther, and just below it. In most cases it is quite simple, merely terminating in a glandular dilatation of the upper margin, called the rostellum. It is lined with a lax tissue composed of minute ascending jointed hairs, and has a direct communication with the cavity of the ovary, either open or only imperfectly closed up. The glandular dilatation in all *Vandeæ* and *Ophrydeæ*, and in many genera, separates from the stigma and adheres to the pollen masses; but it is also in numerous other genera at all times inseparable from it. In *Bonatea*, in *Habenaria*, and in some other genera of *Ophrydeæ*, there are two arms to the upper edge of the stigma, each arm being channelled for the reception of the caudicula of a pollen mass, and terminating in a separable gland; between these lies a membrane, very variable in size, sometimes merely a connecting web, sometimes a distinct plicature or lobe, and occasionally fornicate, and extended in the middle into a mucro.

The fruit is usually a capsule of six valves, bursting when ripe, and discharging a multitude of minute seeds, with a netted loose tunic. In *Vanilla* however and some other genera the fruit is succulent, and the seeds have a hard brittle integument immersed in aromatic pulp. The seeds apparently contain an exalbuminous embryo; but from the great minuteness of the parts this point is not yet satisfactorily determined.

Impregnation in *Orchidaceæ* was at one time thought to take place in a peculiar manner by the intussusception of the fertilising principle of the pollen grains. It has now however been proved experimentally by Brown, A. Brongniart, Morren, and the writer of this article, that it in reality takes place only by the application of pollen grains to the mucous surface of the stigma, as in other plants.

This order contains 394 genera and about 3000 species.

The following genera, which are mostly described in this work under their names, are British:—*Orchis, Gymnadenia, Aceras, Habenaria, Ophrys, Herminium, Goodyera, Spiranthes, Listera, Neottia, Epipactis, Cephalanthera, Corallorhiza, Malaxis, Sturmia, Cypripedium.*

(R. Brown, *Prodromus Floræ N. Hollandiæ*, 8vo., 1810; the same author, *Observations upon the Impregnation of Orchideæ and Asclepiadeæ*, 8vo.; Endlicher, *Genera Plantarum*, p. 185, 4to., Vienna; Lindley, *Genera and Species of Orchidaceous Plants*, 8vo.; Lindley, *Vegetable Kingdom.*)

ORCHIDALES. [ENDOGENS.]

ORCHIL. [ROCCELLA.]

ORCHIS, a genus of Plants the type of the natural order *Orchidaceæ*, and belonging to the tribe *Ophrydineæ*. The old Linnæan genus *Orchis* is now divided into many genera [ORCHIDACEÆ], but a large number of species are still retained under this designation. The tribe *Ophrydineæ* is distinguished by the pollen masses being divisible into lobes, which are waxy and definite in number. The anthers are wholly adnate. The genus *Orchis* belongs to a section of this tribe, in which the cells of the anther have a rostellate process between their bases. In *Orchis* the perianth is ringent and hooded; the lip 3-lobed, spurred; the glands of the stalks of the pollen-masses are in a common pouch. The following is an arrangement of the British species according to Babington:—

* Glands of the pollen-masses separate; lip erect in æstivation.

† Bracts mostly 1-nerved; root-knobs undivided.

‡ Lip 3-lobed; lobes broad and short.

Orchis Morio, Green-Winged Meadow-Orchis. *O. mascula*, Early Purple Orchis.

‡‡ Lip 3-lobed; middle lobe dilated, bifid, and often with an intermediate tooth.

O. fusca. O. militaris. O. Simia. O. ustulata.

†† Bracts with three or more nerves; root-knobs undivided.

O. laxiflora.

††† Bracts with three or more nerves; root-knobs palmate.

O. maculata, Spotted Palmate-Orchis. *O. latifolia*, Marsh-Orchis.

** Glands of the pollen-masses united; root-knobs undivided.

† Lip erect in æstivation.

O. pyramidalis, Pyramidal-Orchis.

†† Lip spiral in æstivation.

O. hircina, Lizard-Orchis.

(Babington, *Manual of British Botany.*)

ORDERS, a group of objects in natural history classifications, subordinate to a Class, or Sub-Class. It is however like many other general terms used very loosely, especially by zoologists. In botany it is more definitely applied, and is used synonymously with Family and Tribe. In zoology Family and Tribe are frequently employed to denote groups subordinate to orders. [FAMILIES OF PLANTS; SPECIES.]

OREOCEPHALUS. [IGUANIDÆ.]

OREOCI'NCLA, Mr. Gould's name for a genus of Birds inhabiting the Himalaya Mountains and New Zealand. The species from the latter locality (*O. macrorhyncha*) is nearly allied to, but differs from, *Turdus varius* of authors. ('Zoological Proceedings,' 1837.)

OREODAPHNE, Mountain Laurel (from ὄρειος, mountainous, and δάφνη, a laurel), a genus of Plants belonging to the natural order *Lauraceæ*. It is hermaphrodite, dicœcious, or polygamous, with a 6-parted nearly equal calyx, the limb eventually disappearing. It has 9 stamens, oblong anthers, with narrow filaments, 4-celled, the 3 inner looking outwards. The fruit is succulent, more or less immersed in a deep thick cup formed out of the altered tube of the calyx. The flowers are panicled or racemose, axillary, and occasionally umbellulate.

O. opifera is native of the woods of Para and the Rio Negro. It has oblong cuspidate leaves, tapering into the petiole, silky on the under side. The panicles are compact, divaricating, and silky. The fruit is oval in shape, and yields upon distillation a volatile oil, of a yellow colour and peculiar smell. It is used in Brazil as a remedy in pains and contractions of the limbs.

O. cupularis is a very large tree with a strong-scented wood; it has ovate elliptical leaves, acute at both ends, sometimes blunt at the apex, ending in a channelled stalk, obsoletely netted, smooth; the axils of the costal veins without pores. The flowers are in clustered few-flowered rough hoary racemes below the axillary and terminal bud. The calyx of the fruit is nearly globose. This species is the cinnamon of the Mauritius, where it grows, and also in Bourbon and Madagascar.

(Lindley, *Flora Medica.*)

OREOTRAGUS. [ANTILOPEÆ.]

ORGANIC REMAINS. By this term geologists understand the numerous remains of plants and animals which occur among the stratified rocks. The same objects receive also the names of Petrifactions and Fossils. Some of these objects are obviously parts of animals and plants, and retain their original structure, more or less altered by chemical agencies since their sepulture in the earth; others are earthy, stony, or metallic bodies, moulded within or upon parts of animals or plants, and thus resembling those parts in external aspect, but having none of their internal organic texture. Nor can we exclude from the notion of the remains of organic beings the few cases where marks of vital action and movement occur on the surface and in the interior of rocks, such as the foot-prints of reptiles on the sandstones of Cheshire and Dumfriesshire, and of birds on the Oolite rocks of America, the holes made by Lithophagous *Conchifera* in the limestone of Mendip, and the perforations of the valves of Shell-Fish by Zoophagous *Mollusca*.

In 1828, M. Adolphe Brongniart, after examining the richest collections then known of fossil plants, gave the following interesting comparative table of fossil and recent species:—

Class of Plants.	Fossil.	Recent.
Agamia	27	7,000
Cryptogamia cellulosa	2	1,500
C. vasculosa	266	1,700
Phanerogamia gymnospermia	57	150
P. monocotyledonea	49	8,000
P. dicotyledonea	100	32,000
	501	50,350

Or 1 to 100.

Organic remains may be considered in three points of view. 1, What are the tribes of animals and plants which occur imbedded in aqueous deposits of great antiquity, or (as rather improperly termed) in a fossil state? 2, In what condition are they preserved? 3, In what manner are they distributed in the earth?

Judging from published catalogues and the course of discovery, the living creation may be estimated to contain 100,000 plants, and far more than double that number of animals. In a fossil state we may say, in round numbers, that 1000 plants and 10,000 animals have been accurately discriminated and classified. The numerical proportions vary according to the groups of plants and animals selected for comparison.

In 1830 Professor Phillips drew up some comparative tables of fossil and recent animals, which were inserted in the 'Encyclopædia Metropolitana.' One of these is subjoined:—

Remains of Animals.

	In the Strata.	In superficial Accumulations.	Living estimated.
Mammalia	35	109	1,100
Cetacea	8	—	
Birds	few	few	5,000
Reptiles	71	—	2,100
Fishes	183	—	5,500
Insecta	74	—	100,000
Crustacea	104	—	500
Annulosa	104	—	1,000
Cephalopoda	788	—	100
Pteropoda	5	—	50
Gasteropoda	880	—	3,100
Conchifera	20,26	—	1,700
Tunicata	—	—	—
Radiaria	278	—	1,000
Polypiaria	476	—	1,000
	6,027	109	122,100

Or 1 to 20.

The relative proportions of recent and fossil animals and plants, taken according to their terrestrial, fresh-water, or marine residence, were thus estimated by Professor Phillips in 1836 in his 'Guide to Geology.'

	Recent.	Fossil.	Proportions.
Terrestrial Plants	59,000	500	118 to 1
Terrestrial Animals	115,500	330	350 to 1
Fresh Water Plants	100	40	2 to 1
Fresh Water Animals	3,560	260	14 to 1
Marine Plants	1,000	40	25 to 1
Marine Animals	11,750	6,065	2 to 1

The progress of discovery shows that all the tables referred to here contain estimates much below the truth; both plants and animals have been found to nearly twice the tabular numbers (fishes, for example, in 1838, were stated by Agassiz to be 800 fossil and 800 recent); but as the proportions are not very materially affected, it is not necessary to construct new tables suited to the present amount of knowledge.

The extreme paucity of terrestrial plants and animals in a fossil state is a circumstance very easily accounted for by the analogy of modern nature; for if few of the 60,000 plants and hundreds of thousands of animals find their way by inundations or other causes to modern lakes and oceans, we have no reason to expect the remains of the ancient terrestrial fauna or flora to abound in the ancient marine or lacustrine sediments. We must therefore always acknowledge the imperfection of the picture which organic remains present to us of the vegetables and animals which anciently covered the early dry land of our planet. On the other hand, the large proportion which fossil shells and *Zoophyta* bear to the corresponding recent classes (nearly as 1 to 1, if the hard parts of the recent objects are alone considered) is exactly what might à priori be expected in examining sediments from water; and we may confidently affirm that from data so ample (corroborated by fossil fishes already bearing a proportion of 1 fossil to 10 recent), the condition and character of the ancient oceans and lakes may be in a considerable degree known.

The imperfection of innumerable specimens of fossil plants, shells, fishes, &c., is not entirely nor principally owing to the chemical and mechanical agencies which have been exerted to modify their aspect and substance; on the contrary, the broken condition of many fossil trees, and the scattered situations in which their stems, leaves, and fruits occur, and in some cases the loss of part of their structure, are to be ascribed to the turbulent action which accompanied their inhumation, and to the exposure and decomposition which they had previously sustained. Among fossil bivalve shells it is very common to find the pieces separated by the decay of the hinge ligaments; not unfrequently the shells are broken; sometimes they are rolled and worn. These accidents preceded their inclusion in the rocks, and they are indications not to be mistaken of the condition of the waters in which the *Mollusca* lived, and the rate and circumstances of the deposition of sediment.

In whatever condition buried, the remains of plants and animals have been subsequently affected both by mechanical and chemical forces: the effect of the former is evident in the compressed Ammonites of Watchet, Tytherton, and Speeton, in the Goniatites and Pectens of Bradford in Yorkshire, and in the Fishes and *Ichthyosauri* of Charmouth. Some of the most interesting cases of this mechanical compression are commonly witnessed among the shales and gritstones

which cover coal; for the large cylindrical stems of *Sigillaria* and *Lepidodendron* lie flat as paper between the laminæ of shale, but appear with a depressed elliptical section when they lie obliquely across the grits, and retain their cylindrical figure whenever they stand erect in the rocks.

The conditions under which the remains of animals are presented vary very much. The conditions of preservation in which fossil plants appear may be thus classed:—

1. The plant little altered; as in the brown coal-formations of the Rhine, and in a particular case at Gristhorp near Scarborough, among the Oolites, where *Solenites Murrayana* of Lindley is found flexile, elastic, and with its tissues distinct. The same thing was observed by the author at Ardwick near Manchester, in the coal formation.

2. The plant carbonised to jet or coal. This conversion of the vegetable substance is very common in clays of every geological age; plentifully so in the coal formation.

3. The substance of the plant entirely removed from the place that it occupied, leaving a hollow where it was deposited. This happens in coarse gritstone, as near Leeds.

4. The cells of the plant filled with extraneous matter, as carbonate of lime in *Lepidodendron Harcourtii* (see the 'Fossil Flora of Great Britain'), pyrites in the fruits of Sheppey, silica in the wood of Woburn.

The remains of the animal kingdom present a parallel series:—

1. Bones of *Vertebrata* generally, scales of fishes, the coverings of *Crustacea*, are often but slightly changed from their original composition. They often retain the gelatinous parts of their mass.

2. Shells, corals, and *Echinodermata*, composed of carbonate of lime with gelatin, have in some cases (and very often among tertiary strata) not lost the whole of their gelatinous part. From this condition of little change there is every gradation observable, till (in the oolites particularly) the whole of the organic substance has been entirely removed, and a cavity is left in its place. The sides of this cavity retain the impression of the external surface of the coral or shell; and it not unfrequently happens that in the cavity once occupied by a shell is an almost unattached mass of stone, which filled the interior of the shell, and represents the figure of the animal, in several respects, perfectly.

3. Into this cavity carbonate of lime has been again introduced in solution, so as to become clearly crystallised in solitary rhomboids, or in a connected mass, replacing completely the gelatin and carbonate of lime which composed the original shell; in other cases silica, and, rarely, iron pyrites, fill up the vacuity.

4. The greensand formations show abundance of examples of the impregnation of the calcareous substance of shells, corals, and *Echinodermata*, with a siliceous infiltration.

The occurrence of organic remains is not known to be dependent on depth below the surface of the earth or on particular height above it. Fossil plants occur in our deepest collieries, and fossil shells crown very lofty points of the Alps and Pyrenees. Yet, because of the limited thickness of the strata, and the entire absence of organic reliquiæ from the granite masses below them, it is evident that at the depth of a few thousand yards below the surface, in most situations, the traces of ancient life end. In like manner, because in general the lower strata, in which few or no organic forms remain, rise to the highest ground, many mountain ranges are almost or absolutely deficient in fossils. Upon the whole these are most numerous in the lower parts of the earth's surface, because the formations there occurring are generally of a later origin than the stratified rocks which are uplifted into mountain chains.

In modern oceans the occurrence of marine *Mollusca, Zoophyta*, &c., in a living state, is either known or inferred to be limited to moderate depths, from 10 to 100 or 1000 feet; when therefore we reflect on the vast abundance of shells in the Silurian strata, buried beneath several thousand feet of old red-sandstone, or of the comparable phenomena presented by the mountain limestone shells which are covered by 3000 or 5000 feet of coal strata, we see clearly in these cases the probability (independent of the proof deduced from considering the nature and position of the rocks) of the occurrence of great upward and downward movements affecting large breadths of the ancient oceans.

Shells, fishes, and *Polypifera* affect, while living, peculiar situations; the rocky, sandy, and argillaceous parts of the sea-bed yield *Radiata* and *Mollusca* in very unequal abundance; and it is worth inquiry how far such relations and peculiarities can be discovered among fossil reliquiæ. If anciently vegetables were swept down by inundations from the land and buried in marine or fresh-water deposits, we ought to find some correspondence between these deposits and the sediments which now, in various parts of the world, are drifted with the trees and herbs to great inland lakes, estuaries, or the open sea. This expectation is justified by observation. It is almost exclusively in arenaceous and argillaceous strata, which for other reasons geologists have inferred to be detrital deposits, that we find the specimens of terrestrial herbs and trees, mostly fragmentary, and often accumulated in irregular patches. This is well seen in the arenaceous strata of the Yorkshire coast. Again, it is principally in limestones that we find the lamelliferous corals and a large proportion of the *Echinodermata*, and this is in accordance with observation of the analogous living races.

But the circumstance to which the laws of distribution of organic

remains in the earth are most distinctly and constantly related, is the antiquity of the strata. This will appear from the following brief statements.

In the oldest of all the strata known to geologists, the gneiss and mica-schist systems, which repose upon the unstratified granites and congeneric rocks, few or rather no traces of organic life appear. Hence it is that fossils appear excluded from particular geographical areas, as for example frequently from the interior parts of great mountain ranges, which are generally composed in a considerable proportion of these ancient primary strata.

On the contrary, among the more recent of the marine strata for example, the eocene tertiary strata of London and Paris, the number of organic fossils is prodigiously great. If these contrasted cases were the only ones which appeared to suggest a law that 'the number of organic fossils in the strata continually augmented from the earliest primary to the latest tertiary rocks,' they would deserve attention; but the supposition becomes changed into exact inference by comparing successively the systems of strata on a uniform plan. [GEOLOGY.]

Such being the facts with regard to the number of species of organic remains in the several systems of strata, we may next inquire as to the distribution of the several kinds of fossil plants and animals. Taking the broadest view of the subject, we may represent the distribution of the classes of plants and animals in compendious tables.

Distribution of the Classes of Plants.

Systems of Strata.	*Agamia.*	*Cryptogamia cellulosa.*	*Cryptogamia vasculosa.*	*Phanerogamia gymnospermia.*	*Phanerogamia monocotyledonea.*	*Phanerogamia dicotyledonia.*
Tertiary	*	*	*	*	*	*
Cretaceous	*	..	*	*	*	..
Oolitic	*	..	*	*	*	..
Saliferous	*	..	*	*	*	..
Carboniferous	*	..	*	..	*	..
Palæozoic	*	..	*	..	..	..
Primary	..	..	..	..	..	..

The reader will not fail to remark that the classes belonging to the columns marked ‡ below, are represented in all the fossiliferous strata, and that they all contain hard conservable parts, more abundantly than any other of the classes. They are also principally marine, some of them exclusively so. These facts should make us scrupulous in believing that the full system of ancient organic life is disclosed to us by the series of organic fossils preserved in the earth.

Distribution of the Classes of Invertebral Animals.

Systems of Strata.	*Polygastrica.*	*Porifera.*	*Polypifera.*	*Acalephæ.*	*Echinodermata.*	*Entozoa.*	*Rotifera.*	*Cirripedia.*	*Annulida.*	*Myriapoda.*	*Insecta.*	*Arachnida.*	*Crustacea.*	*Tunicata.*	*Onchifera.*	*Gasteropoda.*	*Pteropoda.*	*Cephalopoda.*
Tertiary	*	*	*	..	*	..	*	*	*	*	*	*	*	..	*	*	*	*
Cretaceous	*	*	*	..	*	..	..	*	*	..	..	..	*	..	*	*	..	*
Oolitic	..	*	*	..	*	..	..	..	..	..	*	..	*	..	*	*	..	*
Saliferous	..	..	*	..	*	..	..	..	..	..	..	..	*	..	*	*	..	*
Carboniferous	..	..	*	..	*	..	..	..	..	..	*	*	*	..	*	*	..	*
Palæozoic	..	..	*	..	*	..	..	..	..	..	..	..	*	..	*	*	..	*
Primary	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
			‡		‡								‡	‡	‡			‡

Fishes are the only class of *Vertebrata* found in all the systems of strata. Reptiles begin to appear (if not in the Carboniferous system) certainly in the next above. Birds and *Mammalia* appear locally and rarely in the Oolitic rocks. If, lastly, we enquire in what part of the series of aqueous deposits the remains of Man have been found, the answer furnished by modern observation is very different from the fanciful conjectures common in the 17th century. Then the remains of men, "evidences of the deluge" (as Scheuchzer calls his imaginary fossil man, but real fossil salamander!) [AMPHIBIA], were supposed to be common in rocks of every age; now we are not able to quote a single authentic example of any such occurrence except in loose surface

soil, sand, gravel, and caverns, in which, not uncommonly, pottery, fabricated bones, and other marks of rude civilisation accompany the reliques of our progenitors. If this absence of the bones of men from the marine strata were the only evidence which geology had to offer concerning the comparatively late creation of man, we might excuse the singular error which from time to time is revived by speculators little acquainted with the progress of science, the error of attributing to the human race, for whom the present aspect and arrangement of the globe is adapted, the same antiquity of origin as to those numerous tribes of plants and animals which became extinct before the birth of man, and were adapted to other and earlier conditions of the planet.

Distribution of the Classes of Vertebral Animals.

Systems of Strata.	*Pisces.*	*Reptilia.*	*Aves.*	*Mammalia.*
Tertiary . .	*	*	*	*
Cretaceous . .	*	*	..	..
Oolitic . . .	*	*	*	*
Saliferous . .	*	*	..	..
Carboniferous .	*	.. ?	..	..
Palæozoic . .	*	..	..	..
Primary . .	..	..	..	..

We may produce a few of the proofs necessary to the establishment of this truth, by determining first, what are the degrees of analogy to existing races presented by the organic fossils of the different systems of strata. As before observed, the remains of terrestrial plants and animals occur too rarely, and in a certain sense too accidentally, in the strata of marine origin to be of much importance in this reasoning. Taking then our examples chiefly from marine tribes, we may state that in the Palæozoic Strata none of the species are known to be now living, and about two-thirds of them belong to genera which are also extinct. Among these extinct genera are the whole group of *Trilobites*, the *Clymeniæ*, *Goniatites*, *Orthocerata*, *Phragmocerata*, &c., *Productæ*, and many lamelliferous corals.

All the species in the Carboniferous System are in the same manner extinct, and fully half of the marine tribes belong to extinct genera, often identical with those in the Palæozoic Series. Here we find some hundreds of terrestrial plants (*Lepidodendron*, *Stigmaria*, &c.), now entirely unknown among the 80,000 which botanists are acquainted with. Nearly the same proportion of the species found in the Saliferous and Oolitic Systems (about 40 per cent.) belongs to extinct genera (all the species being unknown in modern oceans). Among these genera we have the gigantic reptile forms, the Enaliosaurians, the Iguanodons, the *Megalosaurus:* the countless Cephalopods, Ammonites, and Belemnites; many *Crinoidea* and *Echinida*, besides plants approaching to *Zamia*, *Equisetum*, and tropical Ferns.

The Cretaceous System, in like manner, contains many extinct genera (*Mosasaurus*, *Turrilites*, *Scaphites*, *Ananchytes*, *Marsupites*, &c.), in which about 40 per cent. of the species yet found may be ranked. All the species are distinct from existing tribes.

But in the Tertiary Strata, which crown the series of marine deposits, a different result has rewarded the diligent comparison between fossil and recent species. The great number of shells in these deposits gives excellent means of judgment, and M. Deshayes has in consequence been able to establish very exact inferences. In the oldest of the Tertiaries (Eocene deposits of Lyell) there occur from 3 to 5 per cent. of existing species. In those of middle age (Miocene deposits) from 7 to 28 (averaging 18) per cent.; but in the uppermost series of Tertiaries (Pleiocene deposits) from 40 to 95 per cent.

Thus, by estimates, as exact as can be made, of the whole number of species, geologists are enabled to perceive clearly that the affinity between fossil and recent species of animals and plants is greatest in the most recent strata, least in the most ancient, and in general is inversely proportional to the antiquity of the strata. Not only man is absent from the fossil world of life, but nearly all the actual creation is wanting there, and is replaced by the relics of other and earlier creations.

By considering and comparing the organic remains which fill the successive systems of strata, we find that, as few living forms appear among the lower tertiaries, few or none of the tertiary forms appear in the lower parts of the Cretaceous System: this system is in the same manner distinct from the mass of the oolites, these from the red-sandstones, the latter from the carboniferous rocks, and all from the palæozoic groups.

Each of these systems of strata contains the remains of animals and plants which were in existence in the sea, in fresh waters, or on the

land, at or previous to the time of the production of those strata; and by combining the evidence derived from all, we arrive at a view, incomplete indeed, yet not necessarily inaccurate, of the succession of organic life upon the globe.

It is perhaps a common opinion that the earliest forms of life, those which occur in the fossiliferous primary (or palæozoic) rocks, are of simpler organisation than such as belong to later periods; and a conjectural view of the succession of organic life on the globe obscurely hints at a gradual complication of animal and vegetable organisations in proportion to the elapsed time. In favour of this view, the first occurrence of Fishes in the uppermost of the Silurian Strata, and the first occurrence of Reptiles in the lower beds of the Magnesian Limestone Formation deserve consideration. But, on the other hand, it is not to be concealed that the earliest fishes which do appear exhibit analogies to reptile structure, and betray no mark of inferior organisation; and the earliest remains of reptiles belong to high grades of that class.

On referring to the most ancient known British fossils, those few which lie in the slates of Snowdonia, we find them to consist of Lamelliferous *Polypifera* and *Brachiopoda*, such as *Lingula*, *Producta*, and *Spirifera*—a small assortment certainly, and thus perfectly in harmony with the view of the gradually increasing numerical amount of fossil forms already explained, but not such as to justify a statement of their inferiority of organisation. In the next stage of organic life, the Silurian System, the fossil species amount to several hundreds, and among them are many *Polypifera*, many *Echinodermata*, *Brachiopoda*, and other *Conchifera*, *Gasteropoda*, and *Cephalopoda*, with *Crustacea* and Fishes. It cannot be said that these organisations, compared with others of the same class now living, are, in any just sense, inferior or less complex; nor do we find reason to qualify this assertion while reviewing the similar and larger series of fossils from the Carboniferous System, in which Fishes become numerous and varied in structure.

If we pursue this subject, the result of our inquiries is to establish the fact of the successive introduction of all the classes and most of the great divisions of marine animals in the successive geological periods, not by the improvement or expansion of one original general type, but by addition of new organisations to meet new physical conditions of the globe.

This important result, which presents to us a series of great revolutions in organic life anterior to the desiccation of our present land (which is the bed, or rather exhibits many successively obliterated beds of the ancient seas, with their extinct inhabitants), and adapted to the chain of physical phenomena which preceded and prepared the actual arrangements of nature, may be confirmed by a brief notice of the duration of certain extinct races. By this expression it is not meant to state or to insinuate definite periods of time, but the space occupied on a scale of successive geological events, by the whole traceable duration of particular races of animals. For this purpose we shall take two genera of *Brachiopoda* (*Producta*, *Spirifera*), four of *Cephalopoda* (Goniatites, Orthoceras, Ammonites, Belemnites), three of *Crustacea* (*Calymene*, *Asaphus*, *Glyphia*), three of Fishes (*Holoptychius*, *Palæoniscus*, *Tetragonolepis*), and three of Reptiles (*Ichthyosaurus*, *Pterodactylus*, and *Mosasaurus*). The systems of strata being, as before, represented by horizontal lines, and the particular fossils ranged in vertical columns, the asteriaks denote the occurrence and geological duration of the groups.

Systems of Strata.	*Producta.*	*Spirifera.*	*Goniatites.*	*Orthoceratites.*	*Ammonites.*	*Belemnites.*	*Calymene.*	*Asaphus.*	*Glyphia.*	*Holoptychius.*	*Palæoniscus.*	*Tetragonolepis.*	*Ict. giganteus.*	*Pterodactylus.*	*Mosasaurus.*
Tertiary	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cretaceous	..	..	..	..	*	*	..	..	..	..	..	..	..	..	*
Oolitic	..	*	..	..	*	*	..	..	*	..	..	*	*	*	..
Saliferous	*	*	..	..	*	..	..	..	..	..	*	..	..	..	..
Carboniferous . . .	*	*	*	*	..	..	..	*	..	*	..	..	..	..	..
Palæozoic	*	*	*	*	..	..	*	*	..	*	..	..	..	..	..
Gneiss, &c. . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Here then is a representation of very numerous facts known to geologists, which demonstrate that each group of extinct organisation, each genus of such a group, each species of such a genus, has a definite geological range, appears at a particular point in the scale of geological events, and ceases at another point. From these facts, investigated and collected, it is a clear and positive inference that, during the period which elapsed in the production of the stratified rocks, many combinations of animals and plants—in this sense many systems of organic life—came into being and passed away, not by violent catastrophes or universal revolutions, but by partial substitutions distinctly traceable, often coincident with or consequent on

changes of the strata, and more or less referrible to previous remarkable changes in the physical condition of the globe.

From such a view, which we regard as fully established in truth, the 'Identification of Strata' by organic remains (as geologists, following Dr. William Smith, term the employment of Zoological and Botanical Evidence to determine the geological age of formations or systems of strata) follows as a natural and simple consequence. But in employing this powerful instrument of research, geologists must not overlook ascertained facts which limit the extent and modify the rigour of the application:—

1. The geographical area within which any one species of fossil has been found is limited, and seldom (except in the palæozoic strata) extends beyond a few degrees of latitude and longitude. (The same thing applies to living species.)

2. The geographical range of fossil genera and larger groups is much greater, but their geological range is also greater, and the evidence which they furnish of geological age is diminished in precision.

3. Difficulties hence arise of a very serious nature where strata really contemporaneous, or nearly so, but widely separated (as in North America and Europe), are to be compared. Of 100 species of fossils found in the cretaceous rocks of America, only two or three are identical with European species in the same rock.

4. In all cases where distant deposits are to be classed in age by their organic contents, a prudent geologist will not decide by what is called a characteristic fossil, since this may only have a local value; he will not be satisfied with a few fossils of one genus or group; he will not pronounce a positive opinion, unless several species of characteristic groups, and belonging to different organisations, are presented for examination. On such evidence, embodying the characteristic combinations of organic life for each geological period, a just and secure inference may rest, and thus employed, 'Organic Remains' become a clue to many of the darkest pages in the ancient history of our planet.

ORI'GANUM (from *ὀρίγανον*), a genus of Plants belonging to the natural order *Labiatæ*, or *Lamiaceæ*. It has an ovate tubular calyx, 10-13 nerved, striated, with nearly 5 equal teeth, the throat villous inside. The corolla has a tube equal in length to the calyx; the upper lip sub-erect, emarginate; the lower spreading, trifid, with nearly equal lobes. There are 4 protruding stamens, distant, somewhat didynamous. The lobes of the style are nearly equal. The species are herbs.

O. vulgare, Marjoram, has stalked ovate-obtuse leaves, ovate bracts longer than the calyx, the heads of the flowers roundish, panicled, and crowded. The bracts are usually purple, ovate-obtuse, and at least half as long again as the calyx. It is a native of Great Britain in dry uncultivated places, and of Europe, North of Africa, and of Middle Asia and America. It is an ornamental and aromatic plant, and yields what is sold as oil of thyme in the shops, a common remedy for toothache. It is frequently used mixed with olive oil as a stimulating liniment against baldness, in rheumatic complaints, and against strains and bruises. The dried leaves used instead of tea are very pleasant; they are likewise employed in fomentations. The essential oil is so acrid that it has been used by farmers as a caustic. It is the *'Ορίγανον μέλαν* of Theophrastus, lib. vi., cap 2, and the *'Αγριορίγανος* of Dioscorides, 3, 31.

O. heracleoticum is a very variable species, but is recognised by the bracts being longer than the calyces, by the loose spikes, and small flowers. The stamens are more or less villous, the leaves pale-green, glabrous, or pubescent. The flowers are white and one-half the size of the preceding species. This, the Winter-Sweet Marjoram, seldom ripens seed in this country, and is propagated by slips and cuttings. It requires a dry and sheltered situation. It is a native of the region of the Mediterranean, Greece, and about Odessa on the Black Sea. It has an aromatic sweet flavour, and is much used as a relishing herb in cookery. This is the *Culina gallinacea* of Pliny, 20, 16; Cato, 'De Re Rustica,' c. 127; Seren, v. 909; and the *'Ορίγανον ἡρακλεωτικὸν* of Dioscorides, 3, 29.

O. creticum (Linnæus), is the *'Ορίγανον* of Hippocrates, 'Morb. Mul.,' 1, 609; the *'Ονῆτις* of Dioscorides, 3, 30; and the *Λευκὸν ὀρίγανον* of Theophrastus, 6, 2.

O. Marjorana of Linnæus is the *Marjorana hortensis* of Moench, and the *'Αμάρακον* of Theophrastus, 'Hist. Plant.' 6, 7; the *Σάμψυχον* of Dioscorides, 3, 41. It has nearly glabrous racemosely panicled branches, petiolate oblong-ovate leaves clothed with heavy tomentum on both surfaces, oblong sessile spikelets glomerate on the branchlets. This plant is a tree or shrub in its native country, but an annual in our gardens. It is native of the North of Africa near Mascar, on hills, and of Asia, on the mountains of Kumaon. The bracts and calyces are complanate, closely imbricate. The corollas small, purplish or white. As the seed seldom ripens in this country, it is generally procured from France. When in blossom, the plant is cut and dried for winter use, as a savoury ingredient in cookery.

O. Dictamnus, the *Amaracus dictamnus* of Bentham: the *Δίκταμνος κρητικός* of Hippocrates; the *Δίκταμνον* of Theophrastus, 'Hist. Plant.,' 9, 16; and the *Δίκταμνος* of Dioscorides, 3, 37. It has almost sessile leaves, clothed with dense wool on both surfaces as well as the branches. The leaves are broad, ovate-obtuse, quite entire, rounded at the base; the floral leaves are small, almost glabrous. The corolla purple, without a spur. The heads of the flowers nutant.

O. Smyrnæum vel Syriacum is the *"Τσσωπος* of Dioscorides, 3, 27, and of Hippocrates, 'Morb. Mul.,' 3. 490. The ancient plant is usually referred to *Hyssopus officinalis*, but according to Fraas this plant does not grow in Greece, Asia Minor, or Syria. *O. sipyleum* of Linnæus is the *Μάραν* of Dioscorides, 3, 42.

(Babington, *Manual;* Lindley, *Flora Medica;* Fraas, *Synopsis Pl. Fl. Classicæ*).

ORIOLE. [MERULIDÆ.]

ORIOLI'NÆ. [MERULIDÆ.]

ORITHY'IA. [OXYSTOMÆ; ACALEPHÆ.]

ORNATI. [AMMONITES.]

ORNISMYA. [TROCHILIDÆ.]

ORNITHICHNITES, the name for the footmarks of birds impressed on the surface of sandstone in the valley of the Connecticut, first discovered by Professor Hitchcock. [GRALLATORES; BIRDS.]

ORNITHOCE'PHALUS. [PTERODACTYLE.]

ORNI'THOGALUM, a genus of Plants belonging to the natural order *Liliaceæ* and the tribe *Asphodeleæ*. It has a perianth of six patent leaves, the stamens inserted upon the receptacle, and adhering only slightly to the perianth. The anthers are incumbent, attached by their backs. The flowers are white or yellow, never blue.

O. umbellatum, Common Star of Bethlehem, has corymbose flowers, the peduncles longer than the linear-lanceolate bracts, lanceolate simple filaments, linear glabrous leaves. The flowers are white, with a broad green longitudinal band externally. It is found in meadows and pastures in Great Britain, and is the *Βολβίνη* of Theophrastus, 'Hist. Plant.' 7, 13; the *'Ορνιθόγαλον* of Dioscorides, 2, 173; and the *Bolbine alba* of Pliny, 29, 5.

O. Pyrenaicum, Spiked Star of Bethlehem, has flowers in an elongated raceme; the peduncles at first spreading, afterwards erect; lanceolate acuminate bracts; the filaments dilated below with an elongated point. The flowers are of a greenish white, the segments of the perianth variable in breadth. The leaves wither before the stalk appears; they are rarely contemporaneous. It is extremely common near Bath, and in Sussex and Bedfordshire. This species is the *'Εκιμενίδειος σκίλλα* of Theophrastus, 'Hist. Plant.' 7, 10; 7, 11.

O. nutans has but few leaves in a lax nodding raceme; the peduncles shorter than the bracts; the filaments flat, membranous, and trifid; the lateral points acute, the middle one very short, bearing the anther; the leaves linear-lanceolate; the flower large, white, and greenish externally. It is occasionally found in fields and orchards in Great Britain. It is the *Βολβὸς ἥμερικὸς* of Dioscorides, 2, 201.

O. maritimum, Squill. [SCILLA.]

(Lindley, *Flora Medica;* Babington, *Manual;* Burnett, *Outlines of Botany;* Fraas, *Synopsis*, &c.)

ORNITHO'LOGY, the science which teaches the natural history and arrangement of Birds. This term is derived from the Greek words *"Ορνις*, a bird, and *λόγος*, a discourse; signifying literally 'a discourse upon birds.' [BIRDS.]

ORNI'THOPUS, a genus of Plants belonging to the natural order *Leguminosæ*. The species are found in pastures and wild places in Europe. They are characterised, among other things, by a cluster of curved pods which are jointed something like a bird's toe, on which account they are called Bird's-Foot Trefoil. The species found in this country is a plant from two to six inches high, with pinnated leaves and small white flowers striped with red, and is of no economical importance; but in Portugal occurs the *O. sativus*, an annual growing as much as two or three feet high, with stems as succulent and nutritious as those of vetches or lucerne, and cultivated in that country as food for cattle under the name of Serradilla. It succeeds in loose sand, and is capable of yielding an abundant produce in the poorest soils.

O. purpusillus, Bird's-Foot, is a common species in Great Britain.

ORNITHORHYN'CHUS, Blumenbach's name for the extraordinary animal known as the Duck-Bill, or Duck-Billed Platypus—*Platypus anatinus* of Shaw; Mallangong, Tambreet, and (according to the French) Mouflengong, of the natives of New South Wales; Water-Mole of the English colonists.

When this animal was first described, and even after its skin was received in this country, its structure was so strange that naturalists hesitated to believe in its existence. Evidence however gradually accumulated, and fortunately fell into the hands of those capable of using it; and we now know, principally by the labours of Professor Owen, that the *Ornithorhynchus* is an ovoviviparous animal, that it suckles its young, and that its proper place is among the *Monotremata*, or Monotremes, a group to which no animal hitherto discovered belongs, excepting that which forms the subject of this article and *Echidna*. [ECHIDNA; MONOTREMES.]

Both these forms appear to have been first presented to the public by Dr. Shaw—*Echidna* under the appellation of *Myrmecophaga aculeata;* and the duck-billed animal under the name of *Platypus anatinus*. This was at the close of the 18th century; at the commencement of the present, Blumenbach described the latter form more at large under the title of *Ornithorhynchus;* and Mr. Home (afterwards Sir Everard) gave an account of some anatomical peculiarities connected with the head and beak, in 'Phil. Trans.' (1800). Sir Everard's subsequent papers on the anatomy of *Echidna* and *Ornithorhynchus* ('Phil. Trans.,' 1802) went more at large into the subject, and disclosed numerous affinities between two forms differing much in

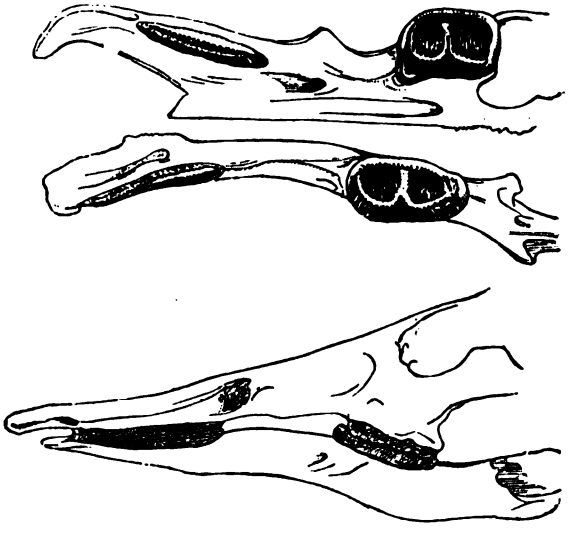
external appearance. He therefore grouped them both under the same generic name; and at the same time expressed his opinion that the generative process differed considerably from that of the true *Mammalia*, resting that opinion on the peculiarities of the organs destined for reproduction, and on the absence of nipples in both sexes, especially in the female *Ornithorhynchus*.

Geoffroy St.-Hilaire was not tardy in adopting the opinion of Sir Everard. He constituted a new order for these strange forms, and a hasty dissection having led him to conclude that the genital products of both sexes, as well as the urine and fæces, had their issue by a common outlet, he gave to that order the name of Monotremes. His inferences were that both mammary glands and nipples were wanting, and certain accounts of the discovery of eggs of the *Ornithorhynchus* strengthening his belief in the oviparous character of the Monotremes, he separated that order from the *Mammalia*.

Many different opinions were entertained by subsequent anatomists and zoologists, and it was not till the papers of Professor Owen were published that many doubtful points in the structure and habits of this animal were settled. The first of these papers, 'On the Mammary Glands of the Ornithorhynchus Paradoxus,' was read before the Royal Society (21st June, 1822), and published in 'Phil. Trans.' for 1832, part ii.; the second, 'On the Ova of the Ornithorhynchus Paradoxus,' was read before the same society on the 19th June, 1834, and is published in 'Phil. Trans.' for 1834, part ii.; and the third, 'On the Young of the Ornithorhynchus Paradoxus,' was communicated to the Zoological Society of London on the 27th May, 1834, and is published in the first volume of the 'Transactions' of that society.

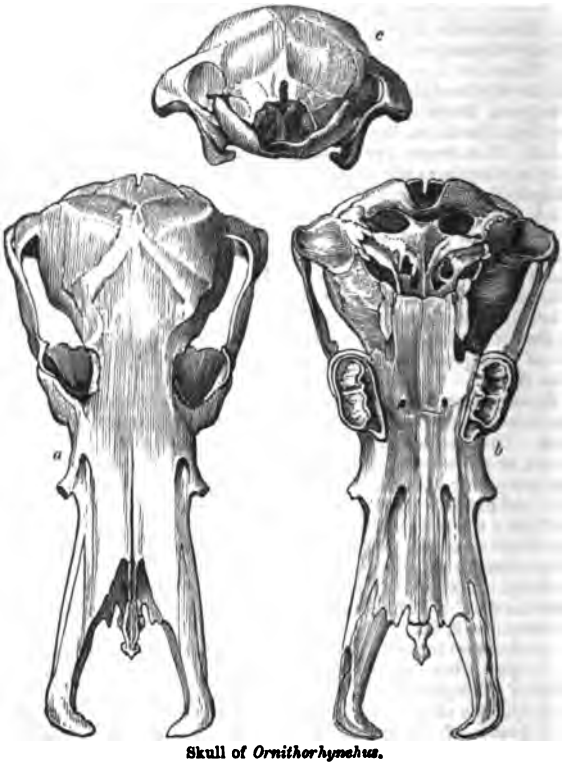
From these papers we derive the following details of the structure and economy of this creature.

The dental formula of *Ornithorhynchus* may thus be noted—molars, $\frac{2-2}{2-2} = 8$; although the organs thus noted are really not true teeth.

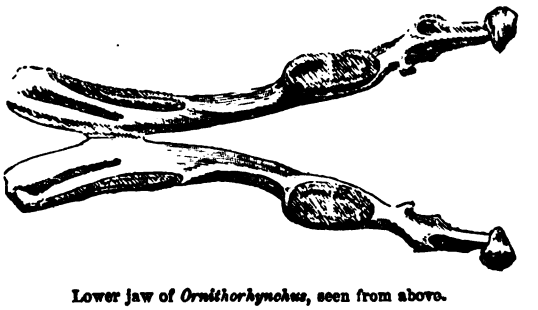


Teeth of *Ornithorhynchus*. F. Cuvier.

The cranium, though widely differing from that of other mammals, approaches more closely to the cranial type of that class, as Cuvier observes, than to any other. It is rounded, wider than it is high, and without either sagittal or occipital crest. It is narrowed and flattened between the orbits, which are small and directed upwards. The muzzle afterwards becomes flattened and widened again, and presents on each side a small hook or process above the suborbital hole; it then becomes bifurcate, and its two flattened and slightly-divaricating branches terminate each by an involute kind of hook. The zygomatic arches are rectilineal and high vertically, and at their upper border is a marked post-orbitary apophysis. Under their anterior base the maxillary bone forms a nearly horizontal flattened surface, to which the two molars adhere. Their posterior base above the glenoid facet is pierced with a hole which communicates from the temple to the occiput. The entire palate is plain, and is continued (narrowing suddenly behind the molars) to the oval holes; up to this point the septum of the nostrils remains bony. The tympanic cavities are very small, and hidden as it were under the mastoid apophysis in the form of a small crest. Cuvier could only detect in his specimens two clear sutures; that which divides the anterior hooks, and that which separates the maxillary from the palatine bones. The position, the implantation of the teeth, and the passage of the suborbital canal, well define the maxillary bone. The hook-like bones, which are as it were set in them anteriorly, appear to be the intermaxillary bones. Between them there is suspended, in the midst of the cartilages of the upper mandibles, a small bone, which has an upper plane divided into two by a furrow, a lower plane notched on each side, and a vertical plane uniting the two others. In the neighbourhood of this bone the nostrils are pierced, and it may be taken to represent the nasal bones and the palatine portion of the intermaxillary bones. In the anterior angle of the orbit is a very small lachrymal and a large suborbital hole. This last gives origin to a canal which opens in front of the small hook on the side of the muzzle; it is divided into two by the lateral cartilage of the beak. There comes besides from this canal a hole which opens in the palate under the preceding, and another which, after having formed a long canal, opens at the side of the intermaxillary bone, and consequently in the edge of the osseous beak. Between the first of these three suborbital holes, a little higher, is a small hole which communicates with the aperture of the orbit, pierced in front of the optic, and which Cuvier believes to be analogous to the anterior orbital hole. The first he thinks answers the supra-orbital hole in man. The single hole, analogous to the spheno- and pterygo-palatine, is pierced in the lower part of the orbit, a little behind the suborbital canal. It enters also in the nasal canal and in the palate near the first molar. The optic hole is very large, and the spheno-orbital equals it; the oval hole is very large and distinct. Between the two oval holes are two membranous spaces. There are behind two very large holes at the place of the condylodians, but Cuvier supposes that they comprise also the jugulars. Internally the inequalities are but little marked. The sella, which is but little elevated, is hollowed out in the middle by a longitudinal canal, and terminated backwards by a clinoid and very elevated lamina. The most curious internal part is the ethmoidal fosset, which is small, and has only a single hole of no great size for the olfactory nerve, and perhaps another very small one; on each side are spaces, purely membranous, to separate it from the canal of the suborbital nerve. The three semicircular canals project far inwards, and intercept a very remarkable hollow. Here may be traced many characters in which the skull of the *Ornithorhynchus* approaches those of birds. The bony tentorium is scarcely perceptible, but there is—and this is very remarkable—a large longitudinal osseous falx.



Skull of *Ornithorhynchus*.
a, seen from above; *b*, seen from below; *c*, seen from behind.



Lower jaw of *Ornithorhynchus*, seen from above.

In both of the Monotremes the most remarkable part of their osteology is perhaps the shoulder, which answers to that of birds, and still more to that of certain lizards. The external surface of the scapula is concave, so that it is far from adapting itself to the ribs. Its form and relative position will be better explained by the cuts than by words. The whole of what may be termed the sternal apparatus appears to be formed more after the model of the Saurians than after that of the Mammals; indeed it very much resembles that of the *Ichthyosaurus* [ICHTHYOSAURUS], and, like it, is admirably adapted for an animal destined to collect its food at the bottom of lakes and rivers, and requiring machinery to enable it to rise continually to the surface for a supply of air.

Sternal apparatus of *Ornithorhynchus*, two-thirds of the natural size.

The bones of the arm and fore arm, &c., have nothing so remarkable about them as to require particular description, especially as their conformation and relative position will be seen below; but it is deserving of notice that the carpus reminds the observer of the same part in the *Carnivora*. The number of the phalanges is the same as in the other mammals, two for the thumb and three for the fingers.

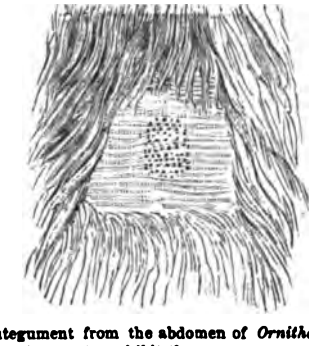
The pelvis and posterior limbs of the Monotremes are framed more according to the Marsupial type; and the animal presents the supernumerary bones which are articulated to the pubis and embedded in the muscles of the abdomen, and are characteristic of that group. Their locality is the same and they are as well developed as in the Opossum. [MARSUPIATA.] They are remarkable for the width of their base, which occupies nearly the whole of the anterior border of the pubis. But besides these marsupial bones there are in the external part of the pubis of the *Ornithorhynchus* two external pointed apophyses, one directed outwards, the other forwards. The ossa ilii are short, prismatic, and a little enlarged on their anterior border; the pointed tuberosities of the ossa ischii are directed backwards, and the ischium itself is not soldered to the sacrum as in the other *Edentata*; the three bones join as usual at the cotyloid fossa, but it is to be remarked that the pubis and ischion equally concur to form the symphysis, so that this part of the pelvis is very large and divided crucially by their suture. The oval holes are moderate and very nearly round. The cotyloid fossa is not notched on the side of the oval hole; but in the *Echidna* its bottom is not ossified, and a great aperture is left in that part of the skeleton.

Skeleton of *Ornithorhynchus*: *a*, the supernumerary bones.

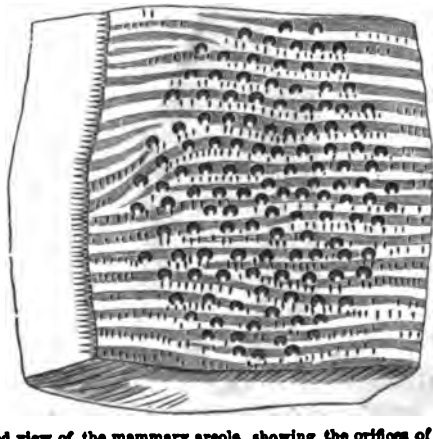
Though the anterior part of the sternum and shoulder in the Monotremes bears a resemblance to those of the Lizards, the rest of that portion of the skeleton exhibits a conformation analogous to that of quadrupeds. The composition of the sternum is effected by successive pieces, and not by a cartilaginous dilatation as in the Saurians, or a disc composed originally of five pieces, as in Birds. There are four of these pieces, without reckoning either the Y-shaped bone or the xiphoid cartilage, which in the *Ornithorhynchus* is ossified and forms a fifth, making six in all. The piece which immediately follows the Y-shaped bone is larger than the others, and in the *Ornithorhynchus* exhibits traces of longitudinal division. The sternal portion of the ribs is ossified as well as the other, as in Birds, and is joined to the sternum by a cartilaginous portion, but there is no recurrent apophysis to the dorsal ribs as in Birds. The sternal portion of the fifth and sixth ribs is very much dilated in the *Echidna*, and it is also very much dilated but not ossified in the first five or six false ribs; these dilatations extend as far as the eighth in the *Ornithorhynchus*, and become imbricated or laid over each other like tiles. In both genera the last three false ribs have only very small inferior portions. In *Echidna* there are six true and nine false ribs on each side; in *Ornithorhynchus* there are two more false ribs, but only two lumbar vertebræ, whilst *Echidna* has three. Both genera have seven cervical vertebræ, like the rest of the Mammals. In *Echidna* they are flat below, but have a sort of median crest in that direction in *Ornithorhynchus*, and in the latter, even in the adult state, may be still discerned the sutures which unite the transverse apophyses to the body of the vertebræ; here again is an analogy to the Reptiles. The first four dorsal vertebræ in the latter genus have also small inferior crests, which are wanting in *Echidna*; and in the caudal vertebræ a still greater difference exists—*Echidna* has only twelve, rapidly diminishing conically, whilst *Ornithorhynchus* has twenty at least, with large and dilated transverse apophyses, forming a depressed tail, which reminds the observer of that of the Beaver. The spinous processes throughout have but little elevation, especially in *Ornithorhynchus*. The vertebræ, with the exception of those of the neck, do not retain the sutures which join their parts longer than those of other Mammals.

In the Museum of the Royal College of Surgeons in London are preparations displaying the internal structure of the *Ornithorhynchus*. The cardiac and pyloric orifices of the stomach are closely approximated, as in the stomachs of birds. The greater part of the cavity extends beyond these orifices, and increases as it descends into the abdomen. The parietes are thin; the two layers of muscular fibres run in opposite directions, and are thickest along the curvature of the pylorus. The intestines terminate in a common cloaca.

The reproductive system is very characteristic of these animals. In five apparently adult and full-grown *Ornithorhynchi* examined by Professor Owen, the mammary glands presented as many different degrees of development. The number of lobes composing each gland amounted from 150 to 200; they were elongated, sub-cylindrical, disposed in an oblong flattened mass, and converged to a small oval areola situated in the abdominal integument between 3 and 4 inches anterior to the cloaca, and about an inch from the mesial line. The lobes in the smaller glands preserved the same breadth to near the points of insertion, but in the larger ones they were broadest at the free extremity, measuring three or four lines across, and becoming narrower to about one-third from the point of insertion, where they ended in slender ducts. The lobes were almost all situated to the outer side of the areola, and consequently converged towards the mesial line of the body. The panniculus carnosus was interposed between the glands and the integument, closely adhering to the latter, but connected with the glands by loose cellular membrane. This muscle was here nearly a line in thickness; its fibres were longitudinal, and separating, left an elliptical space for the passage of the ducts of the gland to the areola.



Portion of the integument from the abdomen of *Ornithorhynchus paradoxus*, with the hairs removed so as to exhibit the mammary areola. (Owen, 'Philosophical Transactions.')



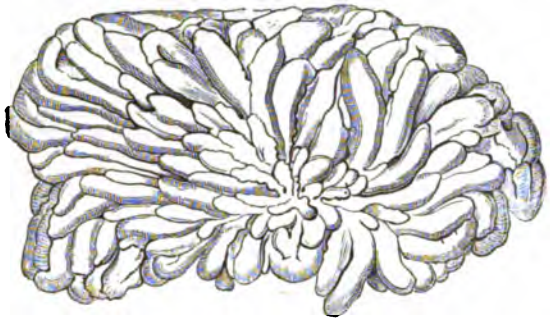
Magnified view of the mammary areola, showing the orifices of the ducts of the glandular lobules. (Owen, 'Philosophical Transactions.')

From the minuteness of the orifices of the ducts in the specimens with the small glands, the situation of the areola could hardly be detected without previously dissecting the gland; whilst in those in which the glands are fully developed, the areola is easily discovered on the removal of the hair by a practical eye.

Professor Owen states that, on compressing the glands in a specimen in the Museum of the Zoological Society of London, where they had arrived at the maximum of development, minute drops of a yellowish oil, which afforded neither perceptible taste nor smell, except what was derived from the preserving liquor, escaped from those orifices.

The differences in the state of the female organs of generation observed in the *Ornithorhynchi*, presenting the different conditions of the abdominal glands above described, were such as to indicate that the period of the full activity of those glands was subsequent to that of the uterine functions; whereas, on the hypothesis of their being scent-glands, the relation should have been reversed.

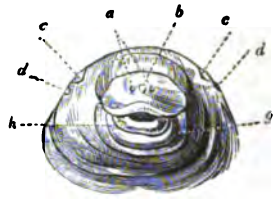
The following cut exhibits the mammary gland fully developed.



Mammary Gland of *Ornithorhynchus*, reduced below the natural size. (Owen, Philosophical Transactions.')

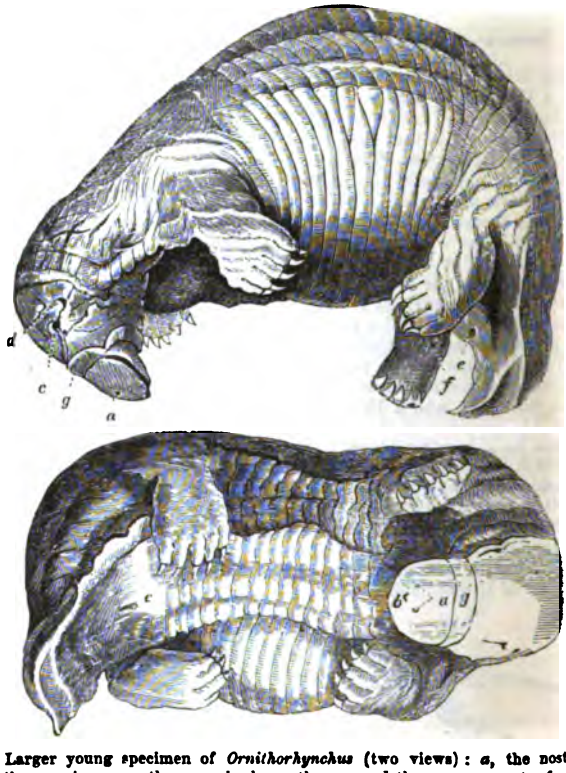
The female organs are well displayed in the preparations preserved in the Museum of the Royal College of Surgeons. The most remarkable feature in this part of the structure of this creature is the double uterus which open like the os tincæ in the *Mammalia*, and like the oviduct in the Turtle (*Chelonia Mydas*). In the common external passage of the cloaca the clitoris is situated, which has an elongated preputium: the clitoris is bilobed. The season of sexual congress is at the latter end of September or the beginning of the month of October. The precise period of gestation and the condition of the excluded product, strictly speaking, still remain to be determined; but in the first week in December, Mr. G. Bennett found in a nest of an *Ornithorhynchus* three small naked embryoes, not quite two inches in length, and which he therefore supposed, with apparently good ground, to have been recently born. The young *Ornithorhynchi* were not preserved, for want of the necessary means of preservation. But Dr. Hume Weatherhead presented to the Zoological Society of London two young specimens a little further advanced than those found by Mr. Bennett. They were of different sizes. The smallest rather exceeded two inches in length, measured from the end of the bill to the end of the tail in a straight line. The largest was double that size, and was one of the two young *Ornithorhynchi* taken with the mother from a nest on the banks of the Fish River by Lieutenant the Honourable Lauderdale Maule, and kept alive for about a fortnight by that gentleman. These specimens were placed in the hands of Professor Owen for examination, and form the subject of his paper in the first volume of the 'Transactions of the Zoological Society.' Our

Smaller specimen of young *Ornithorhynchus*; *a*, nostrils; *b*, prominence on the upper beak; *e*, the vent; *f*, the orifice and rudimentary spur of the hind foot.



Front view of mandibles of the same, a little open to show the tongue; *a*, nostrils; *b*, prominence of the upper beak; *c*, the eyes; *d*, the ears; *g*, the membrane at the base of the mandibles; *h*, the tongue.

Magnified figure of the hind foot of the female, showing the rudimentary spur, *f*, projecting from the socket.



Larger young specimen of *Ornithorhynchus* (two views): *a*, the nostrils; *b*, the prominence on the upper beak; *c*, the eyes; *d*, the ears; *e*, vent; *f*, orifice and rudimentary spur of hind foot; *g*, membrane at the base of the mandibles. (Owen, 'Zoological Transactions.')

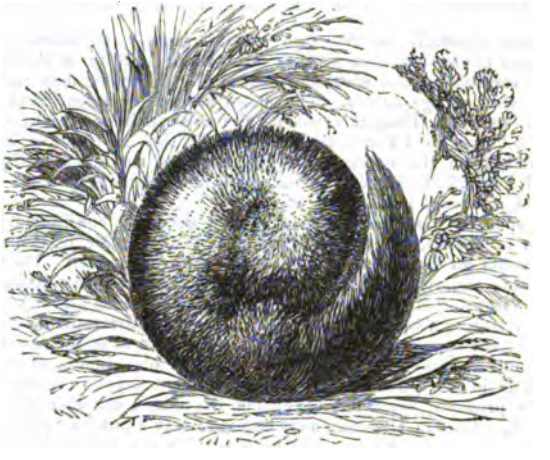
limits will not permit us to follow the Professor throughout this interesting memoir, to which we refer our readers; but there are some points which must be noticed. The stomach of the larger specimen was found full of coagulated milk. On carefully inspecting the whole contents with a lens, no portions of worms or bread could be detected; which, Professor Owen observes, solves the doubt entertained by Lieutenant Maule as to whether the mother nourished this young one with the food which was given to her for her own support, or with the secretion afterwards discovered to escape from the mammary pores; for the mother having been killed by accident on the 14th day after her captivity, it was observed, on skinning her while yet warm, that milk oozed through the fur on the stomach. A portion of the coagulated milk from the stomach of the young one was diluted with water and examined by Professor Owen under a high magnifying power, in comparison with a portion of cow's milk coagulated by spirit and similarly diluted. The ultimate globules of the Ornithorhynchus's milk were distinctly perceptible, detaching themselves from

the small coherent masses to form new groups; the corresponding globules of the cow's milk were of larger size. With the milk globules of the *Ornithorhynchus* minute transparent globules of oil were intermixed. So far the experiment may be considered to have been decisive; but to prevent the possibility of doubt, Professor Owen took a little mucus, and added a drop of water to it, when it instantly became opaque; and its minutest divisions under the microscope were into transparent angular flakes, entirely different from the regularly-formed granules of the milk of the *Ornithorhynchus*.

The circumstances particularly worthy of attention in these young animals are the total absence of hair, the soft and flexible condition of the mandibles, and the shortness of these parts in proportion to their breadth as compared with the adult, as Professor Owen pointed out. The tongue, which in the adult is lodged far back in the mouth, advances in the young animal close to the end of the lower mandible, and its breadth is only one line less in an individual four inches in length than it is in fully grown animals; a disproportionate development which is plainly indicative, as Professor Owen remarks, of the importance of the organ to the young *Ornithorhynchus*, both in receiving and swallowing its food.

With regard to their food and habits, Lieutenant Maule says he fed the female which he kept in captivity on worms and bread and milk. Mr. G. Bennett, in his paper 'On the History and Habits of the Ornithorhynchus Paradoxus' ('Zool. Trans.,' vol. i.), gives the following account of one when feeding, which he had secured by a cord fastened to the hind leg:—"It was exceedingly lively, swam in the centre of the stream, and appeared in excellent health and spirits. The water at one part of the river being very clear, I saw its motions distinctly under the water. On diving, it sank speedily to the bottom, swam there for a short distance, and then rose again to the surface; it ranged the banks, guiding itself in its progress according to the impressions received by the mandibles, which appeared to me to be used by it as very delicate organs of touch. It seemed to feed well; for whenever it inserted its beak into the mud, it evidently procured some food from thence, as, on raising the head, after withdrawing the beak, the mandibles were seen in lateral motion, as is usual when the animal masticates. Although several insects were basking and fluttering about the surface of the water, close to it, no attempt was made to capture them, either from its not seeing them, or from its preferring the food which the mud afforded. The motions of the mandibles in this animal, when seeking its food in the mud and water, are the same as those of a duck when feeding in similar situations. After feeding, it would lie sometimes on the grassy bank, and at others partly in and partly out of the water, combing and cleaning its coat as usual with the claws of the hind feet. After permitting it to swim, feed, and clean itself for an hour, it was replaced, although with great reluctance on its own part, in its box; it did not however, as before, betake itself to repose, but commenced and continued a scratching on the sides of the box." The same author states that these animals feed on the minute *Testacea* which may be found about the water-plants and in rivers. On examining the cheek-pouches or the stomachs of these animals, he always observed the food to consist of river insects, very small shell-fish, &c., which were constantly found comminuted and mingled with mud or gravel, probably to aid digestion. River weeds have also been found in their pouches, and the natives say they feed on them also. In the Museum of the Royal College of Surgeons are preserved the débris of insects belonging to a genus of the *Nauceridæ*, which were found in the cheek-pouches of an *Ornithorhynchus*. ('Physiological Series,' No. 541, B.) We owe to Mr. G. Bennett, who has contributed so much to our knowledge of the natural history of this and other scarce animals, a description of the burrows of these extraordinary creatures. They were traced up a bank of a river, where, amongst some long grass, the entrance of a burrow was discovered, and the internal construction of it was laid open by digging. The entrance was large, particularly when compared with the width of the passage continued from it, measuring 1 foot 3 inches in depth, and 1 foot 1 inch in breadth. As it receded from the entrance, the burrow became narrower, being about the usual breadth of the animal when uncontracted. "After having traced it," continues Mr. Bennett, "for the distance of 10 feet 4 inches, and having just delved down upon it so as to perceive it still continuing its course up the bank, the beak and head of a Water Mole were seen protruding for an instant from the upper part, as if it had been disturbed from its repose, and had come down to see what we were about with its habitation. It only remained for an instant; for, as soon as it beheld us, . . . it immediately turned up to take refuge in that part of the burrow which yet remained unexplored. In turning round however it was seized by the hind leg and dragged out. The animal appeared very much alarmed when it was hauled out of its subterraneous dwelling; it discharged its urine (which had rather a strong odour) and its fæces, when first caught, which I attributed to fear, for this is not usual with other living specimens that I have since seen. It uttered no sound, nor did it attempt to bite; and proved to be a full-grown female. When I held the unfortunate *Platypus* in my hands, its bright little eyes glistened, and the orifices of the ears were expanded and contracted alternately, as if eager to catch the slightest sound, while its heart palpitated violently with fear and anxiety. . . . This animal uttered, when disturbed from its sleep, a noise something like the

Ornithorhynchus feeding. (Bennett, 'Trans. Zool. Soc.')



Ornithorhynchus sleeping. (Bennett.)

Ornithorhynchus combing itself with its claws. (Bennett.)

growl of a puppy, but perhaps in a softer and more harmonious key. Although quiet for the greatest part of the day, it made efforts to escape, and uttered a growling noise during the night." But we must return to the burrow, the distance of the entrance of which from the

water's edge was 5 feet. It ran up the bank in a serpentine course, approaching nearer to the surface of the earth towards its termination, at which part the nest, composed of dried grass, and weeds strewed over the floor, is situated; but none had been as yet made in this burrow. The termination, of the form shown in the cut, measured 1 foot in length by 6 inches in breadth. Mr. Bennett found the whole extent of the burrow, from the entrance to the termination, to be 20 feet by actual measurement. He observes that the burrows are situated above the usual river height, but do not appear to be above the extensive floods of the river, which frequently take place during the winter season.

Burrow of *Ornithorhynchus*. (Reduced from Bennett, 'Zool. Trans.')

Authors generally describe two species, namely, *Ornithorhynchus rufus*, and *Ornithorhynchus fuscus;* but the probability is that they are but varieties of one species, if indeed the difference may not be merely that of age or sex. The males are rather larger than the females, and Mr. Bennett considers the average length to be from 1 foot 6 inches to 1 foot 8 inches. A male shot in the Yas River measured, from the extremity of the mandible to the extremity of the tail, 1 foot 7½ inches, and a female shot in the same river was 1 foot 7 inches, measured in the same way.

The spur of the male has been pretty generally considered as a weapon of offence, and a very venomous one; but Mr. G. Bennett's experiments go far to prove that this idea is unfounded. He thus relates his experience in the case of a wounded male just taken out of the water:—"Having heard so much related about the injurious effects resulting from a puncture by the spur, I determined to avail myself of the opportunity to ascertain the correctness of the assertion. The wounded state of the animal presented no objection to the experiment, as in one published account, in which the poison is reported to have produced such terrible effects, the animal was also mortally wounded. As soon therefore as it became lively I put its 'poisonous spurs' to the test. I commenced by placing my hands in such a manner, when seizing the animal, as to enable it, from the direction of the spurs, to use them with effect: the result was that the animal made strenuous efforts to escape, and in these efforts scratched my hands a little with the hind claws, and even, in consequence of the position in which I held it, with the spur also. But although seized so roughly, it neither darted the spur into my hand, nor did it even make an attempt so to do. As however it had been stated that the creature throws itself on the back when it uses this weapon (a circumstance not very probable to those who have any knowledge of the animal), I tried it also in that position; but though it struggled to regain its former posture, no use was made of the hind claw. I tried several other methods of effecting the object I had in view, but as all proved futile, I am convinced that some other use must be found for the spur than as an offensive weapon. I have had several subsequent opportunities of repeating the experiments with animals not in a wounded state, and the results have been the same."

ORNUS. [FRAXINUS.]

OROBANCHA'CEÆ, *Broom-Rapes*, a natural order of Monopetalous Exogenous Plants, growing parasitically upon the roots of other species, and, as is very usual in such cases, producing no true leaves, but furnished with brown or reddish scales in their place. They have a didynamous structure, irregular flowers, and a superior ovary with four or more parietal placentæ, which spring up from the surface of the carpels in parallel lines covered with microscopical seeds containing a minute embryo lying in abundant albumen. On account of their didynamous monopetalous flowers, they are usually stationed by systematical writers in the vicinity of *Scrophulariaceæ*, but in many respects they correspond better with the typical form of *Gentianaceæ*. In this country the order is represented by the genus *Orobanche* itself, the various species of which, called Broom-Rapes, are found in fields, upon the roots of broom, furze, hemp, clover, bed-straw, &c. *O. rubra*, the handsomest of them, has hitherto been discovered only upon basalt and trap-rocks in the Hebrides and adjacent shores, and near Belfast. [OROBANCHE.] The quality of these plants seems to be generally astringent, but they have been little investigated. The order contains 12 genera and 116 species.

Orobanchaceæ.

A plant of *Anoplanthus uniflorus*. 1, a corolla slit open; 2, the ovary with its style and stigma; 3, the same, cut across to show the placentation.

OROBANCHE (from ὄροβος, a kind of vetch, and ἄγχω, to strangle, because its species grow on the roots of vetches, and were supposed to destroy them by strangulation), a genus of Plants, the type of the natural order *Orobanchaceæ*. It has 2 lateral, undivided or cloven permanent sepals; a ringent withering corolla, the upper lip concave, notched, the lower reflexed, in three unequal wavy lobes; a gland under the ovary; the anthers sagittate with the lobes pointed at the base; the filaments almost as long as the tube of the corolla, downy and glandular; the capsule ovate, pointed, with four parietal parallel placentæ. The species are parasitical, usually simple, rarely branched, scaly erect herbs. Eleven species of this genus are British.

O. major (*O. Rapum*), Greater Broom-Rape, has the sepals 2-nerved, equally bifid, nearly as long as the tube of the corolla, the corolla bell-shaped, ventricose at the base, in front arcuate; the lips wavy, obsoletely denticulated (not fringed), upper lip helmet-shaped, scarcely emarginate; sides patent, middle lobe of the lower lip much longer than the lateral lobes; the stamens inserted at the base of the corolla, glabrous below, their upper part and the style glandular pubescent. This plant is a native of Europe, growing parasitic upon broom, furze, and other shrubby leguminous plants, on a barren and dry soil. It is abundant in some parts of Great Britain. It is very bitter, and is a powerful astringent.

O. minor, Lesser Broom-Rape, has the sepals many-nerved, the lobes of the lower lip equal, the stigma bi-lobed. The lobes of the stigma are purple, the anthers yellow when dry. It is found in Europe parasitical upon the roots of the *Trifolium pratense*. Although it is sometimes very abundant, it does not appear to injure the crop of clover. It is constantly found in many parts of England with the clover crops.

O. rubra has the corolla glandular, pubescent externally, and the upper lip internally, the lips acutely denticulated, the stamens inserted near the base of the corolla. It is a native of the north of Ireland and of Cornwall in England. It has a sweet scent, and is found parasitical upon the *Thymus Serpyllum*, Common Thyme.

O. caryophyllacea has the corolla tubular, bell-shaped, curved on the back; the stamens inserted above the base; the corolla hairy within. The stigmas are of a dark purple, the anthers at first purple, yellow when dry. It has been found in Siberia and Italy, and on the Himalaya. It has been found also in the county of Kent in England, where it is parasitic on the roots of *Galium Mollugo*.

O. elatior has the corolla curved, tubular, slightly compressed above; the upper lip 2-lobed, toothed; the lobes inflexed; the stigma yellow. It is a native of Europe, and is parasitical on the *Centaurea Scabiosa*. It grows in Great Britain, but is a rare plant.

O. Hederæ has the middle lobe of the lower lip of the corolla longest; the stigma yellow. Found in Europe, parasitical upon Ivy (*Hedera Helix*).

O. cærulea has a calyx of 4 sepals, tubular, with triangular subulate teeth shorter than the tube of the corolla; the corolla tubular, slightly curved in front, the middle of the tube compressed on the back; the throat slightly inflated externally; glandular lobes of the lips obtuse with reflexed margins, lower lip hairy within, suture of the anther hairy. It is a native of Europe, in Austria, Italy, Germany, and the

south of France. It has been rarely found in Great Britain in the fields of Hampshire and Norfolk, and in Jersey. The flowers have a bluish colour.

O. ramosa has a calyx of 4 sepals, tubular, with triangular ovate acuminate teeth, the anthers glabrous, the stem branched. This plant is a native of Europe, and has been found in Great Britain in Norfolk and Suffolk, where it grows on the roots of hemp and the *Galeopsis Tetrahit*.

The other British species are—*O. amethystea*, parasitical on *Daucus Carota*. *O. Picridis*, found upon *Picris*. *O. arenaira*, on *Achillæa millefolium*.

(Babington, *Manual of British Botany*.)

OROBUS, a genus of Plants belonging to the natural order *Leguminosæ* and the tribe *Viciæ*. It has a style linear, cylindrical, and downy above; the calyx is obtuse at the base, its upper segments being deepest and shortest.

O. tuberosus, the Tuberous Bitter Vetch, is a smooth plant with winged stem; leaves with 2-3 pair of elliptico-lanceolate mucronate dotted leaflets; the peduncles few-flowered, hardly exceeding the length of the leaves; the teeth of the calyx unequal, ovate, bluntish, shorter than the tube; the legumes terete and obsoletely reticulated; the style joined and the seeds globose. This plant is a native throughout Europe, and is abundant in Great Britain. It has creeping roots, which swell out into tubers at irregular intervals. The tubers are highly esteemed in the Highlands of Scotland, where they are called Cormeille; the inhabitants dry them and chew them, in order to give a better relish to their whiskey; and they are also supposed to be good against diseases of the lungs, and to prevent hunger and thirst in those who chew them. In Breadalbane and Ross-shire they bruise and steep them, and distil an agreeable fermented liquor. The tubers have a sweet taste, something like liquorice, and when boiled are not unpleasant. They have been used as food in times of scarcity. In Holland and Belgium they are roasted and eaten in the same manner as chestnuts. In England this plant is also known by the names of Wood-Pea and Heath-Pea, and in Scotland Knapperta.

O. luteus, Yellow Bitter Vetch, is a smooth plant with simple angular stems, 3-5 pairs of leaflets, roundish semi-sagittate stipules, elongated many-flowered peduncles, equal in length to the leaves; the legumes compressed, the seeds globose. This plant is a native of the Alps of Switzerland, France, Italy, and Siberia. It has handsome orange and yellow flowers, and Haller has expressed his opinion that it is the handsomest of all the plants with papilionaceous flowers.

O. niger, Black Bitter Vetch, has pinnate leaves with from 3-6 ovate or elliptical leaflets; linear-lanceolate acute stipules; with an angular, erect, and branched stem. It is a native of subalpine districts in Europe. It is found in Forfarshire and Inverness-shire in Scotland. The flowers are purple, and the plant turns quite black on drying.

There are about 40 other described species of *Orobus*. They are all of them elegant-flowering plants, and being hardy, may be cultivated on the open flower-border.

ORONTIACEÆ, *Orontiads*, a natural order of Endogenous Plants, under which Lindley, in his 'Vegetable Kingdom,' includes the *Acorineæ* of Link and other authors. This order embraces the genera *Calla*, *Orontium*, and *Acorus*, which are the types of three separate tribes. They are related to *Juncaceæ*, *Liliaceæ*, *Piperaceæ*, and *Araceæ*. It contains 13 genera and 70 species. Some of the species are used by man. *Symplocarpus fœtidus*, the Skunk Cabbage, yields a fetid volatile oil. The rootstocks of *Calla palustris* are eatable. [ACORINÆ.]

(Lindley, *Vegetable Kingdom*.)

ORPHEUS. [MERULIDÆ.]

ORPIMENT. [ARSENIC.]

ORPINE. [SEDUM.]

ORRIS-ROOT. [IRIS.]

ORTALIDA. [CRACIDÆ.]

ORTHAGORISCUS, a genus of Plectognathous Fishes belonging to the family *Gymnodontidæ*. On account of their round form the species are called Sun-Fishes. The genus has the following characters:—Jaws undivided, forming a cutting edge; body compressed, deep for its length, short, truncated, without spines; tail short and very high vertically; rays of the dorsal and anal fins long and pointed, both united at the caudal fin at the base. Two species of this curious genus have been taken on the British coasts.

O. mola, the Short Sun-Fish, the Molebut, although only occasionally seen, has been taken around all the shores of Great Britain. When observed in our seas they have generally appeared as though they were dead or dying, and floating along on one side, presenting the broad surface of the other side to view. This seems to be a natural position.

O. oblongus, the Oblong Sun-Fish, Oblong Tetrodon, Truncated Sun-Fish. This fish is larger, longer, and rarer than the last.

(Yarrell, *British Fishes*.)

ORTHITE, a Mineral consisting of Silicate of Cerium, Iron, &c. This mineral occurs in minute, slender, columnar imbedded masses. Fracture conchoidal. Hardness 6·0 to 7·0. Colour gray, inclining to black. Streak brownish-gray. Lustre vitreous. Opaque. Specific gravity 3·288. Before the blow-pipe it swells and fuses into a blackish globule; with borax it gives a transparent glass; gelatinises in acids, and yields a solution of cerium. It is found at Finbo, near Fahlun in Sweden, and also in Greenland, &c. The analysis of the mineral from Finbo, by Berzelius, gives—

Silica	36·25
Protoxide of Cerium	17·39
Protoxide of Iron	11·42
Alumina	14·00
Lime	4·89
Yttria	3·80
Oxide of Manganese	1·36
Water	8·70
	——97·81

ORTHOCERAS. [ORTHOCERATIDÆ.]

ORTHOCERATIDÆ, a family of Cephalopodous *Mollusca*. It has the following characters:—Shell straight, curved, or discoidal; body-chamber small; aperture contracted, sometimes extremely narrow; siphuncle complicated. This family is fossil. It includes the genera *Orthoceras*, *Gomphoceras*, *Ormoceras*, *Phragmoceras*, *Cyrtoceras*, *Gyroceras*, and *Ascoceras*.

The *Orthoceratidæ* are connected on the one side with *Nautilidæ*, and on the other with *Ammonitidæ*. These families are all many-chambered, and have been called *Cephalopoda polythalamacea*.

Three principal considerations have guided the geological naturalists, to whom principally the divisions of the Nautiloidal *Cephalopoda* are due, in the arrangements which they have proposed:—

1. The spirality of the shell. In *Nautilus* it is involute or convolute; in *Orthoceras* straight; and between perfect involution and absolute straightness we have every degree of curvature.

2. The form in which the septa, whereby the cavity becomes concamerated, meet the inner surface of the shell. In most *Nautili* this is a gentle and simple curve; in many *Orthocerata* it is waved; in many *Clymenia* undulated, or deeply and angularly notched.

3. The situation of the siphuncle on the disc of the septa. In most *Nautili* the siphuncle is nearly in the centre of the disc; in *Clymenia* it is on or near the inner or ventral edge; in *Cyrtoceras* generally near to the outer or dorsal line.

To these Mr. C. Stokes ('Geol. Proceedings') has added, in the case of the *Orthocerata*, the consideration of the form of the siphuncle itself; and Mr. Broderip ('Silurian Researches') has noticed, in the character of *Phragmoceras*, the form of the aperture and last chamber.

It is difficult to be satisfied, while attempting the arrangement of Nautiloidal *Polythalamacea*, with following out to its remote consequences any one of these principles exclusively. From the general figure we derive three main groups, namely:—

A. Orthocerata, &c. Straight.

B. Cyrtocerata, &c. Incurved or convoluted near the apex, ending in a straight or recurved limb.

C. Nautili, &c. Altogether convoluted.

A. To subdivide these groups, we may take in *Orthocerata*, not the septal edge, but the siphuncular structure; and, with Mr Stokes, separate *Ormoceras*, because of its tumid interruptal siphuncle; and, with Bronn, *Actinoceras*, because of its radiating siphuncular processes. Species of *Ormoceras* belong to the Upper Palæozoic Strata generally, namely, to the Upper Silurian Rocks of Murchison, the Devonian and Carboniferous Systems in Europe and North America, above which they are unknown. *Actinocerata* have the same or a more limited range. *Orthoceratites* proper (excluding curved species, like *O. paradoxicum*, Sow.), have the same geological range, and exhibit so great variation in the form of the cone, the disposition of the septa, and situation of the siphuncle, as to furnish many helps to recognise the otherwise undistinguishable forms of the numerous species which fill the older rocks.

Orthoceras lsterale.

For example, the cone is nearly a circular base, the septa are transverse, and the siphuncle is nearly central, in *O. giganteum* and *O. cinctum* of the Mountain Limestone; the cone has an elliptic base, oblique septa, and an excentric siphuncle, in *O. laterale*, *O. Breynii* of the Mountain Limestone, and *O. imbricatum* of the Ludlow Rocks.

The last chamber and the mouth also vary in form. In one species from the Ludlow Rocks the form of these parts has suggested to Mr. Sowerby the generic name of *Gomphoceras* ('Silurian Researches'); and another, from the Mountain Limestone, has received the specific designation of *O. fusiforme*.

It may be remarked that the cases are few in which the apex of *Orthocerata* has been actually observed: in several cases of supposed straight shells the apicial part is seen to be curved, and it is our conviction that this is very much more common than the heedless application of *Orthoceras* would lead to suppose.

The following are the characters of some of the genera:—

Orthoceras (ὀρθός, straight, combined with κέρας, a horn), Breynius.—A straight concamerated shell, with septa regularly concave towards

the mouth, perforated by a simple nearly cylindrical siphuncle, either in or not far removed from the centre of the disc (never marginal).

a. Last chambers cylindrical, as *O. giganteum.*

β. Last chamber contracted towards the aperture, as *O. fusiforme.*

Ormoceras (ὄρμος, a head, combined with κέρας), Stokes.—A straight concamerated shell, with septa as in *Orthoceras*, perforated by a siphuncle similarly situated, but much dilated in each chamber, and contracted at the parts where the septa are attached to it. The inner part of the siphuncle is divided into chambers, corresponding in number with the chambers, and deeply indented in the middle, where the septa of the shell are attached to them; so that one-half of each division of the siphuncle is in one chamber, and the other half in the next chamber.

The typical species are from Drummond Island, in Lake Huron. (Stokes, in 'Geol. Proceedings,' 1838, and 'Geol. Transactions,' 1840.)

Actinoceras (ἀκτίν, a ray, combined with κέρας), Stokes.—A straight conical concamerated shell, with septa as in *Orthoceras*, and siphuncle shaped, as to its external face, as in *Ormoceras*. Within the siphuncle is a continuous tube, which appears to have been capable of expansion and contraction, and is furnished with verticillate radii, which connect the tube with the walls of the siphon.

The species are from Lake Huron and other parts in North America, and Castle Espie in Ireland.

Conoceras (Bronn) is included in *Actinoceras* (Stokes).

Conularia (Miller).—A straight or slightly bent (?) pyramidal 4-sided concamerated (?) shell.

C. quadrisulcata is a common shell in what were called Transition Rocks in Sweden, Wenlock, Dudley, &c.; and a similar species occurs in the Carboniferous Rocks of Coalbrook Dale and Rutherglen.

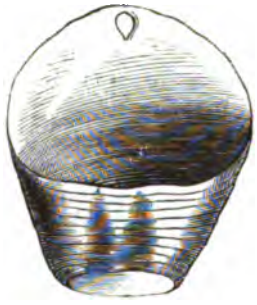
B. In classing the bent or partially convoluted *Polythalamacea*, we may find advantage in attending to the situation of the siphuncle. For example, the siphuncle is subdorsal or approaches the outer line of curvature in *Cyrtoceras* (Goldfuss) and *Gyroceras* (Meyer); it is subcentral in *Lituites* (Breyn); and it is subcentral or approaches the inner line of curvature in the genus *Phragmoceras* (Broderip).

The geological distribution of these forms is nearly as in the true *Orthocerata*. They are all peculiar to the strata below the new red system; and mostly occur below the carboniferous or Mountain Limestone. *Phragmoceras* prevails in the Ludlow Rocks; *Cyrtoceras* specially abounds in the strata of South Devon, the Eifel, and the Mountain Limestone; and *Gyroceras* and *Lituites* follow nearly the same rule; a few species of *Lituites* occur in the Silurian Rocks.

Cyrtoceras (κυρτός, curved, and κέρας, a horn), Goldfuss.—Bent, arched, or partially convoluted, the free end being sometimes elongated and straight. Septal edges seldom free from a slight waving; siphuncle subdorsal, or even marginal, seldom quite round; aperture nearly orbicular.

C. depressum is found in the Eifel.

Several other species occur in Devonshire, near Ludlow, &c.



Cyrtoceras depressum.

Gyroceras (γυρός, incurved, κέρας, a horn), Meyer.—Coiled like a tendril, so that the volutions do not touch. Septal edge even, siphuncle dorsal, marginal. Aperture nearly round.

G. gracile, Meyer. Bronn, in 'Leth. Geog.,' vol. i. fig. 6. From the slates of Dillenburg.

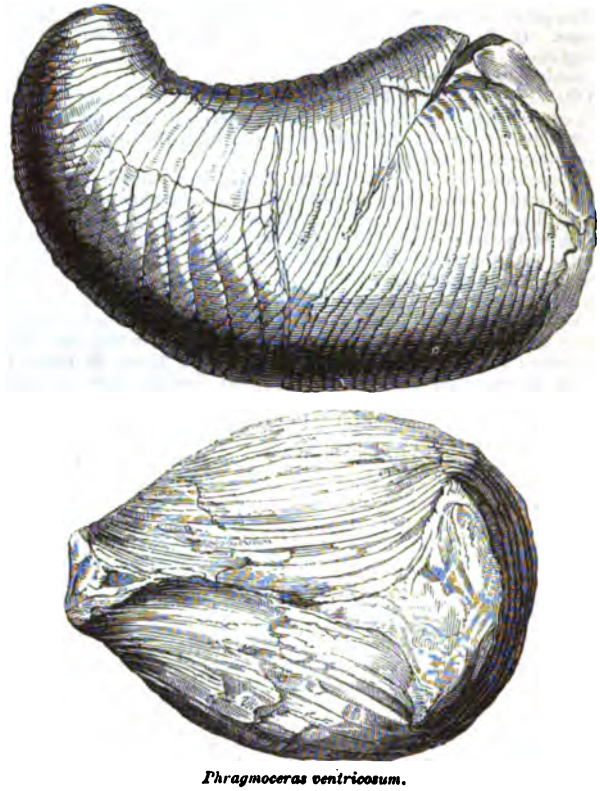
Lituites, Breyn.—Convoluted, so that the volutions touch in all the inner part, but afterwards extended into a straight or bent portion. Septa pierced by a subcentral siphuncle. Aperture nearly round.

L. articulatus, Sowerby, is an example.

Lituites articulatus.

Phragmoceras (φράγμα, septum, κέρας, a horn), Broderip.—Shell incurved and compressed, more or less conical; septal edges entire, crossed externally by the lines of growth; siphuncle near the inner margin; aperture contracted at the middle, its outer extremity produced into an elongated beak. Two figures are given below to show the singular contraction of the aperture.

P. ventricosum. Broderip, in 'Silurian Researches.'



Phragmoceras ventricosum.

C. Among the completely spiral and convoluted *Polythamacea*, the situation of the siphuncle and the form of the septa become useful guides.

The siphuncle is dorsal in some *Nautili* of the Mountain Limestone, which ought perhaps therefore to be distinguished; subcentral in most of the *Nautili* of the Oolitic, Cretaceous, and more recent deposits, as well as in recent species; ventral in *Clymenia* (Munster) and in some otherwise true *Nautili* of the Coal Formation and Magnesian Limestone.

The septa are simply concave, with their edges even, in most *Nautili;* but in some species (*N. bilobatus*, from the Coal Formation and Mountain Limestone) they are deeply undulated, as in the simplest *Clymenia* [GONIATITES]; in a remarkable fossil from the London Clay (*Nautilus Ziczac*), deeply and angularly folded, nearly as in some Goniatites. Finally, in the *Clymenia* of Count Munster, all having a ventral siphuncle, the septal edge is simply waved, or has rounded inflexions, angular bands, or a mixture of these in the same shell.

Taking a general view of the distribution of the *Polythalamacea* we find—

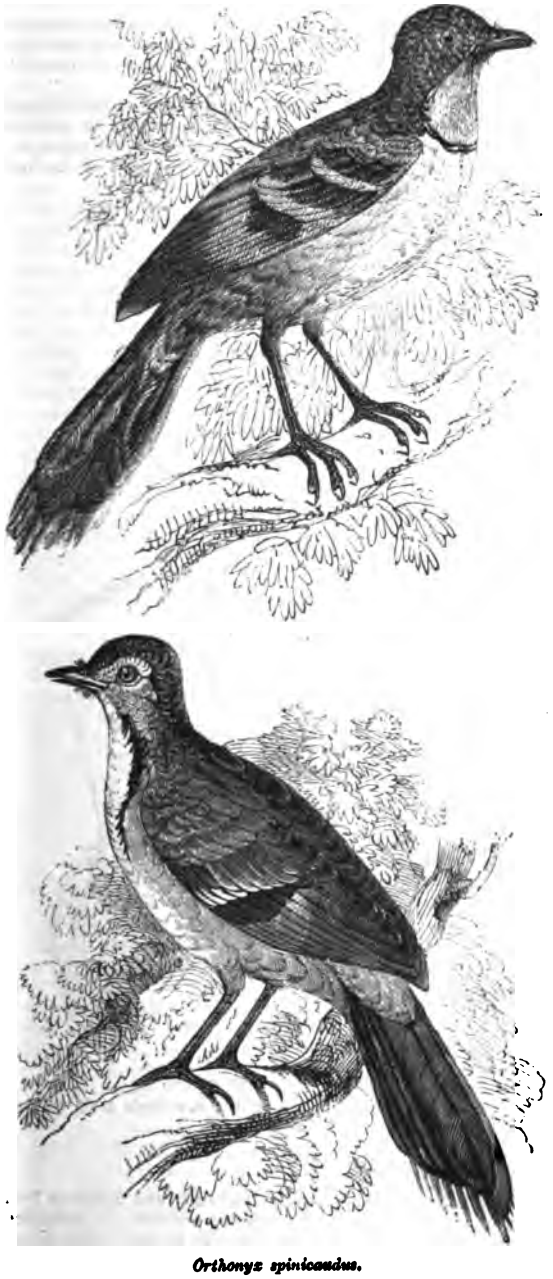
In a living state	*Spirulidæ* and *Nautilidæ*.
In the Tertiary Series . .	Some of the *Nautilidæ*.
In the Cretaceous Strata .	*Nautilidæ, Belemnitidæ, Ammonitidæ*.
In the Oolitic Strata . .	*Nautilidæ, Belemnitidæ, Ammonitidæ*.
In the Saliferous Strata .	*Nautilidæ* (not including *Orthocerata*), *Ammonitidæ* (of the type called Ceratites only).
In the Carboniferous Strata	*Nautilidæ*, including *Cyrtocerata, Orthocerata, Ammonitidæ* (of the type called Goniatites only).
In still Lower Strata . .	*Nautilidæ* (including *Cyrtocerata, Phragmocerata, Orthocerata*, and *Clymeniæ*); *Ammonitidæ* of the type of Goniatites only.

Finally, in strata lower than these, as the Snowdonian Slates, where shells and Polypiarian remains occur, none of the *Polythalamacea* are known. [AMMONITES; CEPHALOPODA; NAUTILIDÆ; BELEMNITES; BACULITES; BELLEROPHON.]

ORTHONYX, M. Temminck's name for a genus of Birds arranged by Mr. Swainson with *Buphaga* under *Buphaginæ*; these two genera

forming the whole of that sub-family. It has the following generic characters:—Bill very short, straight, but the culmen arched from the base; sides considerably compressed; nostrils large, basal. Wings moderate, but considerably rounded; the first four quills graduated, and shorter than the fifth. Tail rather lengthened, rounded; the feathers very broad, and the webs soft, but the shafts stiff, very rigid, and terminating in naked points. Feet enormously large and strong; the outer toe rather longer than the middle, which is again longer than the inner toe; hinder toe shorter than the middle. Tarsus longer than either of the toes; claws strong, very slightly curved; the anterior all of the same length; the hinder one longest. (Sw.)

The only species is *O. spinicaudus*, Temm., *O. Temminckii*, Vig. and Horsf. It is rufous brown above, lineated with black; lesser coverts of the wings gray, streaked with brown; plumes of the top of the head slightly prolonged into a sort of false crest, which is however but little apparent; tail rounded, of a tarnished brown-colour, each feather-stem terminated by a point furnished with small stiff bristle-like appendages. A bright orange patch covers the breast of the male, which part is white in the female.



Orthonyx spinicaudus.
Upper figure, male; lower figure, female.

M. Lesson states that this bird is said to be a native of New Zealand. A specimen in the Museum of the Linnean Society of London was presented by Mr. Brown, who met with it near Hat Hill in 1804.

Messrs. Vigors and Horsfield speak of this genus ('Linn. Trans.,' vol. xv.), which consists of the single species above noticed, as holding the same place in Australia as the true *Certhia* fills in the ancient continent, and the numerous group of *Dendrocolaptes*, Herm., in South America. They observe that it possesses the strong and lengthened shafts of the tail feathers which support the typical scansorial birds in climbing, and that it immediately connects the whole group by a strong affinity to the woodpeckers.

Mr. Swainson ('Classification of Birds,' vol. i.) describes the bird as rather larger than a sparrow, but with the general form and proportions of *Mœnura*, except in the tail, the rigidity of which, he remarks, would imply that it feeds in a semiperpendicular attitude.

ORTHOPTERA, one of the orders into which Insects are divided. This order, of which we have familiar examples in the common Cockroach (*Blatta*), the House-Cricket, and the Grasshopper, is distinguished by the following characters:—The superior wings are semi-coriaceous, usually displaying numerous nervures in a longitudinal direction, and having the interspaces filled up with transverse, or reticulated, smaller nervures; the anterior portion of the inferior wings is generally of a different substance from the posterior portion, the nervures are more crowded, and in character, and often even in colour, it nearly resembles the anterior pair of wings; the hinder portion of these wings is almost always more transparent, and, when not in use, is folded like a fan. The superior wings often overlap horizontally, as in the cockroaches, but in many species they meet at an angle like the roof of a house, as in the grasshoppers and locusts. The legs in some are formed for running; in others, the hinder pair of legs are very long and the thighs of these legs are thick, and in fact formed for leaping. The antennæ do not vary much; they are usually filiform; in many, extremely long and slender, in which case they are composed of innumerable minute joints; in others, they are shorter and thicker, and the joints are less numerous and consequently more distinct. The parts of the mouth are well developed and approach in structure those of the order *Coleoptera;* they are usually however less firm and compact, especially the labial apparatus. The upper portion of the prothorax is generally very large. The metamorphosis of the *Orthoptera* is semi-complete, that is to say, the larvæ and pupæ resemble the perfect insect, excepting that in the larvæ there are no wings, and in the pupæ the wings are in a rudimentary state. Some species however in the perfect state are wingless, in which case it is extremely difficult, and perhaps impossible, to distinguish the perfect insect from the pupæ or even the larvæ.

Latreille divides the order *Orthoptera* into two sections, to which he applies the names *Cursoria* and *Saltatoria*, or runners and jumpers. In the *Cursoria* all the legs are usually alike and fitted for running, and they are thus easily distinguished from the *Saltatoria*, in which the hinder legs are long and the thighs thick. The males of the species belonging to the second section have the power of producing a shrill noise, but this is not always effected in the same manner.

To the section *Cursoria* belong the families *Forficulidæ* (or Earwigs) [FORFICULIDÆ], the *Blattidæ* (Cockroaches) [BLATTIDÆ], the *Mantidæ* (or Mantis tribe) [MANTIDÆ], and the *Phasmidæ* [PHASMIDÆ]. The section *Cursoria* may be divided into three families— the *Gryllidæ* (of which the Common House-Cricket affords an example) [GRYLLIDÆ], the *Locustidæ* (Locusts), and the *Acridiidæ* (or Grasshoppers) [LOCUSTIDÆ].

The principal characters of these families are given under the proper heads; they may be distinguished by the following arrangement:—

A. Tarsi 3-jointed.
- *a.* Abdomen furnished with a forceps-like appendage — *Forficulidæ.*
- *b.* Abdomen without forceps.
  - * Antennæ filiform or prismatic . . . . — *Acridiidæ.*
  - ** Antennæ very long and setaceous . . . — *Gryllidæ.*

B. Tarsi 4-jointed, antennæ setaceous . . . . — *Locustidæ.*

C. Tarsi 5-jointed.*
- *a.* The prothorax the longest of the three thoracic segments . . . . . — *Mantidæ.*
- *b.* The prothorax the shortest of the three thoracic segments . . . . . — *Phasmidæ.*
- *c.* The prothorax broad, more or less rounded, and generally covering the head . . . . . — *Blattidæ.*

ORTHOTOMUS. [SYLVIADÆ.]

ORTOLAN, the French and English names for a species of Bird belonging to the family *Fringillidæ*, much esteemed by epicures for the delicacy of its flesh when in season. It is the *Hortulanus* of Gesner and others, *Miliaria pinguescens* of Frisch, *Emberiza hortulana* of Linnæus, Ortolano of the Italians generally, Tordino Berluccio of the Venetians, Garten Ammer and Fellammer of the Germans, and Gerste Kneu of the Netherlanders. Willughby writes the name Hortulane; and Montagu terms it the Green-Headed Bunting. [EMBERIDÆ.]

This bird is found in the south of Europe, which may be considered

* In one genus which is placed in this family (*Heteronytarsus*), the posterior tarsi have only three joints.

the summer and autumnal head-quarters of the Ortolan, though it is a summer visitor in the central and northern parts. In Italy it is said to be common by Temminck and others. Prince C. L. Bonaparte states that it is found in the Sabine Mountains, but not commonly, in the summer, and that it rarely occurs in the plain of Rome, but that it is frequent in Tuscany. Lapland, Russia, Denmark, Sweden, and Norway are among the countries visited by it. In these islands it seems to be only entitled to rank as an accidental visitor, but it is by no means clear that it does not occur more frequently than is generally supposed: for, especially to an unpractised eye, it might be mistaken for the Yellow-Hammer, and in some states of its plumage for other Buntings. It has been taken in the neighbourhood of London; and one of these specimens was alive in 1837, in the aviary of the Zoological Society in the Regent's Park. Bewick's figure ('Green-Headed Bunting,' last edition, Supp., p. 24) was captured at sea off the Yorkshire coast, in May, 1822. In southern Europe it is common from May to August, and every spring and autumn may be observed at Gibraltar on its migration. Mr. Strickland saw it at Smyrna in April. North Africa is its winter residence. Colonel Sykes notes it in his 'Catalogue of the Birds of Dukhun' (Deccan).

When properly fed, for which purpose there are large establishments in the south of Europe, where they are placed after having been trapped and furnished with plenty of millet-seed and other grain, till they become sheer lumps of fat, they are delicious morsels. Mr. Gould states that this is effected in Italy and the south of France in a dark room. Prince C. L. Bonaparte says, "Nella vicina Toscana, dove gli Ortolani sono frequenti, si mantengono nelle Uccelliere illuminate giorno e notte finchè restino soffocati dalle pinguedine." (In the neighbouring districts of Tuscany, where the Ortolans are numerous, they are kept in aviaries which are illuminated day and night, where the birds are fed till they are suffocated by their fatness), and he adds the relishing words, "carne squisita" (flesh exquisite).

Ortolan.

Upper figure, male; lower figure, female. (Gould.)

ORTYGIS. [TETRAONIDÆ.]

ORVET, the French name for the Blindworm (*Anguis fragilis* of Linnæus). [BLINDWORM.]

Messrs. Duméril and Bibron ('Histoire des Reptiles'), who place the form among the Scincoidean Lizards, and next to *Ophiodes*, state that up to the time of their publication all authors have denied an external auditory opening to the *Anguis fragilis*, Linn., whereas this Scincoidean has one, very small it is true, but distinct nevertheless when pains are taken to search for it, even without the aid of a lens. They state that this orifice, which is linear, and from one to two millimetres in length, is situated behind the commissure of the lips, at a distance equal to the length of the muzzle; sometimes it is uncovered, sometimes it is hidden under the scales; and in the latter case they must be raised before it is perceptible. [OPHIDIA.]

ORYCTEROPUS. [AARD-VARK.]

ORYX. [ANTILOPÆ.]

ORY'ZA, a genus of Plants belonging to the natural order of Grasses. It is the name by which rice was known to the Greeks and Romans, and which has been adopted by botanists as the generic name of the plant yielding that valuable grain. The Greek name would appear to be derived from the Arabic Aruz, and this is allied to Uri, the Telinga name of cultivated sorts; but the Sanscrit names are Unoo, Dhanya, and Vrihi; the wild kind being called Nivara, while the great tanks are called Erays in the Tamul language. The European names are evidently all derived from the same sources, but the name Paddy is applied to the rice in its natural state, or before being separated from the husk. The natives of India call it Dhan in this state, as well as the plant, and the rice itself is called Chanwul.

The genus *Oryza* has two glumes to a single flower; paleæ two, nearly equal, adhering to the seed; stamens six, and styles two. Dr. Roxburgh describes two species; one, *O. sativa*, distinguished by its diffuse panicle; the other, *O. coarctata*, has the panicle contracted, the valvulets of the calyx subulate, and the leaves culm-clasping. This species is a native of the delta of the Ganges, and was first discovered there by Dr. Buchanan in 1796, but was not found to be applied to any use.

The Common Rice, *O. sativa*, unlike many long cultivated grains, is still found in a wild state in and about the borders of lakes in the Rajahmundry Circars of Hindustan, though never cultivated, because the produce is said to be small compared with that of the varieties in cultivation. [RICE, in ARTS AND SC. DIV.]

Common Rice (*Oryza sativa*).

a, panicle of the rice-plant, with ripe grains; *b*, a single grain enveloped in its husk and awned.

OSCILLATORIA. [ALGÆ.]

OSIER. [SALIX.]

OSMAZOME, a name given by Thénard, and adopted by most chemists, to a spirituous extract of meat; according to Berzelius it is not a peculiar substance, but a mixture of several different bodies, among which are lactic acid and lactates. In the opinion of Berzelius the name ought to be abandoned. According to the experiments of Chevreul however Osmazome contains a peculiar substance, to which he has given the name of Créatin (from κρέας, flesh).

Creatin is solid, inodorous, insipid, colourless, and has a pearly lustre; it does not act upon test papers, and crystallizes in right prisms. Its specific gravity varies from 1·35 to 1·84. When heated

it crackles, loses water at 212°, and melts without being discoloured; but on continuing the heat it decomposes, yielding ammonia. At 65° Fahr., 100 parts of water dissolve about 1·2 part; this solution is scarcely at all acted upon by saline or metallic substances. The solution slowly decomposes, exhaling a distinct ammoniacal odour and becoming turbid. Alcohol and most acids also dissolve it.

OSMERUS. [SALMONIDÆ.]

OSMIUM. [PLATINUM.]

OSMUNDA, a genus of Plants belonging to the natural order *Filices*, and to the sub-order *Osmundaceæ*. It has clustered theœ arranged in a branched spike terminating the frond.

O. regalis, the Flowering Fern, has bipinnate fronds, pinnules oblong, nearly entire, dilated, and slightly auricled at the base; the clusters panicled, terminal. This fern is a native of Great Britain in boggy places, and often attains a height of from 1 to 8 feet. It is very common in many parts of England, and especially on the lakes of Killarney in Ireland. It is common throughout Europe, and a plant of the same name is found in the United States.

(Babington, *Manual of British Botany;* Newman, *British Ferns.*)

OSPREY. [FALCONIDÆ.]

OSSEOUS BRECCIA. [OSSIFEROUS BRECCIA.]

OSSIFEROUS BRECCIA, OSSIFEROUS CAVERNS. The existence of large fissures and caverns in rocks is a fact known to miners and quarrymen in all parts of the world; that these cavities are frequently filled with stalactitical sparry and earthy accumulations, and sometimes with the bones of animals, is another fact on which modern geologists have based a long train of ingenious inferences. Fully to examine these facts and inferences would be to discuss one of the most comprehensive and unsettled problems of geology. It is possible however to present in a small compass the leading considerations which belong to the subject.

Great fissures and caverns, though not absolutely confined to limestone rocks, are yet by far of most frequent occurrence in these deposits. They are not common in all limestones, but have certain determinate relations to their mass and the positions which they occupy. It is peculiarly in thick masses of limestone (whether magnesiferous or purely calcareous) that we find great caverns in England, Ireland, France, Belgium, North Germany, the Tyrol, Carinthia, Italy, Greece, North and South Africa, India, Australia, North and South America. It is sometimes observed that great cavities abound in limestone rocks, not so much at as near to points and lines where the ordinary position of the strata is violently disturbed by great faults, and axes of elevation and depression. Thus the numerous caverns of Derbyshire and Yorkshire, and of the Mendip Hills, are situated in or near to situations of violently-disrupted strata; and by accumulating observations of this nature we gradually come to perceive, in many cases, a real dependence of the chasms in the rock on the fractures which have broken it.

But there are few caverns or great fissures all whose features can be thus explained. The disturbance has not so often produced the caverns as the conditions necessary for their production. On the contrary, in very many cases we perceive, even in caverns now dry, forms of internal surface which mark the decomposing influence of air and moisture, and the erosive power of running water. Through many of them water now runs, through more of them it formerly ran, conducted into these subterranean channels by the fractured condition of the strata. The great caverns of the Peak at Castleton and Buxton may be quoted as examples. Other caverns occur, nearly or entirely exempt from the direct influence of fractures passing through them. Such a case occurs at Kirkdale in Yorkshire; a cave which has for great lengths an even floor and roof, and is connected, not with faults or axes of movement, but with great joints in the limestone. This cave has been traversed by water conducted by these joints. Water dropping, trickling, or running through the fissured limestone rocks, dissolves (by the almost constant carbonic impregnation which it derived from the atmosphere and decomposing vegetation) its calcareous channels, and transports away to the surface of the ground the materials of petrifying springs, the tufaceous mounds of Matlock, and the travertino of southern Europe. In certain classes of limestone rocks there is reason to conjecture that the caverns have not been occasioned by violent fractures, nor yet by the influence of joints, but that they are a part of the original structure of a coral reef (in which cavities were left by the polypean builders), or have been generated by those chemical processes which we have as yet imperfectly traced and classed as metamorphic effects. This may be the case in certain magnesiferous (dolomitic) limestones in Derbyshire, Franconia, &c.

In regard to the filling of these cavities, we must again, in a great majority of instances, appeal to the action of water—an inverse action, new circumstances causing water to deposit where once it excavated; or an indirect action, occasioning new accidents. Stalactitical depositions and many varieties of sparry accumulations, which are now happening in caverns and fissures, exemplify the former case; and as an instance of the latter, we may describe what is happening on a part of the Yorkshire coast. Here the chalk is cavernous; the caverns, connected above with small fissures reaching to a mass of diluvial clay, pebbles, &c., are continually enlarged by the waves and spray of the sea; and sometimes their roof, thus weakened, falls in, and the diluvial masses from above pour down into the cave, but are soon removed by the agitation of the tide.

Another instance is of familiar occurrence in the mining districts of the north of England, where limestone, more or less cavernous and fissured, is covered by shales or argillaceous toadstones. Near the edge of these argillaceous beds many rather regular pits ('swallow-holes') occur, through which the surface drainage reaches the limestone, and carries into its cavities some of the materials which are dislodged in its course.

The geologist who takes into consideration the possible origin of caverns in limestone from original hollows, the influence of joint-fissures, and the effect of violent displacements—and considers further the various degrees and circumstances of their communication to the surface, the various action of water within them, their level in relation to that of the sea, and the nature of the strata or other matter superincumbent on the limestone—will be at no loss to comprehend how various, complicated, and interesting are the sparry and earthy contents of subterranean cavities. These contents have in some cases fallen in, so as to constitute confused heaps or masses of breccia; in other cases they have been drifted by water, and arranged into shallow and irregular beds; and in addition, certain matters have been dissolved, and deposited in crystallised and stalagmitic forms.

The occurrence of bones in these breccias, sediments, and stalagmitic incrustations, is sometimes to be explained by supposing them to have fallen with the other materials of breccia, or to have been drifted with sediments by water; but in a considerable proportion of the cases which have been examined there is no avoiding the conclusion that animals retired by choice, or through fear, or were dragged by violence into these cavities, and there have left their bones. This conclusion, established by the sagacity of Buckland for the hyæna caves of Kirkdale and Torquay, applies to the numerous bear caverns of the Harz, Franconia, and Westphalia, and to some caves in Brazil and Virginia. It is a conclusion of the highest importance in geology and zoology. It assures us of the habitat of many extinct races of quadrupeds, and thus furnishes authentic data for a survey of the geographical distribution of *Mammalia* in one definite period of high antiquity, under physical and climatal conditions of the globe much different from what we now behold. Thus for instance we find among the perished races of British quadrupeds the lion, hyæna, and bear; the elephant, rhinoceros, and hippopotamus; the urus and the elk.

To allow of the introduction of these animals to Britain, we must suppose this island joined to the continent; to allow of their long-continued existence here (which the phenomena in Kirkdale cave substantiate), we must suppose certain climatal and physical conditions of the country, and certain habits of life among the animals. Migrations may be supposed for the deer and the lion, but settled abodes must be ascribed to the hyæna and perhaps to the *Pachydermata*. The extinction of these animals requires other admissions. It is not a local, but a general phenomenon, extending over a great part of the northern zones of the world, and of such startling magnitude, as to have suggested hypotheses of diluvial catastrophes and glacial periods to geologists; while zoologists may perhaps regard it as a great example of the law of limited duration and successive predominance, to which, judging from the whole course of palæontological discovery, all the races of the animal creation are made subject.

(Cuvier, *Ossemens Fossiles;* Buckland, *Reliquiæ Diluvianæ;* Meyer, *Palæologica;* Owen, *On British Fossil Mammalia*, in *Transactions of the British Association;* Mantell, *Petrifactions and their Teachings;* and a variety of Memoirs by different authors in the *Transactions and Proceedings of the Geological Society of London.*)

OSSIFICATION. [BONE.]

OSTRACEÆ, or OSTREIDÆ, a family of Conchiferous *Mollusca*, embracing, according to some authors, the following genera, *Ostrea* (to which the common oyster belongs), *Anomia, Placuna, Pecten, Lima, Spondylus*, and *Plicatula*. To these genera are sometimes added *Gryphæa, Exogyra, Carolia, Pododesmus, Placunanomia*, and *Ænigma*. *Pecten* is often regarded as the type of this family. [PECTINIDÆ.]

OSTRACION. [SCLERODERMI.]

OSTRACODA. [BRANCHIOPODA.]

OSTRAPODA. [BRANCHIOPODA; ENTOMOSTRACA.]

OSTREA. [PECTINIDÆ.]

OSTRICH. [STRUTHIONIDÆ.]

OSTRYA, a genus of Plants, the species of which are called Hop Hornbeams. They derive their English name from their inflorescence consisting, in the female, of scales packed closely over each other so as to resemble very much the head of a hop, and to its foliage being similar to that of the hornbeam. Two species are known; the one, *O. vulgaris*, a native of the South of Europe; the other, *O. Virginica*, of the United States; these are possibly mere varieties of each other. They both form handsome deciduous trees, usually of small size, but sometimes acquiring a height of 60 feet. (Loudon, *Arboretum Britannicum.*)

OTARIA. [PHOCIDÆ.]

OTILOPHES (*Otilophi*), Cuvier's name for a group of Batrachian Reptiles [AMPHIBIA], which have the muzzle angular, and the head furnished on each side with a crest which extends over the parotid portion.

Rana margaritifera is an example (see cut, col. 143). It inhabits Brazil, where, according to Seba, it is called Aquaqua.

Rana margaritifera.

a, seen from above; *b*, placed on its back to show the under parts.

OTIS. [BUSTARD.]
OTOCRYPTIS. DRACONINA.]
OTOLICNUS. [LEMURIDÆ.]
OTOMYS. [MURIDÆ.]

OTO'PTERIS, a genus of Fossil Ferns, of which several species have been described. Its distinguishing character is to have simply pinnated leaves, whose leaflets are auricled at the base, where they join the rachis by a narrow stalk, and are furnished with veins which proceed directly from the base to the apex, without any attempt at forming a midrib. Five species are known, from the beds above the coal-measures, and chiefly from the lias and oolitic formations, of which they are a characteristic feature; these are *O. cuneata*, *O. Beanii*, and *O. acuminata*, from the Oolite, *O. obtusa* from the Lias, and *O. Dufrenoii* from the New Red-Sandstone. There is moreover an *O. dubia* from the Knowlesbury Coal-Field, and an *O. ovalis* from the Scarborough Oolite, both of which are doubtful species; the latter in particular must be excluded from the genus, and probably belongs to *Neuropteris*.

1, *Otopteris dubia*; 2, *Otopteris obtusa*; 3, *Otopteris acuminata*; 4, *Otopteris cuneata*.

OTTER. [LUTRA.]

OTTRELITE is a Mineral occurring in small rounded brilliant plates, with a perfect basal cleavage. Colour grayish or greenish. Streak pale green. Fracture uneven. Scratches glass with difficulty. Specific gravity 4·40. It is found near Ottrez on the borders of Luxembourg. Its analysis by Damour gives—

Silica	43·34
Alumina	24·63
Protoxide of Iron	16·72
Protoxide of Manganese	8·18
Water	5·56
	——98·43

OTUS. [STRIGIDÆ.]
OUNCE. [FELIDÆ.]
OURARI. [STRYCHNOS.]
OURAX. [CRACIDÆ.]
OVALIA. [LÆMODIPODA.]

OVEÆ (Gray), a sub-tribe of the tribe *Bovina* and family *Bovidæ*. It includes the common Sheep and allied species. The following is Dr. J. E. Gray's definition of this family:—Forehead flat or concave. The horns are more or less spiral, wider than deep at the base, and slightly annulated in front. The females are often horniess. The skull has a more or less deep rounded suborbital pit, without any fissure; the masseteric ridge ascending high before the orbit: the auditory bulla small; the basioccipital flat, more or less expanded anteriorly by the extension of the anterior pair of tubercles, the posterior ones small; the cutting-teeth are nearly equal-sized and shelving; and there are no supplemental lobes to the grinders. The hoofs are triangular, and being shallow behind, they have distinct interdigital fossæ. Males emitting no stench.

The genera included in this family are—

1. OVIS. Crumen distinct. Tail elongated. Skin covered with wool or adpressed hair.
2. CAPROVIS. Crumen distinct. Tail very short. Skin covered with thick hair which conceals the wool.
3. PSEUDOIS. Crumen none. Tail rather elongated. Forehead convex. Skin covered with thick hair.
4. AMMOTRAGUS. Crumen none. Tail rather elongated. Forehead concave. Skin covered with short hair, and elongated tuft of hair.

Ovis Aries, the Common Sheep, is subject to great variation, and many of its forms have been raised to the rank of species. Dr. Gray, in the 'British Museum Catalogue,' enumerates no less than 33 varieties of this species.

In the ARTS AND SCIENCES DIVISION of this work an article is devoted to the SHEEP as the subject of the art of the grazier. We here present a few of the varieties which are more interesting to the zoologist. The Sheep is one of those animals which man has domesticated, and which, like the horse, dog, cat, pig, and ox, is subject to the greatest possible variety. These varieties have been often described as species; but the most distinguished zoologists of the present day regard all the forms of *Ovis* as belonging to the species *O. Aries*.

The following is a list of the varieties from the 'British Museum Catalogue':—

1. The Spanish Sheep. It is the *Ovis Hispanicus* of Linn.; called also the Merino Sheep and the British Middle-Wooled Sheep.

2. The Common Sheep (*Ovis rusticus*, Linn.; *O. Gallica*, Desm.; *O. brachyurus*, Pallas; *O. leptura*, Schreb.): the Hornless Sheep (*O. Anglicana*, Linn.). Of this variety there are numerous forms, such as the Muggs Sheep and Shetland Sheep, the Southdown Sheep, the Old Lincoln Sheep, the Romney Marsh Sheep, the Cobwold Sheep, the New Leicester Sheep, the Cheviot Sheep, the Old Teeswater Sheep, the Improved Teeswater Sheep, the Dunky Sheep, the Zetland and Orkney Sheep, the Welsh Mountain Sheep, the Soft-Wooled Sheep of Wales, the Wicklow Mountain Sheep, the Kerry Sheep, the Exmoor Sheep, the Black-Faced Sheep, the Black-Faced Heath-Sheep, and the Rass or Roosh (*Ovis Polii*, Blyth).

3. The Barwall Sheep, *Ovis* (*Aries*) *Bârwâl*, Hodgson; *Ovis Barwal*, Hodgson; *O. Ammonoides* var. 1, Gray. It inhabits Nepaul.

4. The Huniah Sheep (*Ovis Hunia*, Hodgs.); The Hoonia, or Black-Faced Sheep of Tibet. Also a native of Nepaul.

5. The Cago (*Ovis Cagia*, Hodgs.); the Kago, or Tame Sheep of Cabul region; the Cago Sheep of Gray. A native of Nepaul.

6. The Seling. A native of Nepaul.

7. The Curumbar Sheep of Mysore.

8. The Sheep called Gărăr in India.

9. The Dukhun Sheep.

10. The West-Indian Sheep.

11. The Brazilian Sheep.

12. The Demerara Sheep.

13. The South American Sheep (*Ovis Aries*, Rengger).

14. The Smooth-Haired Sheep (*O. Africanus*, Ray; *O. Æthiopica*, Charlet; *O. Africana*, Sloane).

15. The African Sheep (*O. Guineensis*; *A. longipes*, Desm.; *Caper Mambrinus*); the Sheep of Sahara.

16. The Guinea Sheep (Belier et Brebis des Indes, Buffon; *O. A. Guineensis*, Schreb.).

17. The Morvant de la Chine, Buffon.

18. The Shaymbliar Sheep of Mysore.

19. The Sheep of Zeyla, of Buckingham.

20. The Fezzan Sheep, of Bennett, from Tripoli.

21. The St. Helena Sheep.

22. The Marocco Sheep (*O. A. Numidæ*, H. Smith).

23. The Congo Sheep (*O. A. Congensis*, H. Smith).

24. The Angola Sheep (*O. A. Angolensis*, H. Smith).

25. The Zenu or Goitred Sheep (*O. A. Steatinion*, H. Smith).

26. The Ixalus (*Ixalus probaton*, Ogilby; *O. Ixalon*, Sundevall).

27. The Cretan Sheep (*O. Strepsiceros*, Ray; *O. A. Strepsiceros*, Schreb.; *O. Cretensis*, Jonst.; *Capra Cretensis*, Brisson; *Strepsiceros Cretica*, Besch.; Belier et Brebis de Valachie, Buffon; Zackl of the Austrians; Wallachian Sheep of Bewick).

28. The Long-Tailed Sheep of Russia (*O. longicaudatus*, Brisson; *O. Dolichura seu Tscherkessica*, Pallas).

29. The Broad-Tailed Sheep (*O laticaudatus*, Erxl., Geoff., 'Mem. Egypt,'; Lesson, 'Comp. Buffon,' x. 312; *O. laticauda platyceros s. Arabica*, Linn.; *O. Turcica*, Charlet; *O. cauda obesa*, Ludolf). It is a native of Barbary. There are several forms of this variety, of which the following are most prominent:—The Fat-Rumped Sheep (*O. Steatopyga*, Pallas; the Tartarian Sheep of Bewick); the Persian Sheep (*O. A. ecaudatus*, Geoff.); the Fat-Tailed Sheep (*O. A. macrocercus*,

Fat-Tailed Sheep (*Ovis Aries macrocercus*).

Schreb.); the Aora Fiyel, or Abyssinian Sheep; the Bucharian Sheep (*O. Bucharica*, Pallas); the Tibetan Sheep (*O. Thibetanus*, Fischer); the Cape Sheep (*O. Capensis*, Erxleb.); the Sheep of Belkah.

30. The Many-Horned Sheep (*O. polyceratus*, Linn.). It is also called the Four-Horned Ram, and the Dumba Sheep. It is a native of Nepaul.

31. The Puchia, or Hindustan Dumba (*O. puchia*, Hodgson).

32. The Short-Tailed Sheep (*O. brachyura borealis*, Pallas). It is a native of Northern Russia.

33. The Sheep of Tartary. They are said to eat bones like a dog.

The genus *Caprovis* embraces the following species:—

C. Vignei, the Sha, or Koch. It is the Mountain Sheep of the north of India, and is found in Tibet.

C. orientalis, the Armenian Sheep. It is the *Ægoceros Musimon* of Pallas; the *Ovis Musimon* of Brandt. It is a native of Armenia.

C. Musimon, the Moufflon. This animal has a multitude of synonyms. It is the *Capra Ammon* of Linnæus, and the *Ovis Musimon* and *O. Musmon* of other authors. It is the Wild Sheep and Siberian Goat of Pennant. It is found in Cyprus, Candia, and Corsica.

Moufflon (*Caprovis Musimon*).

C. Ammotragus, *A. Tragelaphus*, the Aoudad of the Moors of Barbary, and the Kebsch of the Arabians, is a native of North Africa.

Kebsch (*C. Ammotragus*).

C. Canadensis, the Taye or Big Horn. It is the *Ovis montanus* of Geoffroy; and a variety, the *O. Californiana* of Douglas. Dr. Gray says it is probably the same as the Ammon of Northern Siberia.

There is only one species of *Pseudois*, the *P. Nahoor*, the Nahoor Nervate or Sna. It is a native of Nepaul.

C. Argalis, the Argali. It is the *Ægoceras Argali* of Pallas, and often confounded with the former. It is a native of Siberia. Dr. Gray says of this species—

"The Nyens or Bambheras, or Wild Sheep, seldom or never cross the Hemachal, the Indian side of which range is the special habitat of the Nahoors, while to the north and west beyond Thibet our animal is replaced by other species, so that Thibet may be considered as the special habitat of one species (*Ovis Ammonides*), and the plateaux north of Thibet as far as the Altai of another (*Ovis Ammon*), cited as types of the true ovine form; and it may be added, that the six sorts of tame sheep of Thibet and the Sub-Himalayas all without exception exhibit the essential characters of that form.

"There are several species that may be confounded under this head: the Siberian Argali is found in the most northern part of that country, and it is probably different from the Himalayan animal; but I have not been able to discover any difference between the specimen

Argali (*Caprovis Argalis*).

received from Mr. Hodgson and those which were sent from Siberia by the Russian naturalist."

OVIBOS. [BOVIDÆ.]

OVI'PAROUS. An animal is said to be oviparous when the ovum, or egg, is excluded from the body entire, and hatched after such exclusion. Birds and the great majority of reptiles are oviparous animals.

OVIS. [OVEÆ.]

OVOVIVI'PAROUS. An animal is said to be ovoviviparous when the egg is hatched within the body, and the young one is excluded alive. Thus, among the Reptiles, the young of the Lizard known by the name of *Zootoca vivipara* (the Viper, the Rattlesnake, and the Blindworm), are hatched before they are excluded from the body, and not long before such exclusion; indeed it is probable that the rupture of the egg takes place during the parturition. The Monotremes (*Echidna* and *Ornithorhynchus*) and the *Marsupiata* are examples of ovoviviparous mammiferous quadrupeds.

OVULE. [SEED.]

OVULUM. [CYPRÆIDÆ.]

OWL. [BUBO; STRIGIDÆ.]

OX. [BOVIDÆ.]

OX-EYE. [CHRYSANTHEMUM.]

OXHAVERITE, synonymous with *Apophyllite*. [APOPHYLLITE.]

OX-HOOF. The leaves of species of *Caulotretus* and *Bauhinia* are thus called in Brazil, where they are used as mucilaginous remedies.

OX-LIP. [PRIMULA.]

OX-TONGUE. [HELMINTHIA.]

OXALIDA'CEÆ, *Wood-Sorrels*, a natural order of Polypetalous Exogenous Plants with a superior ovary, a small number of hypogynous stamens, which are usually monadelphous, and distinct styles. Their fruit contains five cells, in which there are numerous seeds, occasionally expelled with violence by a sudden contraction of the sides of the pericarp. The order is so very nearly allied to *Geraniaceæ* that it can hardly be considered distinct. The genus *Oxalis* itself is called Wood-Sorrel, from the acidity of the leaves and the natural habitation of the European species in a wild state; it is however most common at the Cape of Good Hope, where the species are extremely ornamental. In the East Indies the genus *Averrhoa* produces a fruit (the Carambola or Blimbing), used for pickling and preserving; but its extreme acidity renders it unsuitable to many persons. Our *Oxalis Acetosella*, or Common Wood-Sorrel, has been supposed to be the true Shamrock of the Irish, instead of the trefoil to which the name is more commonly applied. In the tropical parts of India is an annual *Oxalis*, called *O. sensitiva* in consequence of its pinnated leaves being irritable like the sensitive plant; it has been lately ascertained that the European trefoil-leaved species have the same property, only in a more feeble degree. ('Bulletin de l'Académie Royale de Bruxelles,' vol. vi., No. 7.) This phenomenon is most conspicuous in a hot sunny day.

O'XALIS (from ὀξύς, sharp, acid; the leaves have an acid taste), a genus of Plants belonging to the natural order *Oxalideæ* or *Oxalidaceæ*. It has 4 sepals connected below, and 5 petals which are likewise frequently connected below. The stamens are 10 in number, and monadelphous; the 5 outer ones shorter than the rest. The styles 5, and the capsules oblong and 5-cornered.

O. Acetosella, Common Wood-Sorrel, is a small perennial plant with a subterranean rootstock consisting of many scaly joints; the leaves are ternate, leaflets obcordate and having the peduncles longer than the leaves, with two scaly bracts at about the middle; the corolla is about 4 times as long as the calyx, and of a white colour beautifully veined with purple. Mr. Curtis remarks that the leaves are often purplish beneath, and that the fruit darts forth its seeds at the smallest touch when ripe. This species of wood-sorrel has a pleasant acid taste, dependent on the presence of oxalic acid, and is frequently used in salads; its flavour approaches near to that of lemons or tartaric acid, with which its medicinal effects also correspond, as it is esteemed a refrigerant antiscorbutic and diuretic. The expressed juice of this species, evaporated and set in a cool place, affords a crystalline salt, which may be used whenever vegetable acids are wanted. It is sold in the shops under the name of Essential Salts of Lemons, and is employed to take iron-moulds and ink-spots out of linen.

O. corniculata, Horned Wood-Sorrel, has a decumbent stem, branched and rooting; the leaves are ternate with obcordate leaflets; oblong stipules united to the base of the petioles; the peduncles are two-flowered, and shorter than the leaves. It is a native of Europe, particularly in Spain, Italy, and Greece, as well as of Japan, Mexico, North America, and England. The flowers are yellow. The flowers of the North American plant are larger than the European.

O. violacea is a North American species.

1 2 3

Oxalis violacea.

1, the stamens and styles after the calyx and corolla have been removed; 2, the ovary with the five distinct styles; 3, a transverse section of an ovary.

O. stricta has an erect leafy stem, umbelliferous peduncles rather shorter than the leaves. It is a native of North America, and is naturalised in Cornwall and Devonshire in England. The flowers are yellow and about the size of those of *O. corniculata*. Browne says, this plant is also a native of Jamaica, and he recommends it as a pleasant cooler and diuretic; formerly it was given in inflammatory cases, but has been superseded by the more agreeable fruit-acids which are now cultivated in the West Indies. Professor Morren of Liège attributes to this species of *Oxalis* the peculiar properties of a sensitive plant. He also observed the same movements in *O. Acetosella* and *O. corniculata*, and some other species. The *O. sensitiva*, called by De Candolle *Biophytum* on account of its sensitive properties, has long been known to possess this quality. The whole genus of *Oxalis* is curious and beautiful, and well worthy cultivation. There are above 220 species described, which are distributed in every quarter of the globe.

(Don, *Dichlamydeous Plants;* Babington, *Manual of British Botany;* Lindley, *Flora Medica.*)

OXYBELUS. [Nyssonidæ.]

OXYCOCCUS, a genus of Plants belonging to the natural order *Ericaceæ*.

O. palustris, the English Cranberry, is found wild abundantly in the fens of Norfolk, Lincolnshire, and many other parts of England, always by the side of little rills, and not among stagnant water; it has slender trailing thread-like shrubby shoots, clothed with tiny linear leaves, and has a 5-parted pink corolla with the segments sharp-pointed and turned back. The fruit is a round austere red berry, which makes excellent tarts and one of the many kinds of marmalade. The Russian cranberries of the shops are borne by this species. They are not gathered till after the disappearance of winter. Near St. Petersburg the cranberry plant is so common, that the snow is stained crimson by the berries crushed to pieces by the passage of sledges over them.

O. macrocarpus, the American Cranberry, is very like the other, but its leaves, flowers, and fruit, are larger; and the latter has a more medicinal taste. It is imported from the United States, in hogsheads, in considerable quantity, and used for the same purposes as the other; but it is considered of inferior quality. [Vaccinium.]

OXYLOPHUS. [Cucujidæ.]

OXYNASPIS. [Cirripedia.]

OXYNO'TUS. [Laniadæ.]

OXYRHYNCHS, a name given by M. Latreille to a great division of Brachyurous *Crustacea*, consisting of the *Maiadæ*, the Oxystomes, and many of the *Anomura* (Anomoures) of M. Milne-Edwards. The latter zoologist however remarks that as the classification in which the term was employed has been long abandoned even by its author, he (M. Milne-Edwards) had thought that it would not be inconvenient to apply it to another family, and so avoid the necessity of adding a new name to zoological nomenclature.

The natural group to which M. Milne-Edwards applies the name 'Oxyrhinque,' is that which presents a nervous system more centralised than he has as yet discovered among the Crustaceans, and it is principally for that reason that he places the Oxyrhynchs at the head of the series formed by these animals. In fact, he observes, the different medullary ganglions of the thorax do not, in this instance, form more than a single solid mass in the form of a disc, whilst in the other Decapods, of which the internal anatomy is known, these same ganglions remain more or less distinct, and only unite so as to form a circular ring. In many of the Oxyrhynchs M. Milne-Edwards has also remarked that the two portions of the liver, instead of being completely separated as in the other Decapods, are united on the median line by an unequal lobe: this viscus is well developed and extends over a great part of the vault of the branchial cavity. The number of branchiæ is always nine on each side of the thorax; seven of these organs, the last of which is inserted above the third foot, are very much developed, and rest on the vault of the sides, whilst the two others are often reduced to the rudimentary state, and are hidden at the base of the first. Lastly, the vault of the respiratory cavity is but slightly elevated, and throughout its extent, nearly comes in contact with the upper surface of the branchiæ. The rest of the internal organisation offers nothing peculiar.

But the same assertion cannot be made with regard to the external organisation of these animals. The general form of their body approximates to that of a triangle, of which the base is rounded and turned backwards. The first pair of feet are generally of the same size on each side; but their dimensions are very different in some species and also in the sexes. The succeeding feet are often of enormous length, and are nearly always slender and cylindrical; this disposition is even carried so far in some of the Oxyrhynchs that it has obtained for them the name of Sea-Spiders. The second or third last pairs are sometimes subcheliform; but these organs never take the form of natatory fins, and in general those of the last three pairs diminish gradually in length.

The Oxyrhynchs are all essentially marine. None are known to live in fresh-water or to frequent the shores of the sea; but all inhabit great depths, and are generally obtained when dredging for large fish. Their long feet would convey an idea of nimbleness, but these *Crustacea* are in general slow in their motions, and soon die out of water. No swimmers are known among them.

OXYRHYNCHUS. [Picidæ.]

OXY'RIA, a genus of Plants belonging to the natural order *Polygonaceæ* (?). It has a 4-parted perianth, the 2 interior segments larger; 6 stamens; 2 stigmas; a 1-seeded nut, compressed, with a membranous wing, larger than the persistent segments of the perianth; embryo central.

O. reniformis, Mountain-Sorrel, is the only species. It is found on the highest mountains of Great Britain, and is an inhabitant of Europe. It is the *O. digynia* of many botanists.

(Babington, *Manual of British Botany;* Koch, *Flora Germanica*).

OXYSTOMA, or OXYSTOMES, a name applied by M. Milne-Edwards to the fourth and last family of Brachyurous *Crustacea* (type, *Leucosia*, Fabr.), comprising all the *Crustacea* which most resemble the type in their general organisation, and especially in the conformation of the buccal apparatus.

The apertures for the passage of the intromissive organs of the males are hollowed out in the basilary joint of the posterior feet, as in the Oxyrhynchs and the Cyclometopes. The disposition of the branchiæ is also nearly the same as in the last-named group, but sometimes the number of these organs is less considerable, and does not amount to more than six on each side. In most of these crustaceans the branchial cavity does not present at the base of the feet any aperture for the entrance of the water necessary for respiration, and this liquid only arrives there by a gutter hollowed out on each side of the prelabial space, serving as a passage for the water expelled from the branchial cavity. This canal is very long in nearly all the Oxystomes, and is converted into a species of tube by a prolongation of the anterior jaw feet. The internal soft parts have not as yet been discovered to present any particular organisation. M. Milne-Edwards divides the family into the following tribes—the Leucosians, the Calappians, the Corystians, and the Dorippians.

The Leucosians embrace the following genera:—*Arcania, Philyra, Myra, Ilia, Guaia, Leucosia, Persephona, Nursia, Ebalia, Oreophorus, Iphis*, and *Ixa*.

The Calappians embrace the genera *Calappa* [Calappa], *Platymera, Mursia, Orythia, Matuta*, and *Hepatus*. [Hepatus.]

The Corystians include the following genera:—*Atelycyclus, Thia, Polydectus, Corystes* [Corystes], *Nautilocrystes*, and *Pseudocorystes*.

The Dorippians include the following genera:—*Dorippe* [Dorippe], *Cymopolia, Caphyra*, and *Ethusa*. [Ethusa.]

OXY'STOMUS. [Sturnidæ.]

OXYURA. [Ducks, col. 440.]

OXYU'RUS (Swainson), a genus of Birds.

OYSTER. [Pectinidæ.]

OYSTER-CATCHER. [Charadriadæ.]

OYSTER-GREEN. [Algæ.]

OZOKERITE, a Mineral, consisting of Carburet of Hydrogen. Colour yellowish-brown; translucent; has a slight bituminous odour, and softens by the heat of the hand, so that it may be kneaded. Fuses readily, emitting a stronger bituminous odour; burns with a clear bright flame without residue. Insoluble in water, only slightly in alcohol, but readily in ether and oil of turpentine. It is found in considerable masses at Slanik in the Buchau district of Moldavia, and is used for fuel. It contains Carbon, 85·204; Hydrogen, 13·787. It appears to be similar in composition to Hatchetine.

P

PACA. [Cœlogenys.]

PACHYCEPHALA. [Pipridæ.]

PACHYCEPHALI'NÆ, Swainson's name for the Great-Headed Chatterers, which form, according to his first arrangement, the second sub-family of the *Ampelidæ*, or family of Chatterers, and are placed between *Leiotrichanæ* (Long-Legged Chatterers) and *Bombycillinæ* (Swallow Chatterers), the other two sub-families being the *Ampelinæ*, or True Chatterers, and the *Piprinæ*, or Manakin Chatterers. Of these sub-families he considers *Leiotrichanæ, Pachycephalinæ*, and *Bombycillinæ* to be aberrant.

PACHYCO'RMUS (Agassiz), a genus of Ganoid Fossil Fishes. [Fish.]

PACHYDE'RMATA (literally Thick-Hides; Dickhäuter of the Germans; Pachydermes of the French), the seventh order of *Mammalia* according to the system of Cuvier.

The first family of Pachyderms in this arrangement consists of those which have a proboscis and tusks, and which are named Proboscideans.

The Proboscideans, in the opinion of Cuvier, have many resemblances to certain Rodents; for instance, their great incisors (so to speak) or tusks; their jaws, which are often formed of parallel laminæ; the form of many of their bones, &c. The whole of this family have five toes on each foot, completely formed in the skeleton, but so incrusted in the callous skin which surrounds the foot, that there is no appearance of them externally, except as they may be traced by the nails attached to the border of this species of shoe. The canines and incisors, strictly speaking, are wanting; but there are two tusks implanted in the incisive bones, which two tusks project from the mouth, and often grow to an enormous size. The proportions necessary for the alveoli or sockets of these tusks, render the upper jaw so high, and so much shorten the bones of the nose, that the nostrils are found in the skeleton towards the upper part of the face; but, in the living animal, they are prolonged into the well known proboscis or trunk. [ELEPHANT.] The parietes of the cranium contain large spaces for rendering the skull light; and the lower jaw has no incisors; as may be seen in the same article. The intestines are voluminous, the stomach simple, and the cæcum enormous. The mammæ, two in number, are situated on the breast; and the young suck with the mouth, and not with the trunk, as some had erroneously supposed. The only living genus of Proboscideans is *Elephas*. [ELEPHANT.]

The other genus is extinct, and consists of the Mastodons. [MASTODON.]

The second family, the Ordinary Pachyderms, have either four, three, or two toes.

I. Those which have the toes equal are in some sort cloven-footed, and, in many respects, approximate the ruminants in the skeleton and in the complication of the stomach.

Living genera, *Hippopotamus* [HIPPOPOTAMUS] and *Sus* (Linn.). [SUIDÆ.] Extinct genus *Anoplotherium*. [ANOPLOTHERIUM.]

II. Those which are not cloven-footed form genera which very much resemble each other in the jaws, in having on each side seven upper molars with square crowns and various projecting lineaments, and seven lower ones with a double crescent on the crown, the last of all having a triple crescent; but their incisors are different.

Genera—*Rhinoceros; Hyrax; Palæotherium; Lophiodon;* and *Tapir*. [RHINOCEROS; PALÆOTHERIUM; LOPHIODON; TAPIR.]

The third family consists of the *Solidungula*, which apparently have but one toe and a single hoof or shoe to each foot, but on each side of the metacarpus and the metatarsus are bony points or processes which represent two lateral toes.

Genus *Equus*, Linn. [EQUIDÆ.]

To these may be added the following extinct genera:—*Chalicotherium*, allied to the Tapirs [TAPIR]; *Chœropotamus* [SUIDÆ]; *Anthracotherium*, allied to *Chœropotamus* and *Dichobunes* (ANTHRACOTHERIUM]; *Elasmotherium*, placed by Fischer between *Rhinoceros* and *Hyrax*; *Cœlodonta*, arranged by Meyer between *Rhinoceros* and *Dinotherium*; *Cainotherium*, placed by Meyer between *Anoplotherium* and *Palæotherium*; *Adapis* [ADAPIS]; and *Hippotherium*, an animal allied to the horse. [HIPPOTHERIUM.] *Dinotherium* is considered by Professor Kaup and others to be nearly allied to the Tapirs, in which case the extinct animal must doubtless find a place among the *Pachydermata*. [DINOTHERIUM; TAPIR.]

PACHYMY'A (J. Sowerby), a genus of Fossil *Conchifera*, probably synonymous with *Panopæa*.

PACHY'ODON, a genus of Fossil *Conchifera*.

PACHY'PTERIS (Brongniart), a genus of Fossil Ferns.

PACHYRHIZUS. [DOLICHOS.]

PACHY'STOMA (Guilding), a genus of Gasteropodous *Mollusca* belonging to the family *Ampullariadæ*.

PACHYTES, synonymous with *Spondylus*.

PACHYTHE'RIUM. [MEGATHERIIDÆ.]

PA'CLITES (De Montfort), a genus of *Belemnites*.

PACO. [LLAMA.]

PACTOLUS, a genus of *Crustacea* belonging to the tribe Pactolians of Milne-Edwards. This tribe belongs to the Apterurous family of the Anomurous section of *Crustacea*. The other tribes belonging to this family are the Dromians, the Homolians, the Raninians, the Porcellanians, the Hippians, and the Paguriens. The Pactolians are placed between the Homolians and the Raninians.

Pactolus has the following generic characters:—First joint of the external antennæ long and cylindrical. Feet moderately long and rather stout, the two anterior shorter than the others, not terminated by a manus or pincers, but only provided with a simple hooked nail; the second pair terminated in the same way; the third pair unknown; fourth and fifth pair didactylous. Carapace triangular, elongated, rather convex on each side behind, not thorny above, and terminated anteriorly by a very long, sharp, delicate and entire rostrum, similar to that of the *Leptopodiæ*. [MACROPODIDÆ.] Abdomen of the female composed of five joints, the first narrow, the three following transverse and linear, and the fifth very large and nearly rounded. Eyes very large, situated behind the antennæ, always projecting from their fosset; a single point behind each orbit.

P. Boscii. Length eight lines, nearly two of which belong to the rostrum, which is furnished with small spines directed obliquely on the sides; carapace smooth, brownish; feet variegated with ruddy and whitish. Country unknown.

Pactolus Boscii.

PADDY-BIRD. [RICE-BIRD.]

PADOLLUS. [HALIOTIDÆ.]

PAEDE'RIA, a genus of Plants belonging to the natural order *Cinchonaceæ*. It has a small 5-toothed permanent calyx, a funnel-shaped corolla, hairy inside, 5-lobed, and with a plaited æstivation. There are 5 stamens, sometimes abortive; the anthers oblong, nearly sessile in the middle of the tube. The style is not protruded, and the stigma bifid. The berry is small, roundish, and globose, tricelled, with a seed in each cell. The flowers are small, white, and usually unisexual.

P. fœtida has a woody twining stem, round and smooth. The leaves are oblong or lanceolate, cordate at the base, and glabrous. The panicles axillary, terminal, opposite, short, and few-flowered. The flowers are usually of a deep pink, the bracts ovate, the calyx 5-toothed, the corolla with a long tube somewhat gibbous and woolly inside; the limb narrow and divided into 5 cordate crenulate segments. The berry is dry, compressed, having 5 lines on each side, 1-celled, and 2-seeded. The seeds are smooth, compressed, enlarged with a somewhat membranous ring all round. The leaves have a very fœtid and alliaceous odour when bruised, yet they are used to impregnate baths, and are administered in a decoction medicinally in cases of retention of urine and some febrile complaints. According to Roxburgh the root is used by the Hindoos as an emetic. It is a native of the East Indies, and of Japan and the Moluccas.

P. ternata has an erect smooth trichotomous stem, with triangular branchlets; leaves 3 in a whorl; oblong-lanceolate axillary trichotomous corymbs, shorter than the leaves; the limb of the calyx campanulate and obscurely 5-toothed. It is a native of the East Indies on the mountains which border on Silhet. The flowers are rather large, funnel-shaped, white, on long filiform pedicels, each pedicel having a pair of linear ciliated bracts above the middle. The flowers are said to be fragrant when fresh, but emit a very offensive smell on being steeped in water after they have been dried.

(Lindley, *Flora Medica*.)

PÆO'NIA is a genus of Plants belonging to the natural order *Ranunculaceæ*. The species are very generally cultivated in gardens for the sake of their large gaudy flowers. They are characterised in their order by a permanent leafy calyx of 5 unequal sepals, 5 petals, stamens whose anthers split open by two fissures along their face, a fleshy elevated disc, and from 2 to 5 many-seeded carpels, terminated by a fleshy recurved stigma. Their fruit consists of leathery follicles, splitting on one side, and exposing to view a number of round, black, shining seeds adhering to a crimson placenta.

P. Moutan is a shrub, of which several varieties, with beautiful whitish flowers stained with pink, are now in our gardens. Of these the most showy is that called *P. papaveracea*, which has a broad crimson stain at the base of each petal. If grown on the north side of a wall, or in a situation where it is but little exposed to the sun in the early part of the day, this species will bear the open air of England without protection; but it sprouts so early in the spring, if exposed to the sun, that it is very liable to be cut off by the late frosts of England. It is a native of China. Of the other species, *P. Brownii* and *P. Californica* are remarkable for being the only species inhabiting America; they are natives of California and of the country to the northward, and have little beauty: the first exists in our gardens, but is extremely rare. The rest of the genus consists entirely of European and Asiatic plants, which, according to De Candolle, form fifteen species; but there can be no doubt that the greater part of these supposed species are mere varieties, chiefly of *P. officinalis*, *P. albiflora*, *P. tenuifolia*, and *P. peregrina*.

All these plants are liable to produce double flowers, which, by the conversion of their numerous stamens into petals, are generally

extremely beautiful: they have however no smell, or not an agreeable one. Being quite hardy, growing readily in any kind of soil, and easily multiplied, either by seeds or by division of the roots, they are generally favourites in gardens.

All the species have an acrid principle concentrated in their roots and seeds, which are accordingly emetic and cathartic in moderate doses. They were formerly in great repute as a medicine; and Dioscorides, whose Παιονία was probably both *P. officinalis* and *P. peregrina*, gives no fewer than sixteen names by which it was known.

PÆONY. [PÆONIA.]

PA'GELLUS, a genus of Fishes of the order *Acanthopterygii*, and family *Sparidæ*. This genus, established by Cuvier, contains all those sparoid fishes in which the front teeth are small and prickly, and very numerous; the molars are of a round form, and there are sometimes more than two rows of them; but the two outer rows in these cases are always much the largest. The foremost teeth form a dense mass, and are compared by Cuvier to the bristly points of the carding-machine used in combing wool, a character which distinguishes these fishes from those of the genus *Pagrus*, in which the foremost teeth are conical; the molar teeth moreover are smaller than in the last mentioned genus. The body is usually of an elongate-ovate and compressed form, and the dorsal fins are continuous. About six European and five extra-European species of *Pagellus* are known. Two species occur on our own coast, *P. erythrinus*, Cuv. et Val., the Spanish Bream, which is of a fine carmine red-colour above, passing into rose-colour on the sides of the body, and tinted with silvery-white beneath; *P. centrodontus*, Cuv. et Val., the Sea-Bream, is also known by the names of the Gilt-Head and Red Gilt-Head. The former of these two species is very common in the Mediterranean, but occurs rarely off the British coast. Mr. Yarrell states that he has never seen above two or three specimens, and these were taken with the Sea-Bream, which is also common in the Mediterranean, and by no means uncommon on our own coast.

The following is the description of the Sea-Bream given by the author of the 'History of British Fishes.' The jaws are short, and equal in length; the eye is very large, irides golden-yellow; the head short; the line of the profile descends rapidly; cheeks, operculum, and interoperculum covered with scales; the preoperculum and part of the space before and under the orbit have a metallic tin-foil appearance: two narrow stripes are observable on each side behind the head, and these meet on the central line at the top; at the origin of the lateral line, behind the edge of the operculum, is a conspicuous dark patch made up of small spots; the colour of the body is reddish, tinged with gray; lighter on the sides, which are golden-gray, and marked with faint longitudinal bands, which extend the whole length of the body: the belly is nearly white, and the dorsal and anal fins are brown, each appearing as if lodged in a groove from the rising edges of the skin and scales along the base: the pectoral fins and tail are red, and the ventrals are gray.

The Sea-Bream is not highly esteemed for the table. It is found most abundantly in the summer and autumn, and apparently leaves the coast in the cold weather. Mr. Yarrell moreover states that the spawn is shed in the beginning of winter in deep water; and in January the young fish, which are called Chads, of about one inch in length, are found in the stomachs of large fishes taken two or three leagues from land: in summer, when from four to six inches long, they abound in innumerable multitudes, and are taken by anglers in harbours, and from the rocks; for they bite with great eagerness at any bait, even of the flesh of their own species. The food, both of the young and adult fish, is not however confined to animal substance, for they devour the green species of sea-weeds, which they bite from the rocks, and for bruising which their molar teeth are well suited, as are their long and capacious intestines for digesting them.

The Spanish Bream is rather more slender in its form than the commoner British species, the eyes are smaller, and the mouth has a wider gape. The colouring is also different; it has not the dark patch which is observable on each side of the body near the head in the Sea-Bream.

PAGRUS, a genus of Fishes belonging to the family *Sparidæ*, with the following characters:—Four or six strong concave teeth in front, supported by smaller conical teeth behind them, with two rows of rounded molar teeth on each side of both jaws. [PAGELLUS.]

P. vulgaris is the Braize or Becker of the English coasts. It is also called Pandora and King of the Sea-Breams. It is not a common fish on our coasts, and is easily known by its conical teeth and red colour.

PAGURIDÆ, or PAGURIANS, a tribe of the apterurous section of the Anomurous family of *Crustacea*, composed of a considerable number of species, the greater part of which are remarkable for the more or less complete softness of the abdomen, the want of symmetry in the appendages of this part of the body, the shortness of the two posterior pairs of feet, and many other characters. In the greater number, the abdomen is small, nearly entirely membranous, and partially rolled upon itself; and for the protection of this defenceless part the animal lodges it in the turbinated shell generally of some gastropod. The crab is retained in the shell by the aid of the posterior feet, and a pair of crustaceous appendages at the end of the abdomen. In some species it is further fixed by means of certain organs on the lower side of the abdomen, to which we shall hereafter allude. The popular names by which these Crustaceans are known in Britain and the West India Islands are Hermit-Crabs and Soldier-Crabs; and in France they are called Bernards L'Hermite. They are held so firmly in the shell of which they have possessed themselves, that they move about with it more or less briskly according to its comparative size or aptitude.

Organisation.—The carapace is divided into many portions by lines, which are more or less membranous; one of these depressions or furrows separates it transversely into two halves, the anterior of which constitutes the stomachal region, and is very nearly confluent with the hepatic regions, which are very small, and occupy its posterior angles. The last or posterior half is divided longitudinally into three portions; the median portion constitutes the cardial and intestinal regions, and the two lateral portions form the branchial regions, which last are separated by a similar line from the lateral parts of the carapace, which descend towards the base of the feet. The ophthalmic ring is sometimes hidden above by a rostriform prolongation of the carapace, but is always free, and has above two small prolongations in the form of scales; the ocular peduncles, which are directed forwards, are not retractile, and are inserted directly above the internal antennæ, which present very variable dimensions, but always have the basilary joint either small or elongated, and are fixed by two short or moderate multi-articulate filaments. The external antennæ are inserted on the outside of the internal ones, on the sides of the ocular peduncles; their second joint has above a spiniform piece, which is ordinarily moveable, and seems to be analogous to the palp. The external jaw-feet are pediform. The sternum is nearly linear forwards, and is a little enlarged posteriorly; the last two rings of the thorax are entirely free and moveable, and the last reaches beyond the carapace, and is completed above by a tergal horny piece. The anterior feet are large, and nearly always of unequal dimensions; they are terminated by a large manus, the claws of which are short and very stout. The two succeeding pairs are very large; the fourth pair on the contrary are short, elevated above the others, and nearly always terminated by a didactylous hand; the fifth pair are equally short, elevated on the sides of the body, and terminated by a more or less well-formed pincer. The first five rings of the abdomen are represented by horny plates of greater or less size, the first of which ordinarily is nearly confluent with the last thoracic ring; sometimes this first abdominal segment is in both sexes furnished with a pair of rudimentary appendages applied against the base of the posterior feet; but in general it is without them. In the male the second segment also is sometimes furnished with a pair of false feet, but in general only gives insertion to an appendage placed on the left side; the three succeeding segments are always deprived of appendages on the right side, and sometimes present none on the left in the male; ordinarily they each support a false foot composed of a basilary cylindrical stem and one or two terminal blades; these appendages, which are consequently four in number generally, are always very small in the male and rather large in the female, whose eggs they serve to fix. At the extremity of the abdomen are two horny plates, which represent the sixth and seventh segments, and a pair of appendages, nearly always non-symmetrical, and terminated by two stout and short branches, which are fixed to the plate holding the place of the sixth abdominal ring. (Milne-Edwards.)

Mr. Broderip ('On the Habits and Structure of Paguri,' 'Zool. Journ.,' vol. iv.), points out two beautiful provisions in their animal economy. Their backs are towards the arch of the turbinated shell occupied by them, and their well-armed nippers and first two pair of succeeding feet generally project beyond the mouth of it. The short feet rest upon the polished surface of the columella, and the outer surface of their termination, especially that of the first pair, is in some species most admirably roughshod, to give 'the Soldier' a firm footing when he makes his sortie, or to add to the resistance of the crustaceous holders at the end of his abdomen or tail, when he is attacked and wishes to withdraw into his castle. On passing the finger downwards over the termination of these feet, they feel smooth; but if the finger be passed upwards, the roughness is instantly perceived. The same sort of structure (it is as rough as a file) is to be seen in the smaller caudal holders. The second provision he observed in a very fine and large species of *Pagurus* from the Mauritius. Two specimens were in his possession, one of which is housed in a very large young shell of *Pteroceras truncatum*, the other (nearly a foot long) is naked, and on examining the under side of the abdomen or tail of this specimen, a great number of transverse rows of acetabula were to be seen, even without the aid of a glass. Dr. Bright has another naked specimen, in which the same formation, which must very much assist the hold of the *Pagurus*, is visible.

Several dissections of the internal organs of the *Paguri* exist in the Museum of the Royal College of Surgeons.

Modern writers recognise several genera of this family.

The *Pagurus* of Aristotle is not a Hermit-Crab; but he describes three kinds of hermit-crabs under the name Καρκίνον. They are termed Καρίδας by Oppian, Ælian, and Galen. Pliny seems to confound them with the Pinnotheres or *Pinnophylax*, as is noticed by Aldrovandus. Rondeletius, Belon, and Gesner describe them, the latter very particularly. Jonston's account is little beyond a compilation from the authors above named. Charlevoix ('History of Hispaniola') says, "that kind which is called a Soldier (Soldat) is

as well as the Crabs, a species of Crawfish (Écrevisse), or of that sort which is called *Cancellus Marinus*. It is found all along the sea, and is good to eat. It has its name from being armed all over the body, except at the lower extremity, where it is naked, and where it seems to possess great sensibility; it therefore sheaths itself as soon as it is born in the first shell it meets with; but to dislodge it, it is only necessary to place it near the fire."

Labat mentions the Soldiers among the animals that descend every year to the sea to bathe themselves and change their skin or their shell. The old 'French Encyclopædia' defines Bernard l'Hermite to be *Cancellus*, an animal of the Crustaceous genus also called Soldier. After a very particular description, the account proceeds thus:—"There are in the isles of America Hermit-Crabs (Bernards l'Hermite) which are three or four inches in length. They relate that this animal comes once a year to the edge of the sea to lay its eggs and change the shell; for it is obliged to quit the shell in which it is lodged, because, having increased in size during the year, it finds itself incommoded in that shell. It therefore comes to the shore and seeks a new shell which may be convenient for it. As soon as it meets with one it comes out of the old one and tries the new lodging, and, if that suits, it remains there; but it is often obliged to enter many shells before it finds one proportioned to it. If it happens that two hermit-crabs stop before the same shell a dispute arises, and the weakest yields to the strongest." The same author states that it pinches hard and does not let go its hold easily, and that the inhabitants eat it, finding it very good, though it does not agree with strangers. This account appears to have been taken from Du Tertre's 'Voyage.'

Sloane thus describes the Soldier:—"This small lobster or crab differs in very little from the European Souldjer or Hermit-Crab. It hath two large forked claws like those of an ordinary lobster, one of which is bigger than the other, both rounded, more tumid, less prickly, and of a paler red than that of Europe, &c. They fit themselves with any shell they find empty, whether it be of the land or sea, and cover themselves almost over in it, carrying it on their backs wherever they go, like a snail. It is not possible to believe how quick the land-crabs and this crab will run upon the least appearance of danger. Till they are turned up nothing appears but a dead shell, the mouth of which lies undermost, out of which some little part of the crab appears after it is taken up." ('Jamaica.') Sloane figures two of these animals (apparently *Cenobita Diogenes*) in Land-Shells (*Helices*); and we saw an individual of the last-named species alive in the shell of a *Helix* at the Gardens of the Zoological Society in Regent's Park.

Catesby, who figures a *Cenobita Diogenes* in the shell of *Turbo Pica*, says—"They crawl very fast with their shell on their back; and at the approach of danger draw themselves within the shell; and, thrusting out the larger claw in a defensive posture, will pinch very hard whatever molests them. They frequent most those parts of the sea-shores which are covered with trees and shrubs producing various wild fruits, on which they subsist, though I have seen them feed on the fragments of fish and other animal substances cast on shore. They being roasted in the shell are esteemed delicate. I do not remember to have seen any of them go into the sea." ('Carolina.')

Browne notices the Soldier and the Common Soldier, and states that the latter is very common in all the harbours of Jamaica.

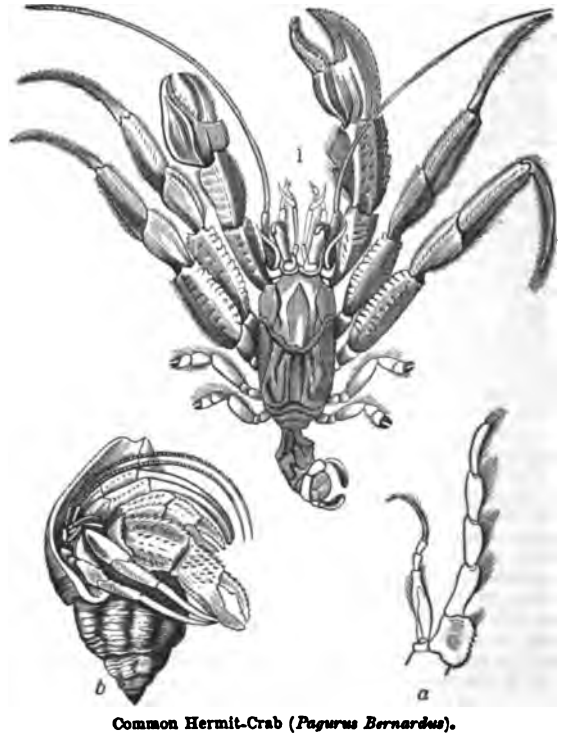
Linnæus says of the *Diogenes* that it inhabits the Asiatic and American oceans in various shells of *Cochleæ*.

Cuvier, after mentioning univalve shells as the usual covering of the genus *Pagurus* (Fabr.), remarks that some species lodge themselves in *Serpulæ*, *Alcyonia*, &c.; and we have seen individuals lodged in *Alcyonia*. Cuvier also observes that it would even seem that some of the *Paguri* are terrestrial.

Sir Henry De la Beche, in a letter to Mr. Broderip, dated August 1st 1828, says—"When I was in Jamaica, about three years since, some of the persons on my estate at Halse Hall brought me specimens of *Paguri*, which they said they had obtained from a savannah, distant about a quarter of a mile from the house. This savannah is a plain formed of what I have elsewhere termed Savannah Sandstone and conglomerate. It is very dry, and covered for the most part with logwood, green ebony, *Lignum Vitæ*, the cashew-tree, and here and there with patches of grass and other plants. After heavy rains the surface of the ground is nearly covered with herbage; but after dry weather a considerable portion of the soil is exposed. The savannah, which is of great extent (my portion consists of at least 2000 acres), is about 30 feet above the Rio Minho, which runs round the border of it, and about 200 feet above the level of the sea, from which it is distant at least 10 miles. The tide only penetrates just within the mouth of the river, and rises there about 11 inches at the height of the springs, so that there is not even brackish water at a nearer point than 10 miles. When the *Paguri* were brought to me they were alive, and I observed they were housed in marine shells, and at first thought they must have been brought from the sea. Upon inquiry however I found that these animals, under the name of Soldiers, were frequently taken alive for food in the savannah, to which I immediately proceeded. On its northern side, and at its junction with the hill that rises above it, I found in the little hollows of the white limestone several of these *Paguri*, all in marine shells, and in full health and activity. I afterwards learnt that they were by no means uncommon in such situations all over the island. When I saw them there had been a good deal of wet weather. They were in moist places, but there were no pools of water."

Another gentleman, who resided some time in the West Indies, informed Mr. Broderip that he had seen the first-mentioned species (*Diogenes*) about his house when he lived at Port Henderson, and that he had also observed them about the houses at Spanish Town, a place about six miles distant from the sea.

Pagurus (Fabricius).—A great resemblance exists among all the *Paguri*, properly so called, not only in the details of their organisation, but in their habits. The cephalo-thoracic portion of their body is shorter than the abdominal portion. The carapace is nearly as large before as it is behind, and is but little or not at all prolonged laterally above the base of the feet; posteriorly it is strongly notched in the middle, and anteriorly it is either truncated or armed with a single rudimentary rostrum. The basilary portion of the ocular peduncles is exposed. The internal antennæ are placed directly above these peduncles; their first joint is convex and nearly globular; the two next are delicate and cylindrical, and only go a little beyond either the peduncular portion of the external antennæ, or the eyes; the terminal stemlets of these organs are very short, and have the same form as those of the Brachyurous Crustaceans. The external antennæ are inserted on the same line as the ocular peduncles, and have above a stout moveable spine which represents the palp; the last joint of their peduncle is slender and cylindrical, and they are fixed by a multi-articulate filament, which is very long. The external jaw-feet are moderate in size, their stem is pediform, and their palp very much developed. The anterior feet are in general very unequal, and one of the hands very convex. The fourth pair of feet are very short, and their penultimate joint, furnished above with a somewhat oval warty plate, is in general very large, and prolonged above the next joint, so as to constitute with it a didactylous pincer. The fifth pair are longer, more slender, more recurved upwards, present also towards the end a granulous plate, and are terminated by a more or less well-formed didactylous pincer. The abdomen is of considerable size and membranous, the plates of its dorsal surface are nearly symmetrical, but very delicate, and distant from each other. Sometimes there is at the base of the abdomen of the female a pair of rudimentary false feet, and two pairs of appendages more developed in the male; but in general the first segment is without any, and the second, as well as the three succeeding segments, has a single one placed on the left side, and fixed to the border of the dorsal plate. These appendages are always small, and terminated by one, two, or even three ciliated lamellæ upon their edges, which in the female are of considerable dimensions, and serve for the insertion of the eggs. The appendages of the penultimate ring of the abdomen are each composed of a basilary joint, which is short and stout, supporting two other short and hooked pieces, one of which is inserted at its inferior border, the other at its extremity and each furnished with a warty plate similar to that on the posterior feet. These two false caudal feet have not exactly the same form, and are of very unequal size, that of the right side being much smaller than the other. (Milne-Edwards.)



Common Hermit-Crab (*Pagurus Bernardus*).
1, out of the shell; *a*, right jaw-foot; *b*, in the shell.

The species are numerous, and are divided by M. Milne-Edwards into the following sections:—

§ Species whose ophthalmic ring is not armed above with a median rostriform piece.

A. Ocular peduncles large, and shorter than the basilary portion of the external antennæ.

a. Spiniform palp of the external antennæ going beyond the extremity of the ocular peduncles.

P. Bernardus, the Common Hermit-Crab, may be taken as an example. It has the following characters:—Hands strongly tuberculo-granulated; terminal joints of the second and third pair of legs spinous on the upper side, slightly tortuous.

It is an inhabitant of the coasts of England, France, and of northern Europe as far as Iceland.

P. striatus. The anterior feet of this species are very large, especially that of the right side. They are covered nearly throughout with transverse lines, which are curved, tubercular, and furnished with small rather thick-set hairs on the upper part of the member; many of the tubercles of these squamiform lines acquire sufficiently large dimensions to become large pointed spines. Colour red mixed with yellow. Length from 7 to rather more than 8 inches.

It is a native of the Mediterranean Sea.

B. Ocular peduncles reaching beyond the basilary portion of the external antennæ.

a. No rostriform prolongation on the anterior border of the carapace.

P. deformis. Ocular peduncles very stout and short, rather longer than the basilary portion of the external antennæ, but much shorter than the anterior border of the carapace; cornea large, and occupying half the length of the terminal joint of the ocular peduncles. Anterior feet short and stout, especially on one side, smooth externally but spiny above; a dentilated crest on the upper border of the larger moveable finger. Succeeding feet smooth, and with but little hair, furnished externally with a projecting crest, which extends over the two first joints, and which, in the third foot, is very much developed and finely dentilated. Nothing similar on the opposite side. Abdomen furnished with four large transverse plates, each with an oviferous false foot, the first three of these are large, and terminated by three elongated and ciliated laminæ in the female. In the male all these appendages are small, and terminated by a single lamina. Length 5 inches.

It is a native of the Mauritius and the Seychelles.

Pagurus deformis.

a, one of the crested claws; the under side of which is towards the spectator.

Six other species are arranged by M. Milne-Edwards under this sub-section, besides *P. sanguinolentus* (Quoy and Gaim.), which he believes to be merely a variety of *P. guttatus*, and not to differ from the *P. Hungarus* figured by Herbst, pl. 23, f. 6.

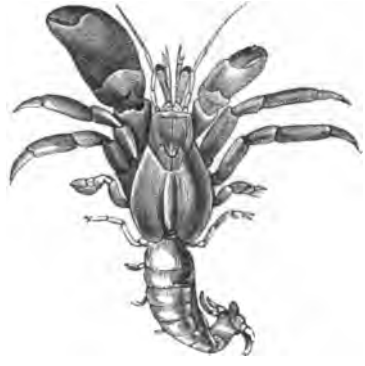
b. Anterior border of the carapace armed on the median line with a more or less projecting rostral tooth.

c. No pairs of appendages on the anterior part of the abdomen.

P. oculatus. Rostriform tooth scarcely developed. Ocular peduncles shorter than the peduncular portion of the internal antennæ, but longer than the anterior border of the carapace, and with their basilary scales small, curved, nearly oval, and approximated.

Found at Noirmoutiers.

Ten other species are arranged under this sub-section, and *P. Chilensis*, one of these, which is nearly allied to *P. elegans*, and inhabits the coast of Chili, is here figured.



Pagurus Chilensis.

c. c. Abdomen, with one or two pairs of appendages under its base.

P. maculatus is an example, and four other species are arranged under this sub-section.

§§ Species having the ophthalmic ring armed above with a moveable rostriform tooth, which advances between the ocular peduncles, and is denticulated on its edges.

P. Miles and two other species are arranged under this sub-section.

In Bell's 'British Stalk-Eyed Crustacea,' six species, besides *P. Bernardus*, are figured as British. There are *P. Prideauxii*, which is often mistaken for *P. Bernardus*, *P. Cuanensis*, *P. Ulidianus*, *P. Hyndmanii*, *P. lævis*, four small species described by W. Thompson, and *P. Forbesii* of Bell.

Cenobita (Latreille).—This genus, in the opinion of M. Milne-Edwards, establishes the passage between the *Paguri*, properly so called, and *Birgus*. The abdomen is conformable with that of *Pagurus;* the antennæ resemble those of *Birgus;* the carapace is equally characteristic, for it is much more solid than it is found in the *Paguri*, is narrowed and compressed forward, and presents in its posterior half a projecting border, which separates its upper surface from the lateral portion, which descends vertically towards the feet.

Under side of carapace, &c. of Cenobite (*Cenobita*).

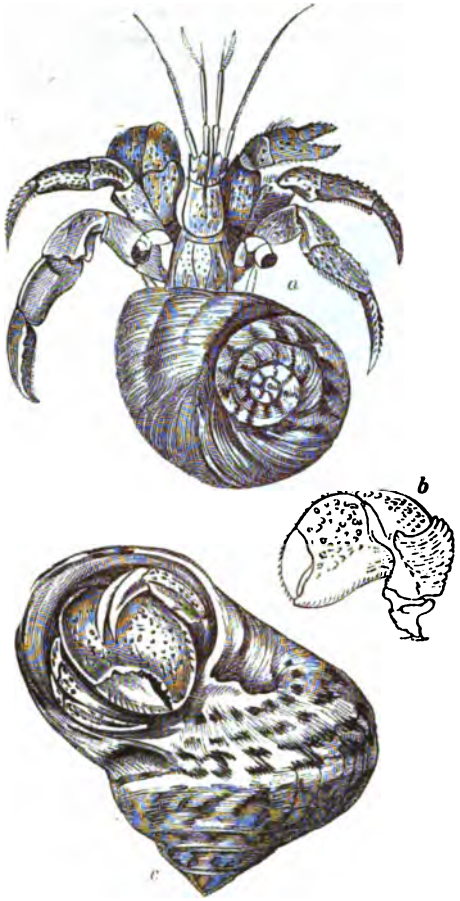
The Cenobites, which are all inhabitants of warm climates, are thus divided by M. Milne-Edwards.

§ Species having the ocular peduncles nearly cylindrical, rounded on the upper border, and terminated by a hemispherical cornea which reaches beyond the prolongation of the peduncular joint received into the notch of its upper border.

C. Diogenes. Stomachal region hardly convex. Ocular peduncles only of the length of the anterior border of the carapace, and nearly triangular; their basilary scale moderate and oval; tarsi very short; a trenchant and very projecting crest on the lower edge of the two last joints of the third left foot. Length about three inches; colour, especially of the large claw, red or violaceous.

It is a native of the Antilles.

Only one other species is placed by M. Milne-Edwards under thi section.



Cenobita Diogenes.

a, partially out of shell, showing the arrangement and structure of the antennæ, carapace, feet, &c. Among these last, what may be called the roughsided pair (the fourth) are well displayed; *b*, large claw, external view. (Milne-Edwards).

c, Cenobite in shell (*Turbo Pica*), showing the disposition of the first pairs of feet when the animal has retired as far as it can, and the large claw acting as a kind of operculum to protect the aperture.

§§ Species whose ocular peduncles are very much compressed, terminated above by a rather sharp border, and supporting a nearly triangular cornea, which does not sensibly reach beyond the prolongation of the peduncular joint received into the notch of its upper border.

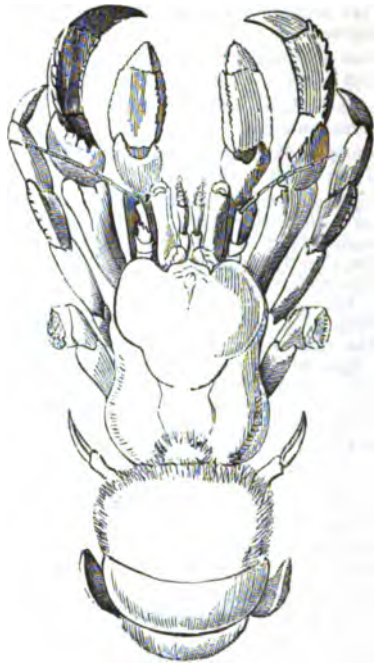
C. rugosa. Stomachal region nearly flat; labial border of the branchial regions very projecting, and slightly curved. Ocular peduncles nearly twice as long as they are high; their basilary scale moderate and pointed. Feet granulous and slightly muricated; the great claw moderate, and furnished above with a row of small, oblique, and parallel crests. Tarsi short and triangular. Upper and external edges of the two last joints of the third left foot elevated into an obtuse crest. Length about 3 inches. It is found in the Indian Ocean.

There are three other species.

Cancellus (Edwards).—This small generic division is but little distant from the *Paguri* properly so called, and is not as yet more than imperfectly known to him, for he had not examined the female of the only species, but the peculiarities offered by the organisation of the male prevent him from referring the form to any genus already established. The abdomen, instead of being rolled upon itself and terminating in a sort of shapeless tail, is perfectly symmetrical; the appendages of the penultimate abdominal ring have the same form as in the *Paguri*, but are similar on each side, and there is no other appendage adhering to the abdomen between this segment and the thorax.

C. Typus is the only known species.

Birgus.—This genus, according to M. Milne-Edwards, appears to establish the passage between the *Paguri* (or rather the Cenobites) and the *Lithodes*. [HOMOLIDÆ.] Their carapace, terminated anteriorly by a horizontal and projecting rostrum, is divided into two portions, as in the Cenobites; the anterior portion formed by the stomachal region is narrow, but the posterior portion is very large and oval, the branchial regions being very much developed, and forming on each side a sort of semicircular buckler, which advances above the base of the feet. The ocular peduncles are stout, rounded, and of moderate length. The internal antennæ have the same conformation as in the



Cancellus Typus.

Cenobites, except that their basilary joint is still more elongated. The disposition of the external antennæ and of the external jaw-feet is also entirely the same as in the last-named Pagurians. The anterior feet are stout, rounded, and of moderate length; the two succeeding pair are terminated by a stout cylindrical joint; and the fourth pair, which are shorter than the preceding, but not elevated above them, are provided with a cheliform hand, the two fingers of which are long and cylindrical; the posterior feet, which are very short and cylindrical, are elevated under the lateral parts of the carapace, and terminated by a very obtuse rudimentary pincer. The abdomen is very large, and covered above by a small horny band, followed by four great corneo-calcareous plates, which occupy its whole width, and over-ride each other, as in the Macrurous Crustaceans. On each side of these great segments are to be seen one or two horny pieces, which seem to be the representation of the epimerian piece of the four corresponding abdominal rings. In the female the first three of these segments, that is to say, the second, third, and fourth rings, have on each side a great false foot formed by a small basilary piece and two great narrow and ciliated appendages; those members are wanting on the right side, and in the male no trace of them is perceptible. The whole of the inferior surface of the abdomen is membranous, except that, towards its posterior part, may be seen a small quadrilateral plate, which gives attachment to a second projecting plate, and has on each side an abdominal rudimentary false foot, composed of a basilary piece and two moveable tubercles, which recall the disposition of the appendages of the sixth abdominal ring of the *Paguri*, but which is symmetrical on both sides of the body. The terminal plate is rounded at the end, covers the anus, and represents the seventh abdominal ring.

The respiratory apparatus in *Birgus* presents very remarkable peculiarities of structure. The branchiæ are 14 in number on each side of the body, and are fixed by a peduncle situated towards the middle of their internal surface. The respiratory cavity is very large, and the branchiæ only fill the tenth part of it; its vault is carpeted below by a delicate and epidermic membrane; but this soon disappears and leaves naked the skin, which is continued with that membrane, and covered by a multitude of vascular vegetations. [BIRGUS.]

PAGURUS. [PAGURIDÆ.]

PAIGLE, a name for *Primula veris*. [PRIMULA.]

PALÆOMYS, Kaup, an extinct genus of Rodents from the Epplesheim Sand.

PALÆONISCUS, a remarkable genus of Heterocercal Fossil Fishes, constituted by M. Agassiz, and included by him in the first family (*Lepidostei*) of his great order of Ganoidean Fishes. Its place in this family will appear from the following synopsis of the *Lepidostei*:—

A. Body elongated, fusiform, upper lobe of the tail vertebrated, and longer than the lower lobe.

Acanthodes; Catopterus; Amblypterus; Palæoniscus; Osteolepis.

B. Body flat, broad.

1. Upper lobe of the tail vertebrated.
   Platysomus; Gyrolepis.
2. Tail regular (the lobes nearly equal).
   Tetragonolepis; Dapedius.

C. Body elongated, fusiform, tail forked or rounded.
Semionotus; Lepidotus; Pholidophorus; Microps; Notagogus.

The generic character of *Palæoniscus* is thus given :—
All the fins of moderate size, with small rays on their edges; the dorsal fin opposite the interval of the ventral and anal fins. Scales moderate. In some species the scales are large, and the body is broader and shorter than in the others; there are always large mesial scales in front of the dorsal and anal fins.

The genus comprehends *Palæoniscum* and *Palæothrissum* of De Blainville.

The geological interest of this genus is considerable, inasmuch as the numerous species appear to be very definitely distributed in the strata of the Carboniferous and Saliferous Systems of Europe and America. The following is the series of species examined by Agassiz, with their localities, and the names of the formations in which they occur :—

1. *Palæoniscus fultus*	Coal Formation . .	Sunderland, Massachusetts; Westwick, Connecticut.
2. *P. Duvernoy* . .	Coal Formation . .	Munster Appel.
3. *P. minutus* . .	Coal Formation . .	Munster Appel.
4. *P. Blainvillii* .	Coal Formation . .	Near Autun.
5. *P. Voltzii* . . .	Coal Formation . .	Near Autun.
6. *P. angustus* . .	Coal Formation . .	Munster Appel.
7. *P. Vratislavensis* .	Rotheliegende . .	Ruppersdorf in Bohemia.
8. *P. lepidurus* . .	Rotheliegende . .	Scharfeneck in Co. Glatz.
9. *P. Freieslebeni* . .	Zechstein	Mansfield, Hesse, Eisleben, &c.
10. *P. magnus* . .	Zechstein	Mansfield.
11. *P. macropomus* . .	Zechstein	Mansfield.
12. *P. elegans* . .	Lower part of Magnesian Limestone	East Thickley in Durham.
13. *P. Robisoni* . .	Carboniferous Limestone	Burdiehouse, near Edinburgh.
14. *P. striolatus* . .	Carboniferous Limestone	Burdiehouse.
15. *P. ornatissimus* .	Carboniferous Limestone	Burntisland, Fifesh.
16. *P. comtus* . .	Magnesian Limestone .	Durham.
17. *P. glaphyrus* . .	Magnesian Limestone .	Durham.
18. *P. macrophthalmus*	Magnesian Limestone .	Durham.
19. *P. longissimus* . .	Magnesian Limestone .	Durham.
20. *P. carinatus* . .	Carboniferous Series .	Newhaven, near Edinburgh.

The researches of Agassiz have given a simple and beautiful generalisation of the distribution of these species; the scales of the *Palæonisci*, which abound in the Coal Formation, are almost universally smooth; those of the species which belong to the Magnesian Limestone are almost universally striated or sculptured. We find a few exceptions to this rule, as at Burdiehouse, and at Ardwick near Manchester, but it rests on a considerable number of coincidences. It is an unexpected result of Agassiz's critical inquiry into the forms of fossil fishes, that the *Palæonisci* of the English Magnesian Limestone are not identical with those of the Zechstein of Germany, notwithstanding the supposed contemporaneity of the rocks.

PALÆORNIS. [PSITTACIDÆ.]

PALÆOSAU'RUS, the name given by Dr. Riley and Mr. Samuel Stutchbury to a genus of fossil Saurians discovered in the magnesian conglomerate on Durdham Down, near Bristol (1834).

The conglomerate wherein the Saurian remains were found rests upon the edge of inclined strata of mountain limestone, filling up the irregularities of their surface, and consists of angular fragments of the limestone cemented by a dolomitic paste. The thickness of the deposit where the remains were discovered does not exceed twenty feet.

Three animals were found, two belonging to the genus *Palæosaurus*, and the other to a genus named by them *Thecodontosaurus*. [THECODONTOSAURUS.]

The following is the generic character of the *Palæosaurus* :—Teeth carinated laterally, and finely serrated at right angles to the axis, differing from those of all the known Saurians.

The two species are *P. cylindricus* and *P. Platyodon*.

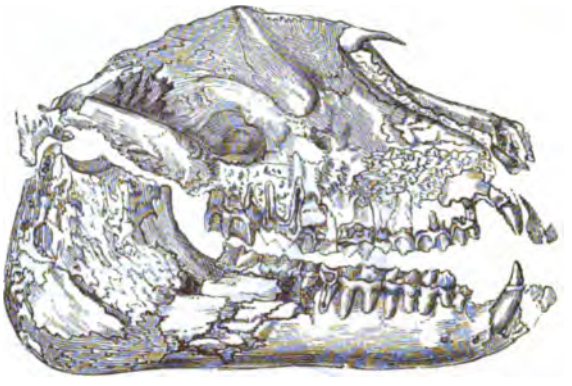
PALÆOTHE'RIUM, Cuvier's name for an extinct genus of Pachydermatous *Herbivora* discovered in the Gypsum Beds at Paris in company with *Anoplotherium*. [ANOPLOTHERIUM.] The following are the generic characters of *Palæotherium* :—

Dental Formula :—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{7-7}{7-7} = 44$.

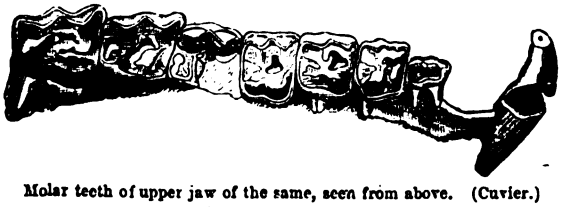
Three toes on each foot. A short fleshy proboscis, for the attachment of the muscles of which the bones of the nose were shortened, leaving below them a deep notch.

The molar teeth bear a considerable resemblance to those of the Rhinoceros; in the structure of that part of the skull destined to support the short proboscis and the feet, the animal closely approached the Tapirs.

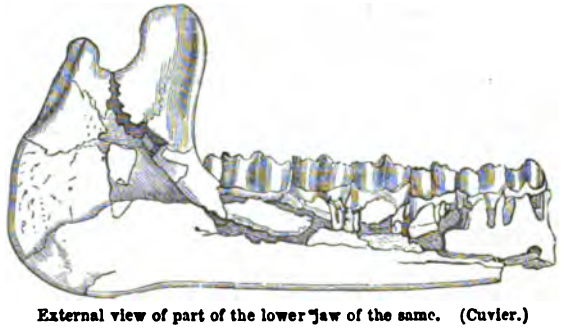
The species are numerous, and the following have been named :—*P. magnum* (Gypsum of Montmartre), *P. medium* (Gypsum of Montmartre, Osseous Breccia, Sète, &c.), *P. crassum*, *P. latum*, *P. curtum*, *P. minus*, *P. minimum*, *P. indeterminatum* (Gypsum of Montmartre), *P. Aurelianense* (Lacustrine Formation of Orleans, Argenton, &c.), *P. Isselanum* (Tertiary, Issel), *P. Velaunum* (Tertiary, Puy-en-Velay).



Skull of *Palæotherium magnum*. (Cuvier.)



Molar teeth of upper jaw of the same, seen from above. (Cuvier.)



External view of part of the lower jaw of the same. (Cuvier.)

Remains of *Palæotheria* have also been found in the Tertiary Formation near Rome, in the department of the Gironde, Provence, &c.

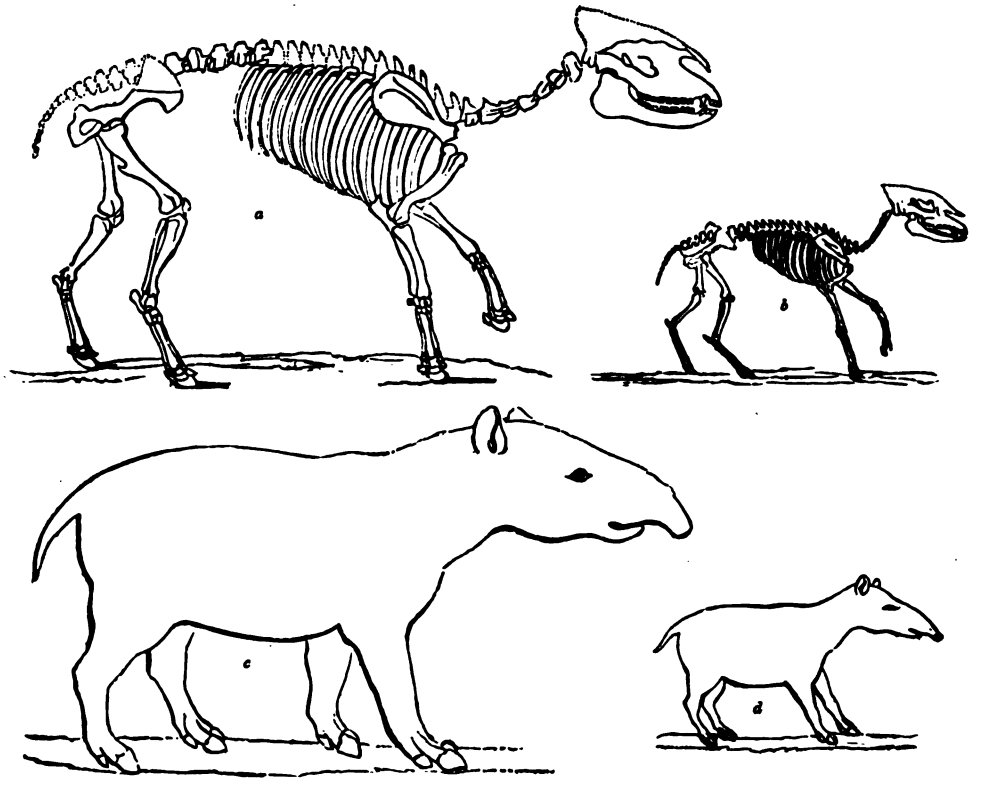
Mr. S. P. Pratt discovered, in the lower and marly beds of the quarries of Binstead in the Isle of Wight, which belong to the lower Fresh-Water Formation, a tooth of an *Anoplotherium* and two teeth of the genus *Palæotherium*, animals characteristic of strata of the same age in the Paris basin. The remains found by Mr. Pratt were accompanied not only by several other fragments of the bones of Pachyderms (chiefly in a rolled and injured state), but also, in his opinion, by the jaw of a new species of Ruminants, apparently closely allied to the genus *Moschus*. From the occurrence of the latter fossil, Mr. Pratt infers that a race of animals existed at this geological epoch whose habits required that the surface of the earth should have been in a very different state from that which it has been supposed to have presented, in consequence of the frequent discovery of the remains of animals which lived almost entirely in marshes. ('Geol. Proc.,' 1830.)

In his work on 'British Fossil Mammals and Birds,' Professor Owen describes four species of *Palæotherium* from the Tertiary Beds of Great Britain. They are *P. magnum*, *P. medium*, *P. crassum*, and *P. minus*.

The geological place of the extinct genus *Palæotherium* is in the first great Fresh-Water Formation of the Eocene Period of Lyell, where it is found with its congeners, of which nearly 50 extinct species were discovered by Cuvier.

The zoological position of the genus appears to be intermediate between the Rhinoceros, Horse, and Tapir. Their habits probably approximated to those of the Tapirs. Dr. Buckland supposes that these animals lived and died upon the margins of the then existing lakes and rivers. He is also of opinion that their dead carcasses may have been drifted to the bottom in seasons of flood, and that some perhaps retired into the water to die. The species varied greatly in size, some having been as large as a rhinoceros, and others having ranged from the size of a horse to that of a hog.

We subjoin illustrations which will give an idea of the relative size of two of the British species. The skull of *P. magnum* is the size of that of a large horse; that of *P. minus* is not bigger than the skull of a roe.



a, restored skeleton of *Palæotherium magnum*; *b*, restored skeleton of *Palæotherium minus*; *c*, restored outline of *Palæotherium magnum*; *d*, restored outline of *Palæotherium minus*. (Cuvier.)

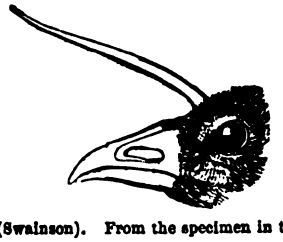
PALÆOZA'MIA, a genus of Fossil Cycadeous Plants, from the Oolitic and Lias Deposits of Yorkshire, Dorsetshire, and Oxfordshire.

PALÆOZOIC EPOCH, or SERIES, is a term applied to the Lower Secondary Rocks of the earth. These rocks are now generally divided into two series—the Newer Palæozoic and Older Palæozoic Rocks. The Newer include the Permian, Carboniferous, and Devonian Systems; the Older, the Upper Silurian, Lower Silurian, and Cambrian. [GEOLOGY; ORGANIC REMAINS.]

PALAMEDEA. [CARIAMA.]

PALAME'DEA (Linn.), a genus of Birds placed by Mr. Vigors among the *Grallatores*, with its congeners *Parra*, *Chauna*, *Rallus*, and *Fulica*, in the family *Rallidæ*. The same author thinks that with *Parra* may be allied *Palamedea* (Linn.) and *Chauna* (Ill.)—the *Parra chavaria* of the 'Systema Naturæ'—both of which seem to approach *Parra* in affinity, although the latter of them is so imperfectly known that its situation cannot be decided with certainty. ('Linn. Trans.,' vol. xiv.)

It has the following generic characters:—Bill shorter than the head, covered at the base with small feathers, conico-convex, slightly vaulted, hooked at the point; forehead armed with a cylindrical horn, which is pointed; nostrils oval, open. Wings spurred, third and fourth quills longest. Anterior toes united at the base by a membrane; hallux touching the ground at the end.



Head of *Palamedea* (Swainson). From the specimen in the British Museum.

P. cornuta, the Kamichi, or Horned Screamer. It is larger than a common goose; greenish-brown above, except on the middle of the neck, which is variegated with black and white, and a large cinnamon-coloured spot on the shoulders; abdomen whitish. A long spear-shaped horn projects from the forehead. Wings long and pointed; tail wide and square. Tarsi slender and reticulated, as well as the toes, which are long and almost entirely free; claw of the hallux nearly straight and very sharp; two spurs implanted on the edge of the wing.

It is the Anhima of the Brazilians, and, according to Cuvier, the Camouche of the people of Cayenne; but M. Lesson thinks that it is the Kotaçca of Barrère.

This extraordinary bird lives in the marshy or inundated places in South America (Guiana and Brazil), which it makes resound with its wild and loud cry. Its food consists of grains and aquatic herbs, as its muscular stomach would indicate, though there are not wanting those who state that it hunts reptiles. It pairs, and lives faithfully with its mate.

Horned Screamer (*Palamedea cornuta*).

Chauna, a closely allied genus, has the bill shorter than the head, clothed with small plumes at the base, conico-convex, slightly vaulted, curved at the point; head unarmed; lore naked. Wings spurred. External toes united at the base by a membrane; hallux touching the ground at the end; posterior and intermediate claws nearly straight. Tail graduated.

C. Chavaria has no horn; occiput ornamented with a circle of

feathers capable of elevation; head and upper part of the neck downy; a black collar; the rest of the plumage lead-colour and blackish, with a white spot on the bend of the wing and another on the base of some of the greater quills; hardly any part of the leg naked. Length of adult, 32 inches.

This is the Chaïa or Chaja of the people of Paraguay.

Chaja (*Chauna Chavaria*).

D'Azara has given us many interesting particulars relating to this bird. Its sharp clarion-like cry is exerted not only during the day, but also in the night, if it hears any noise. The note of the male is expressed by the word Chaja, and that of the female (for they answer each other) by the word Chajali. They are seen sometimes singly, sometimes in pairs, and at other times in numerous flocks. They principally, indeed ordinarily, frequent marshes, and if they are at any time found on the banks of rivers, it is in places where the water is low and runs sluggishly. They do not swim, but enter the water like Herons, but not, like them, in search of fish or frogs, but for the leaves and seeds of aquatic plants on which they live.

D'Azara saw some brought up among the domestic poultry at country-houses, and they were as tame as fowls. Those who kept them told him that the Chaïa ate bits of raw meat, but he saw them picking the grass. They perch on the tops of the highest trees. On the ground they walk with gravity. Some state that the nests are spacious, and formed of small branches on bushes surrounded with water, and others that the bird places it in the rushes in the midst of the water. The eggs are laid in the beginning of August, and the young, which are two in number, follow their parents, though they are only clothed with down.

The Indians of Carthagena rear them among their geese and other poultry, under the idea that they will act as a guard, for the Chaïa is very courageous and will drive away a vulture. D'Azara says that both this bird and the Kamichi are provided with a cottony down at the base of the feathers like swansdown; that the plumage of the neck is a little loose and inclining to downy; and that the skin of the neck is separated from the flesh by an interval of a line and a half, which is filled with cellular integuments, into which the air is introduced. The down at the base of the plumage is evidently calculated to keep up the proper temperature of the bird in its marshy home, and to repel the water when it wades so deep as to immerse the plumage.

It is a native of Paraguay, on both banks of the Rio de la Plata, and in Brazil, far from human habitations.

This genus *Chauna* was established by Illiger for the purpose of separating from the Kamichi, the *Parra Chavaria* of Linnæus, the Chaïa of D'Azara. Cuvier, as we have seen, did not separate it from *Palamedea*, and M. Temminck, in his 'Analysis,' in mentioning the genus *Chavaria*, expresses his opinion that the Chaïa ought not to form more than a species of Kamichi. The same author has subsequently, in his 'Planches Coloriées,' placed it with that genus. Mr. Swainson arranges it as a species of *Palamedea* under the name of *Palamedea cristata*. The general opinion seems to be that the bird should be considered as a species of the genus *Palamedea*, and that the genus *Chauna* should be obliterated.

PALAMEDEIDÆ. [PALAMEDEA.]

PALARUS. [LARRIDÆ.]

PALATE is the partition which separates the cavity of the mouth from that of the nose, forming the roof of the one and the floor of the other. In man it is composed of two portions, which are called respectively the hard and the soft palate: the former is made up of the inferior or palatine processes of each superior maxillary bone and palate bone, which, meeting in the middle line of the body, form a somewhat flattened arch over the mouth; the latter consists of a membranous curtain of muscular and cellular tissue, of which one margin is attached to the posterior border of the hard palate, and the other, with the uvula appended to its middle, hangs loosely backwards into the cavity of the pharynx. Both the hard and the soft palate are covered by a thin layer of vascular mucous membrane, immediately beneath which there are numerous minute glands. On each side, the soft palate is continued downwards in two diverging and arched membranous folds (the arches of the palate), which form the lateral boundaries of the fauces, and between which on each side the tonsil lies. Beneath these folds are muscles passing from the soft palate to the sides of the tongue and pharynx.

The hard palate serves as a firm support against which the food may be pressed by the back of the tongue during mastication; and it is by the various actions of the tongue upon it that we articulate several letters, as *d*, *g*, *j*, *k*, *q*, &c. The soft palate is capable of such motions by the contractions of its muscles, that it can either be raised so as to close the passage from the pharynx to the nose and Eustachian tube, or be depressed so as (with the assistance of the tongue) to close the passage from the pharynx to the mouth, or even to close both those apertures. By a simultaneous descent of the soft palate and contraction of the lateral arches by which it is connected with the tongue, the food when forced to the back part of the latter organ is impelled into the pharynx, constituting the first part of the act of swallowing. The soft palate is also of great importance in the actions by which substances are expelled from the digestive and respiratory organs through the mouth or nose, directing their passage, according to circumstances, into one or other of those cavities, as in coughing, sneezing, vomiting, &c.

PALEA. [CALATHIDIUM.]

PALECHI'NUS, a genus of Fossil *Echinodermata*.

PALEMON. [PALEMONIDÆ.]

PALEMONIDÆ, a family or tribe of Macrurous Decapodous *Crustacea*. They belong to Milne-Edwards's family of *Salicoques*, or Shrimps, and his tribe Palemoniana. The characters of this tribe are as follows:—Body laterally compressed, but the abdomen never sharp. Thorax large, carapace armed in front with a great sabre-like rostrum, nearly always dentated above. Antennæ placed as in the preceding tribe, but longer, and the first pair often with three terminal filaments. All the feet are slender, and the first two pairs are generally didactylous, whilst the last three pairs are never didactylous. The abdomen is of great size. (Milne-Edwards.)

The genera are, *Gnathophyllum*; *Hippolyte*; *Rhynchocinetes*, *Pandalus*; *Lysmata*; and *Palemon*.

Gnathophyllum (Latreille; *Drimo*, Risso).—Rostrum short but compressed, lamellar, and dentilated on its superior edge. Upper antennæ terminated by very short filaments, and blade of the lower antennæ rather large and oval. The external jaw-feet are foliaceous. First two pairs of feet moderate and terminated by a didactylous hand; the last three pairs monodactylous, of moderate length, and terminated by a small dentated tarsus. Abdomen presenting nothing remarkable. (Milne-Edwards.)

G. elegans has the carapace convex, rostrum oblique, and armed above with from six to seven teeth; second pair of feet rather longer and stouter than the first pair; terminal blades of the abdomen oval. Length about 20 lines. It is found at Nice.

Hippolyte (Leach).—General form of the body resembling that of *Palemon*, but their abdomen is incapable of being completely straightened, and appears, in some degree, to be humped; rostrum very large, compressed, and nearly always strongly dentated; internal antennæ small, and terminated only by two multi-articulate filaments nearly of equal length, one of which is very large and strongly ciliated; external antennæ inserted under the preceding, and presenting nothing remarkable; external jaw-feet slender and elongated. Feet formed nearly in the same manner as those of *Lysmata*, only that they offer no appendage at their base; the first pair are short, but rather stout; the second are filiform, terminated by an extremely small didactylous hand, and have a multi-articulate carpus; the last three pairs of feet are rather long, and in general very spiny at the end; the terminal plates of the natatory false-feet are lanceolate, dentilated on their edges, and ciliated all round. Branchiæ 7 on each side. (M.-Edwards.)

The species, which are rather numerous, and all small in size, are divided by M. Milne-Edwards into the following sections:—

1. Species whose rostrum springs from the front and is not continued backwards, with an elevated crest occupying the median line of the carapace.

H. varians. Rostrum passing beyond the peduncle of the internal antennæ, straight, slender, and armed with two teeth above—one situated at its base, and the other near its extremity—and two below,

situated a little behind the last superior tooth; a small spine on each side of the base of the rostrum, above the insertion of the eyes; first joint of the internal antennæ armed externally with a spine of moderate size; lamellar appendages of the external antennæ large, passing a little beyond the rostrum, and oval, or rather truncated obliquely from within outwards, and from before backwards at their extremity. Length 4 or 5 lines. It is found in the British Channel and the coasts of La Vendée. (Milne-Edwards.)

2. Species whose rostrum forms an elevated crest on the anterior part of the stomachal region, but is not prolonged on the posterior part of the carapace.

H. crassicornis has the carapace rounded above; rostrum very small, rather elevated at its base, but taking its origin close to the insertion of the eyes, and not reaching to the extremity of those organs; inflected at first, then straight, bifid at the end, and armed above with two or three dentilations; eyes very large; internal antennæ remarkably stout, their basilary joint dilated and lamellar below. Length 4 lines. It is found at St. Malo. (Milne-Edwards.)

3. Species the base of whose rostrum is elevated into a crest and prolonged to the posterior edge of the carapace.

H. gibberosa. Rostrum taking its origin from the posterior third of the carapace, very much bent and armed with four or five teeth at its base, then curving strongly upwards, and only presenting one small spine towards the level of the extremity of the eyes, and two or three dentilations at its point; its lower border descending very low at its base and armed with six or seven teeth, the posterior of which are very strong; lateral spine of the internal antennæ very large; lamellar appendage of the external antennæ nearly triangular. Length about 18 lines. It is found on the coasts of Australia. (Milne-Edwards.)

The other British species of *Hippolyte* are *H. spinus, H. Cranchii, H. Thompsonii, H. Prideauxiana,* and *H. pandaliformis.*

Rhynchocinetes (Edwards).—M. Milne-Edwards observes that this genus is closely approximated to *Hippolyte,* but that it is distinguished from all the other macrurous crustaceans by the singular conformation of the rostrum, which, instead of being a simple prolongation from the front, is a distinct lamina of the carapace, and articulated with the front so as to be very moveable, and to possess the power of lowering itself above the antennæ, or of elevating itself vertically; in other respects it much resembles the rostrum of *Hippolyte.* It is very large, sabre-shaped, and dentilated on both edges.

R. Typus. Front armed with three spines, of which the median, placed above the base of the rostrum, is followed by another median spine; rostrum very large, longer than the lamina of the external antennæ, armed above with two spines situated near the base, and with seven or eight dentilations situated at its extremity; its inferior border furnished with a score of very large teeth. Length about 2¼ inches.

It is a native of the Indian Ocean. (Milne-Edwards.)

Pandalus (Leach).—Closely resembling *Palemon* in the general form of the body, but distinguished from that genus by the conformation of the feet, of which the two anterior are monodactylous. Carapace armed in front with a very long compressed rostrum, which is elevated towards the end, and dentilated both above and below. Eyes large, short, and free. Upper antennæ formed nearly like those of *Palemon,* excepting that they possess only two terminal filaments; external jaw-feet slender and pediform. Feet slender; the first pair shortest, and terminated by a styliform joint; the second pair filiform, and terminated by a very small didactylous hand; their carpus multiarticulate; succeeding feet presenting nothing remarkable. Disposition of the abdomen the same as in *Palemon.* Number of branchiæ, twelve on each side of the body. (Milne-Edwards.)

P. annulicornis. Rostrum of the length of the carapace, armed above with some ten teeth, which occupy the stomachal region and the posterior half of its fore part; a small tooth near the point of the rostrum, separated from the preceding by a rather long smooth space; interior border of the rostrum armed with from seven to eight very large teeth towards its base, and the last of which are placed towards the extremity. Length of the body about two inches.

It is found on the coasts of England and Iceland. (Milne-Edwards.)

Lysmata (Risso).—Resembling very much the Palæmons, and establishing the passage between them and *Hippolyte;* they have their general form, and their carapace is equally armed with a long, compressed, and dentilated rostrum. Internal antennæ terminating also in three multi-articulate filaments, two of which are long and one very short; the external antennæ are inserted under the first, and present nothing remarkable. The mandibles are deprived of a palpiform appendage.

L. seticordata. Rostrum taking its origin towards the middle of the carapace, a little inflected towards the end, not attaining the extremity of the peduncle of the internal antennæ, and armed with six teeth above and two below; two of the filaments of the superior antennæ as long as the body. Length about two inches. Colour red-brown, striped longitudinally with white.

It inhabits the Mediterranean. (Milne-Edwards.)

Palemon (Fabr.).—Body compressed but little, and generally rounded above. Carapace moderate in size, and presenting towards its anterior third a median crest, which is the origin of the rostrum; this last advances above the base of the eyes and antennæ, and presents nearly always a considerable length; it is very much curved upwards towards the end, and strongly dentilated on its upper and lower borders. Eyes large and projecting. Internal antennæ inserted above the external ones; the first joint of their peduncle very large, depressed, excavated upon its upper surface for the lodgment of the eyes, and armed externally with a strong spine, which occupies its anterior angle; the two succeeding peduncular joints stout and cylindrical. The multi-articulate filaments which terminate these organs are three, two of which are in general extremely long, and one very short and joined by its base to one of the preceding. The external antennæ are inserted below, and rather external to the internal antennæ; the lamellar palp which covers their base is very large, oval, rounded, and ciliated at the end, and armed with a spine at its external border. The mandibles carry a small cylindrical palpiform appendage, and the external jaw-feet are of moderate length, slender, sometimes unguiculated at the end, and sometimes terminated by a small multi-articulate appendage. First pair of feet slender, terminated by a small didactylous hand, and presenting near their base, on the internal side, a small dilatation, which covers the mouth, and acts after the manner of jaw-feet; second pair of feet much longer and stronger, terminated also by a well-formed didactylous hand, and with the carpus entire and formed in the ordinary manner; three succeeding pairs slender and monodactylous, their length diminishing progressively, and without any vestige at their base of flagrum or palp. Abdomen very large, and narrowing gradually towards the end; its upper surface regularly arched, but capable of becoming nearly completely straight, without any hump as in *Hippolyte.* The seventh segment, which forms the median piece of the caudal fin, is triangular and shorter than the lateral blades; it is generally armed with some spines at its extremity, and there are on the upper surface five small spines, the anterior of which is situated on the median line, and the others laterally. The lateral blades of the caudal fin are very large, oval, and nearly of equal size. The abdominal false feet are very large; the first pair carry a large ciliated blade and a second smaller one; the others are provided with two ciliated blades, nearly of the same size, of which the internal one carries towards its base a small cylindrical appendage. (Milne-Edwards.)

M. Milne-Edwards remarks that the nervous system of the Palemons presents a much greater concentration than that of the Crawfishes (Écrevisses); for all the thoracic ganglions are approximated so that they nearly touch each other. The branchiæ, he observes, are eight in number on each side of the body.

The species of this useful and delicious genus are numerous. M. Milne-Edwards records seventeen, besides the Indian *Palemon brevimanus* and *P. Coromandelinus* of Fabricius. Those of our own coasts are well known to the epicure; and some of the species which are found in warm climates attain to a considerable size: such are the *P. Carcinus* of the Indian seas and the Ganges, which attains to nearly a foot in length, and the *P. Jamaicensis* of the Antilles, which is from 10 to 12 inches long.

The prawns generally inhabit sandy bottoms near the coasts, but some are found at the mouths of rivers, and far up. They mostly boil red.

M. Milne-Edwards subdivides the species into the following sections:

1. Species having the anterior border of the carapace armed on each side with two spines, situated one above and the other below the insertion of the external antennæ.

P. serratus. Rostrum reaching much beyond the lamellar appendage of the external antennæ; very much elevated towards the end, and bifid at its extremity; its superior border smooth for nearly its anterior half, and armed on the rest of its extent with from seven to eight teeth; the crest which occupies its inferior border very wide at its posterior extremity, and armed with five or six teeth. The small terminal filament of the superior antennæ very short, not attaining the extremity of the rostrum when it is directed forwards, nor the anterior border of the carapace when it is directed backwards. Length from 3 to 4 inches. Colour grayish with small red and brown spots.

It abounds on the coasts of France and England.

This is the *Astacus serratus* of Pennant; *Cancer Squilla* of Herbst; the Prawn of the shops.

There are two other Prawns which inhabit our coasts: one, the *Palemon Squilla* and *Astacus Squilla* of Fabricius, with a much shorter rostrum, not reaching beyond the lamellar appendage of the external antennæ, nearly straight, and dentated to the top, and about 20 lines long altogether; the other, *Palemon varians,* with a very short rostrum armed with from four to six teeth above, and only two or three below, and about one half the size of the last.

2. Species having the anterior border of the carapace armed on each side with a single spine.

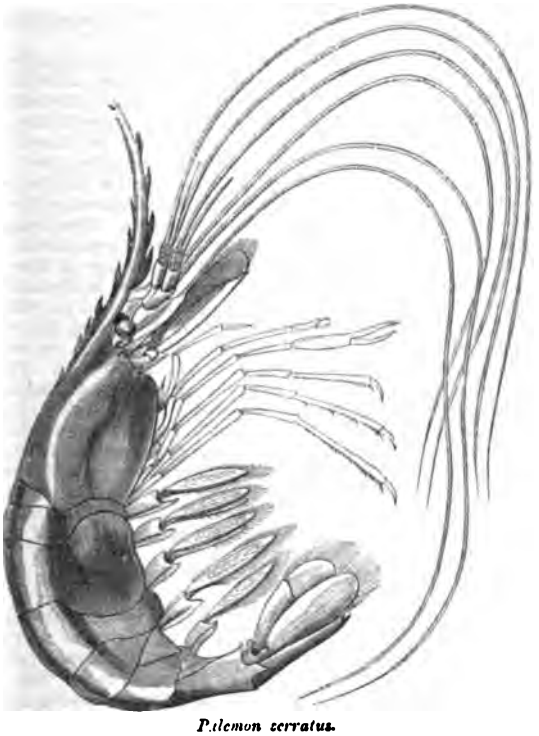
A. A second spine situated behind the preceding, nearly on the same horizontal line.

A.* Prehensile borders of the pincers nearly straight, and touching each other throughout their length.

P. Carcinus, which inhabits the Indian seas and the Ganges, is an example.

*A**.* Prehensile borders of the pincers concave, so as to leave a space between them.

P spinimanus, which inhabits the Antilles and the coast of Brazil, is an example.



Palemon serratus.

AA. No second spine situated at the base or behind that with which the anterior border of the carapace is armed on each side.

P. Gaudichaudi, a native of Chili, is an example.

The other tribes of Milne-Edwards's Salicoques are the Alpheans and Penæans (*Alpheadæ* and *Penæadæ*).

Alpheadæ.—The shrimps comprised by M. Milne-Edwards under this tribe are stouter in their forms than those of the preceding division, but they are not depressed as the Crangons are. [CRANGONIDÆ.] The rostrum is very short, and has never the form of a great projecting central blade, as in the Palemonians. The internal antennæ are placed above the external antennæ, and are, in general, very short. One pair of feet is very stout, and generally terminated by a powerful didactylous hand. The two anterior pairs of feet are nearly always didactylous, but the third pair never are; the three last pairs are rather robust, and serve for walking as well as for swimming.

The genera are *Atya*, *Hymenocera*, *Alpheus*, *Pontonia*, *Autonomea*, *Caridina*, *Nika*, and *Athanas*.

Atya (Leach). [ATYA.]

Hymenocera (Latr.). [HYMENOCERA.]

Alpheus (Fabr.).—Carapace advanced above the eyes, forming above each of those organs a small vaulted buckler. Rostrum very small, and sometimes wanting. In other respects the carapace presents nothing particular. The superior antennæ are small, their first joint short, and armed externally with a lamina, which is ordinarily spiniform; the two next joints are cylindrical; and of the terminal filaments, two in number, the upper one is stouter and shorter than the lower, and presents traces of a division near the end. The inferior antennæ are inserted externally to and below the preceding: the lamellar palp is of moderate size, or even sometimes small and pointed, and their terminal filament presents nothing particular excepting that it is often somewhat compressed. The mandibles are provided with a short palpiform appendage, which is wide and flattened.

They are found in the seas of warm climates. Some species are found in the Mediterranean, but the greater part in the seas of the Antilles or in the Indian Ocean.

M. Milne-Edwards separates the Alpheans into the following sections and subdivisions:—

1. Species with a pointed rostrum.

A. No spine at the outside of the basilary joint of the external antennæ.

Ex. *A. ruber*, from the Mediterranean. (Milne-Edwards.)

B. A great spine fixed on the external border of the basilary joint of the external antennæ, and directed forwards.

Ex. *A. villosus*, from the seas of Australia.

2. Species deprived of a spiniform rostrum.

Ex. *A. frontalis*, from the coasts of Australia.

M. Milne-Edwards records twelve species of *Alpheus*.

Pontonia (Latr.).—Carapace short and convex: the front with a short but robust and inflected rostrum; the eyes are cylindrical, projecting, and very moveable. The internal antennæ are very short, and formed very nearly like those of the Palemons or Prawns; the first joint of their pedicle is very wide and lamellar externally; the two succeeding joints are small and cylindrical. The terminal filaments, two in number, are very short, and the one between them is bifid at the extremity. The external antennæ are inserted above and external to the preceding; their lamellar appendage is large and oval.

M. Milne-Edwards divides the *Pontoniæ* into the following sections:—

1. Species with the rostrum very large and depressed, and the external antennæ inserted nearly on the same line as the superior antennæ.

Ex. *P. macrophthalma*, from Asiatic seas, where it was found by M. Dussumier.

2. Species with the narrow rostrum very much compressed laterally, and inflected towards the point; the external antennæ inserted entirely below the superior antennæ.

Ex. *P. armata*, from New Ireland, where it was found by Messrs Quoy and Gaimard.

Autonomea (Risso).—Antennæ intermediate or superior, terminated by two filaments, one of which is much longer and thicker than the other; external or inferior antennæ longer than the body, and setaceous. Peduncles of the first inarticulate, having their lower portion convex and armed with a spur, the intermediate long and cylindrical, and the last short and bent. Those of the second bi-articulate, without scales, their second portion being hairy at its extremity.

Ex. *A. Olivii*. It occurs in the Adriatic Sea, and rather rarely at the environs of Nice, where it lives solitary in the sea-weed and muddy places; the female carries her reddish eggs about the middle of the summer. (Desm.)

Caridina (Milne-Edwards).—Carapace presenting nothing particular and terminating by a lamellar rostrum varying in length. Eyes projecting. Internal antennæ very long, and terminated by two large multi-articulate filaments, one of which is convex at its base; external antennæ formed like those of the Palemons.

Ex. *C. Typus*.

Nika (Risso).—M. Milne-Edwards observes that this genus is remarkable for the defect of symmetry in the conformation of the first two pairs of feet. In their general form, he remarks, they resemble the Palemons, or rather the genus *Athanas*, for their rostrum is very small. Their internal antennæ are slender, and terminated, as in these last, by two rather long filaments. The external jaw-feet are pediform, long, and stout; the joint which terminates them is pointed at the end. The anterior feet are stronger than those which succeed, but of moderate length; the anterior right limb has a well-formed didactylous hand, whilst that opposed to it is monodactylous and formed after the manner of ambulatory feet. The feet of the second pair of limbs are filiform, and terminated by a nearly rudimentary pincer; their carpus is multi-articulate, and their length very different: the left is nearly twice the length of the anterior feet, and the right is nearly twice the length of its opposite. The succeeding feet are monodactylous, and terminated by a styliform tarsus, which is not spiny: the fourth pair are longer than the third. The abdomen has the same form as in the Palemonians.

N. edulis has the rostrum slightly inflected, and nearly of the length of the eyes. A small tooth on each side, on the anterior border of the carapace, below the insertion of the eyes. Length about 2 inches.

It is an inhabitant of the Mediterranean and the English Channel. Mr. Bell regards this species as identical with *Procepa canaliculata* of Leach. He also describes a second British species, *N. Couchii*.

Athanas (Leach).—Carapace not elevating itself into a carina at the base of the rostrum, as in the Palemonians; the rostrum itself not toothed on its edges. Eyes projecting but little, but not covered by the carapace, as in *Alpheus*. Internal antennæ rather large, and terminating by three multi-articulate filaments, disposed as in *Palemon*, as are the external antennæ also. Mandibles robust, with a palpiform, short, but very large appendage composed of two joints.

A. nitescens has the rostrum sharp, shorter than the peduncle of the internal antennæ; a spine on each side of its base, on the anterior border of the carapace. Hands unequal, convex, and with short and obtuse fingers. Carpus of the second pair of feet divided into five or six joints. Length about an inch.

It is a native of the coasts of France and England.

In the *Penæadæ*, or Penæans, M. Milne-Edwards comprises those shrimps whose abdomen is in general extremely elongated, and whose feet often carry at their base a palpiform appendage more or less developed. The rostrum is short, or nearly null, and the lower antennæ, if not both pairs, are nearly always very long. The conformation of the feet varies much; but generally these organs become for the most part so slender and long, that they cannot serve except for swimming, and sometimes the last pairs become rudimentary or disappear.

Genera—*Stenopus*, *Sicyonia*, *Penæus*, *Euphema*, *Ephyra*, *Oplophorus*, *Pasiphæa*, *Sergestes*, and *Acetes*.

Stenopus (Latreille).—Body not compressed laterally, and tegument comparatively soft. Carapace terminated anteriorly by a small rostrum. Eyes short, and disposed in the ordinary manner. Peduncle of the

superior antennæ slender, and not carrying any lamellar appendage, as in the *Penæi;* terminal filaments of those organs long and cylindrical, and two in number. Lower antennæ presenting nothing remarkable. Mandibles strong, and furnished with a palp which is but little enlarged, and resembling that of the Palemons rather than that of the *Penæi*. External jaw-feet slender, elongated, and provided with a palp which is nearly rudimentary. First three pairs of feet didactylous, and progressively increasing in length; third pair much stouter than the others, and very spiny. Last two pairs of feet very long also, but filiform, and with their last two joints divided into a multitude of small rings: a disposition which is not seen either in the *Penæi* or the *Sicyoniæ*, and which recals the structure observable in the second pair of feet of the species of *Hippolyte*, &c. The feet bear no lamellar appendage as in the *Penæi*. The abdomen is of moderate size, and presents nothing remarkable. (Milne-Edwards.)

Ex. *Stenopus hispidus; Palemon hispidus*, Oliv., from the Indian Ocean.

Sicyonia (Edwards).—Tegument harder than in the greater part of the shrimps. Body slightly compressed. Carapace surmounted with a median crest, which is continued forward into a rather large rostrum. On each side of the carapace, about its anterior third, a spine directed forwards. Eyes large, cylindrical, and exposed. Upper antennæ very short, their peduncle very stout, and not presenting, as in the *Penæi*, a lamellar appendage recurved above the eyes; their terminal filaments, two in number, extremely short. External antennæ inserted below the preceding, and offering nothing particular. First two pairs of jaw feet formed nearly the same as in the *Penæi*, excepting that they are deprived of palps. First three pairs of feet terminated by a small didactylous hand, and elongated from before backwards, as in the preceding genus; the last two pairs monodactylous, and the last much longer than the penultimate pair. None of these organs are multi-articulate, as in the *Stenopi*, nor provided with a flabelliform appendage, or a palp, as in the *Penæi*. Abdomen carinated above, and presenting several furrows, which make it appear as if it were sculptured; it carries below five pairs of false feet, each of which is only provided with a single natatory blade; the median blade of the caudal fin is pointed and furrowed above. Branchiæ 11 on each side.

Ex. *Sicyonia sculpta; Cancer carinatus*, Oliv., from the Mediterranean.

Penæus (Latreille).—Carapace furnished above with a more or less long median crest, which is continued forwards into a nearly straight, lamellar, and dentilated rostrum; on each side, near the insertion of the superior antennæ, a stout tooth, and a curved longitudinal furrow, which circumscribes laterally the stomachal region; a spine nearly always exists at the point of junction of the stomachal furrow and that of the branchial region, and sometimes a small crest is seen between the first of these furrows and the basilary crest of the rostrum. Eyes stout and rounded. First joint of the superior antennæ very large, and excavated above so as to form a cavity in which the eyes are lodged; its external border armed with a tooth, and its internal border with a small lamellar and ciliated appendage, which curves back upwards and outwards. The last two joints of the peduncle cylindrical and very short; and the terminal filaments of varying length. The external antennæ present nothing remarkable. Mandibles provided with a very large lamellar palp. Last two pairs of jaw feet carrying a very long and multi-articulate foliaceous palp, and provided also with a flabelliform appendage which ascends among the branchiæ; external jaw feet long, slender, and pediform. First four pairs of the thoracic feet provided with a flagrum which ascends into the branchial cavity as in the crawfishes, and at the base of all the feet a small lamellar appendage analogous to the palp of the jaw feet, a mode of conformation which reminds the observer of that of the Stomapoda. The first three pairs of feet terminated by a small didactylous hand, and augmenting progressively in length from before backwards. Last two pairs of feet monodactylous and of moderate length. Abdomen extremely large and very much compressed; its posterior moiety surmounted with a median crest more or less marked. False feet not encased by the lateral laminæ of the abdomen, and terminating by two ciliated laminæ of unequal size. Caudal fin large; its median blade triangular, and hollowed below by a median furrow. Branchiæ disposed in bundles as in the lobster, 18 on each side, and between each bundle the flabelliform appendage of the foot situated below. (Milne-Edwards.)

M. Milne-Edwards subdivides the genus into the following sections:—

1. Species having the antennæ terminated by very short filaments.

* A median furrow extending from the base of the rostrum to the posterior border of the carapace.

Ex. *P. Caramote* (*Cancer Kerathurus*, Forsk.; *Palemon sulcatus*, Oliv.). It is found in the Mediterranean.

** No median furrow between the base of the rostrum and the posterior border of the carapace.

Ex. *P. setiferus* (*Palemon setiferus*, Oliv.; *Astacus fluviatilis Americanus*, Seba). It is very abundant at the mouths of the rivers of Florida.

2. Species having the superior antennæ terminated by filaments longer than the carapace.

Ex. *P. membranaceus*, from the Mediterranean.

M. Milne-Edwards remarks that the genus *Melicertus* of Rafinesque seems to differ but little from *Penæus*.

Euphema (Milne-Edwards).—General form of the body approaching closely to that of *Hippolyte*. Carapace terminating anteriorly by a very long rostrum; abdomen bent towards the middle, its second ring prolonged posteriorly into a long spine, which is directed horizontally backwards, as is the rostrum forwards. Eyes large and short. Disposition of the antennæ presenting nothing remarkable; the first pair have, as usual, their first joint excavated above for the lodgment of the eyes, and terminate by two multi-articulate filaments; the second pair of antennæ are inserted below the preceding. Mandibles short, stout, but slightly dentilated, and provided with a palpiform, short, wide, and biarticulate stem; the valvular appendage of the jaws of the second pair is oval, and only a little prolonged backwards. The last two pairs of jaw-feet are moderate, pediform, and provided with a lamellar palp nearly as long as the internal stem; they also carry at their base an appendage which represents the flagrum, but which is membranous and vesicular, nearly as in the Amphipoda. The first three pairs of thoracic feet are terminated by a small imperfectly didactylous hand; and the last two pairs are monodactylous and strongly ciliated, so as to be rather natatory than ambulatory; all carry at their base a small very short flagrum, as well as a lamellar palp. The appendages of the first five rings of the abdomen are composed of a cylindrical peduncle and of two terminal joints, as in the ordinary Salicoques, only the blades are not ciliated. The caudal fin presents nothing remarkable. Branchiæ lamellar, and fixed in many rows on each side of the thorax.

Ex. *E. armata*, the only species known. It inhabits the Southern Atlantic.

Ephyra (Roux).—Body laterally compressed; carapace smooth; abdomen carinated, and rostrum dentated. Jaw-feet very much elongated; and the thoracic feet carrying at their base a palpiform appendage, but not appearing to have a point as in the next genus. First two pairs of feet small, shorter than the succeeding ones, and didactylous; carpi simple.

Ex. *E. pelagica*. It is taken in the Mediterranean, at great depths.

Oplophorus (Milne-Edwards).—Body not compressed. Carapace terminated by a styliform rostrum, which is very long and dentilated on its two borders. Peduncle of the superior antennæ very short, and one of the terminal filaments very stout and pyriform at its base, but soon becoming slender and cylindrical like the other; the lamellar appendage of the external antennæ differs much from that of all the other shrimps; it is large, narrows gradually from its base, terminates in a very sharp point, and presents a series of spines on its external edge. External jaw-feet short, and carrying externally an extremely large lamellar palp. First two pairs of feet very short, terminated by a very small hand, and provided at their base with a very large and ciliated lamellar appendage; three succeeding pairs of feet moderate and monodactylous, the appendix fixed at their base small; and the tarsus of the third and fourth pairs styliform and very large, whilst that of the posterior feet is rounded and extremely short; there is also at the base of each foot a small flabelliform appendage, which ascends among the branchiæ, and the number of these last organs is nine. Abdomen differing but little from that of *Hippolyte*.

Ex. *O. Typus*, from New Guinea.

Pasiphæa (Savign; *Alpheus*, Risso).—Body remarkably flat laterally. Rostrum very short, or even rudimentary, and the carapace much narrower forward than behind. Eyes moderate and directed forward. Peduncle of the internal antennæ slender, and terminated by two multi-articulate filaments, one of which is rather long; external antennæ inserted below the preceding, and offering nothing remarkable. Mandibles strongly dentated, and deprived of a palpiform stem. External jaw-feet very long, slender, and pediform; at their base a lamellar and ciliated palp as in the *Penæi*. The thoracic feet carry also, suspended at the external side of their basilary joint, a rather long lamellar appendage of the same form, but membranous and but little or not at all ciliated. Two first pairs of feet rather stout, nearly of the same length, armed with spines on their third joint, and terminated by a didactylous hand, the pincers of which are slender and furnished with a series of sharp spines on the prehensile border. The next three pairs of feet are very slender, monodactylous, and more or less natatory; in general, if not always, the penultimate pair are much the shortest. Abdomen very long and very much compressed. False feet of the first ring terminating by a single blade, but those of the next four feet carrying each two short natatory and but little ciliated blades. The sixth abdominal ring very long, and the seventh short and triangular. External blades of the caudal fin large and narrowed towards the end.

Ex. *P. Sivado* from the coasts of Nice.

Sergestes (Edwards).—Body slender and a little flattened; carapace presenting anteriorly a small spine in lieu of a rostrum. Eyes very much projecting, and the ophthalmic ring on which their peduncles are inserted not completely covered by the carapace. Upper antennæ extremely long, and carrying, besides the principal terminal filament, two rudimentary filaments. External antennæ inserted below the preceding, and also very long. Second pair of jaw-feet nearly pediform and without either palp or flabelliform appendage, long, slender, bent back on themselves, and applied upon the mouth. Appendages which

correspond to the external jaw-feet offering nothing which can distinguish them from the ordinary thoracic feet; they are delicate, very long, ciliated, and terminated by a very slender styliform joint. Next four pairs of feet with the same general form, slender, filiform, furnished with much hair, and presenting at their base neither flabelliform appendage nor vestige of palp; second and third pairs provided at their extremity with a rudimentary joint, which is nevertheless moveable and disposed so as to constitute a microscopic claw. Penultimate pair of feet very short and a little distant from each other; the last pair nearly rudimentary. Abdomen presenting nothing remarkable, except that its lateral laminæ do not descend so as to encase the base of the false feet as in the ordinary Salicoques. The first pair of these false feet terminate by a single natatory foliaceous blade, and present in the male a corneous prolongation of an odd form, which is fixed to the peduncle of those appendages, and goes to articulate itself on the median line with that of the opposite side. The next four false feet have two narrow natatory blades, which are ciliated and of unequal size. The median blade of the caudal fin is small and pointed, and the lateral blades are narrow, very nearly oval, and terminated in a point. Branchiæ disposed on a single line, seven on each side of the thorax.

Ex. *S. Atlanticus*, the only known species. It inhabits the Atlantic Ocean, at some distance from the Azores.

Acetes (Milne-Edwards).—Analogous to *Sergestes* in its conformation, but placed at a distance from all the animals of the same order by the absence of the last two pairs of feet. Thoracic feet, consequently only three pairs; but, as in the *Sergestes*, the external jaw-feet acquire an excessive length, and perform the same functions as the ordinary feet. Carapace smooth, and presenting at its anterior extremity a longitudinal series of three small teeth, but there is no true rostrum. Eyes spherical and carried on rather long peduncles; the superior antennæ, placed above the external ones, have a long peduncle; but its last joint is shorter than the first, and only carries two bristles, one of which is about twice the length of the body. The lower or external antennæ present a terminal filament not less elongated, and their base is covered, as in ordinary, by a great corneous plate. The mandibles, or jaws properly so called, and the two pairs of jaw-feet, do not differ remarkably from those of *Sergestes;* and the same may be said of the ambulatory feet, which are filiform and terminated by a very elongated joint, but the two posterior feet are wanting, as has been observed. Nevertheless a thoracic segment may still be distinguished behind, carrying branchiæ like the preceding, but without locomotive appendages. The abdomen presents nothing remarkable; the natatory false feet all terminate by two narrow and pointed blades, which are at first nearly of the same length, but the internal one of which becomes shorter on the last segments. The peduncle of these appendages presents very opposite modifications; for upon the first rings of the abdomen it is long and narrow, whilst upon the last it is stout and short. The caudal-fin resembles that of *Sergestes*.

Ex. *A. Indicus*.

PALICOU'REA, a genus of Plants belonging to the natural order *Cinchonaceæ*. The limb of the calyx is 5-toothed or 5-lobed, or nearly entire; the corolla tubular and cylindrical, and a little gibbous at the base or curved, 5-cleft, bearded beneath the middle inside. The teeth of the calyx and corolla sometimes rather unequal. The species are American shrubs wholly destitute of pubescence. The leaves often whorled and of considerable size. The flowers are yellow or white in terminal sessile or stalked panicles, thyrses, or cymes.

P. Marcgraavii is a shrub from 5 to 6 feet high, and has smooth quadrangular branches. It is a poisonous plant, used in Brazil to kill rats and mice.

P. crocea has a smooth stem, ovate or oval-lanceolate leaves. It is a native of Porto Rico, Trinidad, Cuba, and Guadaloupe. According to Von Martius this species is emetic.

P. speciosa has smooth round branches, oblong acuminate leaves, acute at the base, membranous, roughish, shining, with smooth stipules. The leaves have by their yellow colour obtained for the plant the name of Gold-Shrub, highly spoken of in Brazil as an antisyphilitic. "The decoction, which in large doses forms a real poison, acts especially by an increased action of the skin and kidneys, and the digestion is not injured by moderate doses." (Martius.)

P. officinalis is a shrub clothed with harsh yellow down in every part. It is a native of Brazil, and is reported to be a powerful diuretic, and is used both in human and veterinary medicine.

Other species of this genus are said to have qualities similar to the last. *P. diuretica*, *P. strepens*, *P. sonans*, and *P. longifolia* are amongst those reported to possess medicinal virtues. *P. tinctoria* forms a fine red dye much valued in Peru.

Lindley, *Flora Medica;* Burnett, *Elements*.)

PALINU'RUS, the name given by Fabricius to a genus of *Crustacea* which forms the tribe of Langoustiens in the system of M. Milne-Edwards, being the fourth of his family of Cuirassed Macrurians, and characterised by the existence of antennæ of the ordinary form and the absence of didactylous pincers. It is also regarded as the type of a family of the *Palinuridæ*.

The *Palinuri*, or Sea-Crawfish, as they are popularly called, have the body nearly cylindrical. Their carapace is nearly straight from before backwards, very convex transversely, and presents about its anterior third part a deep transverse furrow, which is directed forward on each side and separates the stomachal from the cardial and branchial regions, the only ones which can be well distinguished. The anterior border of the carapace is armed with two stout horns, which advance above the eyes and the base of the antennæ. On each side, below the eyes and nearer to the base of the external antennæ, there is a more or less strong tooth. A great number of spines also nearly always arm the cephalothoracic buckler, over whose surface they are disposed. The ophthalmic ring is free and exposed; the eyes are large, short, and rounded. The antennular ring is very much developed, and advances between the external antennæ, below and in front of the ophthalmic ring; sometimes it is triangular, and much longer than it is wide, and sometimes it is nearly square. The internal antennæ, which spring from the lower part of its anterior border, are very long; their first joint is entirely cylindrical, and so are the next two joints; they terminate by two multi-articulate filaments of varying length. The external antennæ are very stout and very long; their basilary joint, in which the auditory apparatus is lodged, is very large, and is joined to its congener so as to form in front of the mouth a very large epistome; the three succeeding joints are stout, moveable, and thorny; they constitute the basilary portion of the antennæ, and are succeeded by a multi-articulate stem which is very stout and very long. The external jaw-feet are small and pediform; their internal border is only a little or not at all toothed, very obtuse, and furnished with bundles of hairs; their palp is very small or entirely wanting, but they give insertion to a large flabelliform joint. The second pair of jaw-feet are small and vary in the form of their palp; the first pair have a very large palp, which completes the efferent branchial canal forwards, and terminates sometimes by a styliform appendage, sometimes by an oval blade in the form of a spatula. The mandibles are very stout, their edge is trenchant, and their palpiform stem is very slender. The sternal plastron is of large size and composed of five segments joined together; it is very narrow between the first pair of feet, but is enlarged from before backwards, and presents on reaching the penultimate pair a very considerable width. All the feet are monodactyle; the first pair, which are in general shorter and a little stouter than the others, terminate by a short stout finger, which is not very moveable; sometimes there is at its base a spine, which is the vestige of a thumb, but these organs are never even subcheliform. The third pair of feet are in general longer. The abdomen is very stout and very long; its first ring has no appendages, but each of the four succeeding rings gives insertion to a pair of false feet, composed in the male of a small basilary joint and a large oval terminal lamina, whilst in the female there are two similar laminæ, or at least a single lamina and a stemlet which is biarticulate and furnished with hairs. The caudal fin, formed by the seventh abdominal ring and the appendages of that which precedes it, is very large, and each of the laminæ of which it is composed remains flexible and half-horny for its two posterior third parts, whilst above it is crustaceous like the rest of the tegumentary skeleton.

Palinurus, under side. (Milne-Edwards.)

The branchiæ are composed of cylindrical filaments, which are short and close after the manner of a brush; there are eighteen on each side —two above the second jaw-foot, three above the external jaw-foot, three above the anterior foot, four above each of the succeeding feet.

and one above the fifth foot. A large flabelliform appendage elevates itself between each of the bundles of branchiæ. (Milne-Edwards.)

The genus is composed of species of considerable size, remarkable for the hardness of their crusts, and spread over all seas. Rocky coasts are their favourite haunts.

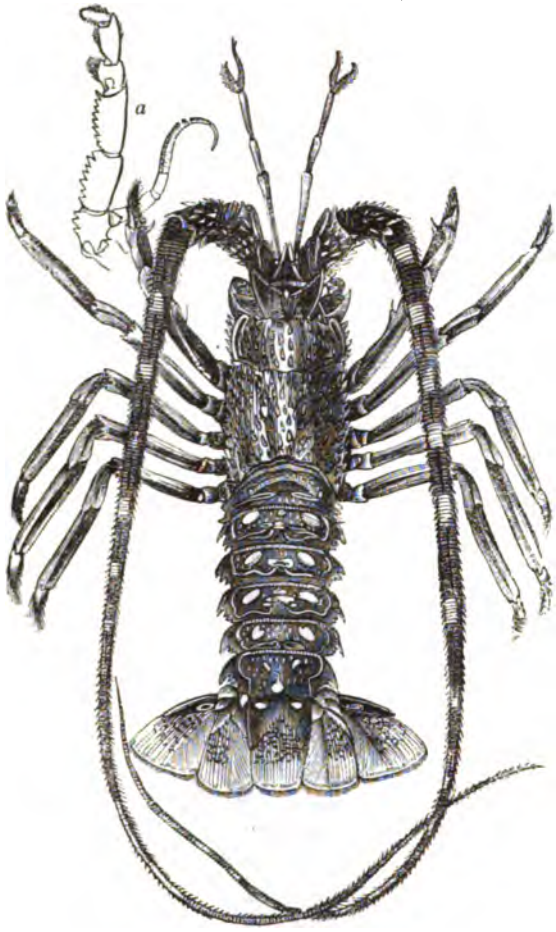
P. vulgaris, the Common Sea Craw-Fish, or Spiny Lobster; Langouste of the French. The lateral horns of the front are smooth above, and armed below with many sharp dentilations; carapace very spiny; suborbital teeth on the border of the carapace very large. Length about 18 inches. Weight sometimes from 12 to 15 lbs.

This appears to be the Καράβος of Aristotle and the ancient Greeks, and the *Locusta* of the Roman authors (Suetonius, &c.) and of Belon. In the 'Portraits d'Oyseaux,' &c., 'observes par P. Belon du Mans' (1557), is a cut of the crustacean, and under it the following lines, which allude to its name (*Locusta*), derived probably from its power of springing with the tail or abdomen :—

> "On peult nommer Sauterelle de Mer
> Ceste Langouste, estant par tout piquante
> Dessus le dos. Dieu la feit peu puissante,
> Mais il la sceut de dure escorce armer."

It inhabits the seas of Europe, and is common on the rocky coasts of Britain, especially in the south, and on the like coasts of France, especially on the south and west.

It is in general use as an article of food when in season, and as wholesome as the lobster; but though M. Milne-Edwards states that the flesh is very much esteemed, the English specimens are certainly far inferior both in tenderness and delicacy of flavour to that of the last-mentioned crustacean.



Common Sea Crawfish (*Palinurus vulgaris*).
a, left outward jaw-foot.

P. fasciatus. Antennular ring armed above with two conical rather large teeth situated near its anterior border. Carapace armed with a small number of spines, and slightly granular, or only dotted on its posterior half; lateral tooth of the anterior border of the carapace small; no spines on the median line of the stomachal region; median tooth of the anterior border of the epistome very large. Length about a foot.

It is a native of the Indian Ocean.

P. guttatus. Antennular ring armed with two very large conical teeth, sometimes preceded by two rudimentary spines. Carapace very spiny; two spines on the median line of the stomachal region near the base of the rostral horns; and on each side of these last, on the anterior border of the carapace, two teeth nearly as large as itself. Length 7 to 8 inches.

Palinurus guttatus.

It is found in the Antilles.

Several fossil species have been referred to the genus *Palinurus*.

PALIU'RUS (the Greek Παλίουρος, and Latin *Paliurus*), a genus of Plants belonging to the natural order *Rhamnaceæ*. It has a spreading 5-cleft calyx, 5 obovate convolute petals, 5 protruding stamens, ovate 2-celled anthers, and a flat pentagonal disc. The fruit is dry and indehiscent, expanding into a membrane round the disc, containing a 3-celled nut. The species are shrubs or trees, with alternate simple leaves.

P. aculeatus, Christ's Thorn, is a very common plant in Palestine, and on the borders of the Mediterranean Sea. It has pubescent

Christ's Thorn (*Paliurus aculeatus*). 1, a ripe fruit of the natural size.

bractless ovate serrulated leaves, quite smooth, 3-nerved, and with 2 spines at their base—one erect, the other hooked. The flowers are of a greenish-yellow colour. The fruit has a very singular appearance,

resembling a head with a broad-brimmed hat on; the French call the tree 'Porte Chapeau.' This species of *Paliurus* is one of the most common thorns in the hedges of Asia, and its flexible spiny branches form an impassable kind of fence. The seeds are sold in the herb-shops of Constantinople, and the native doctors prescribe them in many complaints under the name of 'Xalle.' They are also used as a dye. It is common in the south-east of Europe and in Asia Minor, and in the districts where it grows there is a tradition that this is the plant from which the Jews plaited the crown of thorns for our Saviour. In this country it is not uncommon in shrubberies, where it forms a beautiful bush when in flower, but it does not ripen its fruit. It is supposed to be the third sort of 'Ράμνος mentioned by Dioscorides, who compares the form of the fruit to that of a vertebra; if so the Παλιούρος of this author must have been something else, and perhaps, as Sibthorp conjectures, the modern Ζίζυφι, *Zizyphus vulgaris*, or Jujube.

PALLADIUM. [PLATINUM.]

PALLAH. [ANTILOPEÆ.]

PALLIOBRANCHIA'TA, M. De Blainville's name for his first order of his class (the 3rd of the *Malacozoa*) *Acephalophora*.

PALLIUM, the mantle of *Mollusca*. The mark formed by it in bivalve shells is called the Pallial Impression. This mark is normally found near the margin of the shell, and is thence sometimes called the Marginal Impression. In the *Dimyaria*, or bivalves which have two impressions of muscles of attachment, this mark passes from one of those impressions to the other; and if in its passage it bends inwards posteriorly, it is said to be Sinuated, and the part where this occurs is the Siphonal Scar of Dr. Gray.

PALM-OIL. [ELÆIS.]

PALM-WINE. [BORASSUS.]

PALMA CHRISTI. [RICINUS.]

PALMACEÆ, *Palms*, a natural order of Endogenous Plants, usually trees, with simple stems, inhabiting the warmer parts of the world and especially tropical countries. They constitute a most important order, on account of the many uses to which the species or their products are applied. They are nearly allied to the Liliaceous and Juncaceous or Rushy Plants of northern countries. Linnæus, who had scarcely any means of judging of the real structure of their fructification, and was therefore uncertain where to station them in his sexual system, placed them in an Appendix by themselves and called them the Princes of Vegetation. It has now however been ascertained that they chiefly belong to *Hexandria*, *Monœcia*, and *Diœcia*.

In general they adhere to the soil by clusters of strong simple roots which not uncommonly form a hillock elevated above the surface of the ground. Their trunks are solid, harder on the outside than the centre, and are sometimes, as in the Cane-Palms, coated by a layer of siliceous matter; they are usually quite simple, growing exclusively by a single terminal bud, called in the *Areca* its cabbage, and eaten as a delicacy when boiled; but in the *Hyphæne*, or Doom-Palm, they are regularly forked. In the majority of the order the stem is nearly cylindrical, but in some it is thickest at the base, and in others swollen in the middle; occasionally it is defended by strong hard spines, but is more frequently unarmed, and marked by rings which indicate the places whence the leaves fall off.

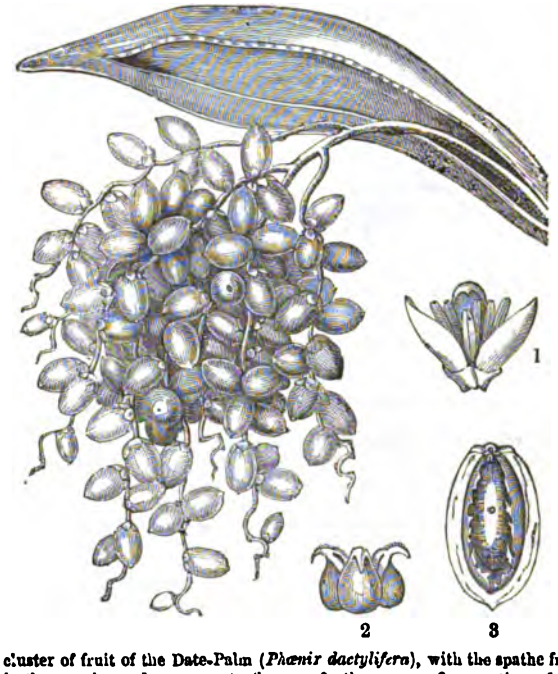
The leaves, called fronds by Linnæus, are alternate, with a very hard epidermis and a distinct petiole, from the base of which a coarse network, called the reticulum, sometimes separates next the trunk; they are usually either pinnated or fan-shaped, but are occasionally nearly split in two; their veins are parallel, the spaces between them plaited, and the whole size sometimes very great, as in the Fan-Palm, in which specimens have been seen as much as 18 or 20 feet in breadth. [CORYPHA.]

The flowers appear in panicled spikes from the inside of hard dry spathes, which are often boat-shaped, and although small, they are sometimes so extremely numerous that each panicle will weigh many pounds. They are generally hermaphrodite, but often monœcious, diœcious, or polygamous. The calyx and corolla consist each of three pieces, which are either distinct or more or less united. The stamens vary in number, from 3 to a large multiple of that number, and bear 2-celled linear anthers which open along their inner face. The ovary consists of 3 carpels, which are sometimes distinct, sometimes consolidated, and occasionally in part abortive, so that the ovary is only 1-celled. The ovaries are almost always solitary, and erect in each cell, but sometimes two are present, which in that case stand side by side; they are orthotropous in some genera and anatropous in others. The styles are very short, the stigmas simple.

The fruit varies extremely in its consistence and appearance. Sometimes it is 3-celled, often 1-celled; in such species as the Cocoa-Nut it is a kind of drupe covered by a coarse fibrous rind; in others it is a soft sweet eatable pericarp, as in the date; in others its surface is broken up into lozenge-shaped spaces, as in the *Sagus*, whose fruit looks as if covered with scale-armour. The seed is single, either solid or hollow, and consists principally of albumen of a fleshy, oily, horny, or cartilaginous texture, within which is lodged a very small cylindrical embryo at some part of the surface distant from the hilum.

Palms appear to prefer a soil in some measure salt, although many species are inhabitants altogether of inland districts and even of high mountains. Their geographical limits appear to be within 36° N. lat. in America, 44° N. lat. in Europe, 34° N. lat. in Asia, and 38° S. lat. in the southern hemisphere; and according to Von Martius, their powers of migration are extremely small; none of them have been able to cross the ocean without the aid of man. Their favourite stations are said to be the banks of rivers and watercourses, and the sea-shore, some species scattered singly and others collected together into large forests.

There is scarcely a species of this order in which some useful property is not found. The Cocoa-Nut [COCOS], the Date [PHŒNIX], and others are valued for their fruit; the Fan-Palm and many more for their foliage, whose hardness and durability render it an excellent material for thatching; the sweet juice of the Palmyra [BORASSUS] when fermented yields wine; the centre of the Sago-Palm abounds in nutritive starch; the trunk of the *Iriartea* or *Ceroxylon* exudes a valuable vegetable wax [CEROXYLON]; oil is expressed in abundance from the Oil-Palm; an astringent matter resembling dragon's blood is produced by *Calamus Draco*; many of the species contain within their leaves so hard a kind of fibrous matter, that it is employed instead of needles, or so tough that it is manufactured into cordage; and finally, their trunks are in some cases valued for their strength and used as timber, or for their elasticity, or their flexibility, as in the Cane-Palm. [CALAMUS.]



A cluster of fruit of the Date-Palm (*Phœnix dactylifera*), with the spathe from which they spring. 1, a separate flower; 2, the ovary; 3, a section of the fruit, containing a single seed, in the middle of whose back is seen a papilla, which indicates the seat of the embryo.

The number of species is estimated at about 1000, divided into 59 genera, distributed through 5 tribes.

(Martius, *Palmarum Familia ejusque Genera denuò illustrata*; also the *Genera and Species Palmarum* of the same author; Endlicher, *Genera Plantarum*; Lindley, *Vegetable Kingdom*.)

PALMACI'TES, a genus of Fossil Plants, from the Coal Formation. (Sternberg.)

PALMALES. [ENDOGENS.]

PALMELLACEÆ. [ALGÆ.]

PALMI'NA (Gray), a genus of *Cirripedia*.

PALMI'PEDES, Cuvier's name for his sixth order of Birds, which is divided into four families:—The Divers (*Brachypteræ*); the *Longipennes*, or Grands Voiliers (Albatrosses, &c.); the *Totipalmes* (Pelicans, &c.); and the *Lamellirostres* (Swans, Geese, Ducks, &c.) [DUCKS.]

PALMIPES, a genus of Star-Fishes belonging to the tribe *Goniasteriæ* and the family *Asteriadæ*. The body is thin, flat, and pentagonal, and covered above and beneath with fasciculated spines; avenues bordered by longitudinal fasciculi of spines; suckers visceral. The species of this genus are not numerous.

P. membranaceus, the Bird's-Foot-Sea-Star, is a British species. It has broad ample sub-acute lobes. Colour white, with red rays and border. It is the thinnest and flattest of all its class. It ranges from the Arctic seas to the Mediterranean.

(Forbes, *History of British Star-Fishes*.)

PALMI'PORA, a genus of *Madreporæa*.

PALMS. [PALMACEÆ.]

PALMULA'RIA, a genus of *Polypiaria*.

PALMYRA. [BORASSUS.]

PALMYRA, a genus of Dorsibranchiate *Annelida*.

PALO DE VACA. [COW-TREE.]

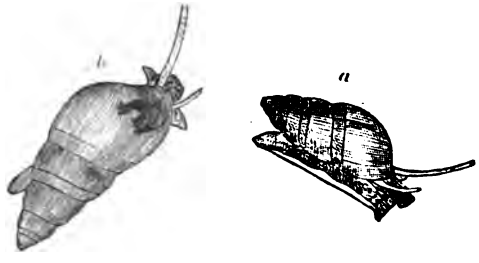
PALPEBRA. [EYE.]

PALUDINIDÆ, a family of Prosobranchiate Gasteropodous *Mollusca*. The species are all inhabitants of the fresh water. They embrace Lamarck's family of Peristomians. The genera included in it are *Paludina*, *Valvata*, *Ampullaria*, *Amphibola*, and *Bithinia*. Through *Ampullaria* the family is allied with *Neritidæ*. The animals have broad muzzle-shaped heads, produced tentacula, sessile or subsessile eyes, and round or ovate entire-mouthed turbinated shells. They are distributed all over the world, in lakes and streams. All the species are operculated. Some of the *Paludinæ* are amongst the largest fresh-water shells, whilst others are the smallest. They are mostly dingy; but some are brilliantly coloured. Their fossil forms do not greatly differ from those which are recent, and they are found as far back as the Oolitic period.

Paludina (Lam.).—Animal furnished with a proboscidiform head; mouth toothless, but containing a small lingual bristly mass; tentacles conic, elongated, contractile; eyes at the external base of the tentacles; foot oval, with a marginal furrow at its anterior part; male organ very large, swelling up the right tentacle, whence it comes forth from an orifice situated near its base; anus at the extremity of a small tube in the flooring (plancher) of the respiratory cavity.

Shell furnished with an epidermis, conoid, having the whorls of the spire rounded, and the apex mammillated; aperture rounded, oval, angular at the summit, the borders united and trenchant.

Operculum horny, its elements concentric, with its summit excentric.



Paludina parvula. Animal and shell magnified.
a, side view; *b*, seen from above. (Guilding.)

Lamarck states that the *Paludinæ*, many species of which have been confounded with the *Cyclostomata*, *Bulimi*, and *Turbines*, inhabit fresh-waters almost generally, but some live also in brackish and even in quite salt-waters. They breathe water only, like the *Valvatæ*, with which they have a great affinity; but their branchiæ are internal, and they are further distinguished from that genus by the form of their aperture, which is rather longer than it is wide, being modified by the last whorl, which presents an angle at its summit. Their habits he describes as being very nearly those of the *Limneæ*, like which the *Paludinæ* may be often seen progressing at the surface of the water, foot uppermost.

This form is widely spread. Species have been found in Europe, Asia, Africa, and America. The European species are the inhabitants of temperate climates.

The number of recent species of *Paludinæ* given by Woodward is 60 and of fossil species 50.

P. vivipara, the Common River-Snail, has the shell ventricose-conoid, thin, diaphanous, very delicately striated longitudinally, greenish-brown, with brown-red obsolete transverse bands; five turgidly-rounded whorls, the sutures strongly marked. It inhabits the fresh-waters, rivers, and ponds of England, France, Germany, &c.

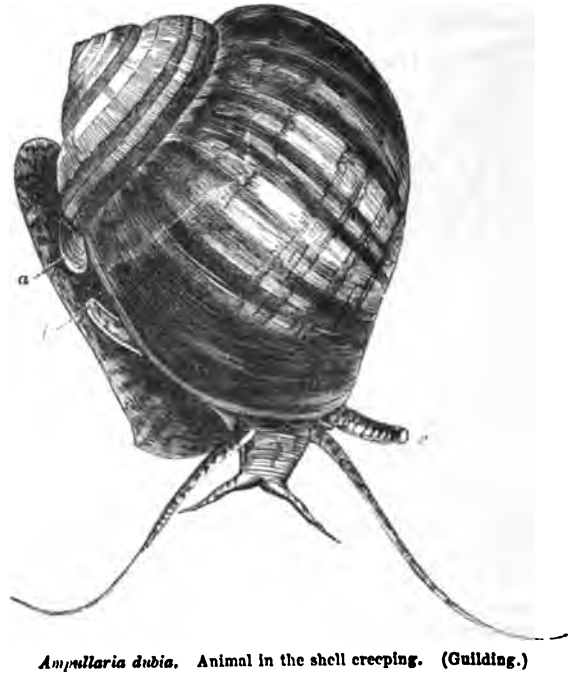
Paludina vivipara. Female.
a, Shell of an adult, with young shells in it; *b*, operculum; *c*, young shell before exclusion.

Nematura, Swainson, and *Bithinia*, Gray, are sub-genera of *Paludina*. Forbes and Hanley record two species of *Bithinia* as British, *B. tentaculata* and *B. Leachii*.

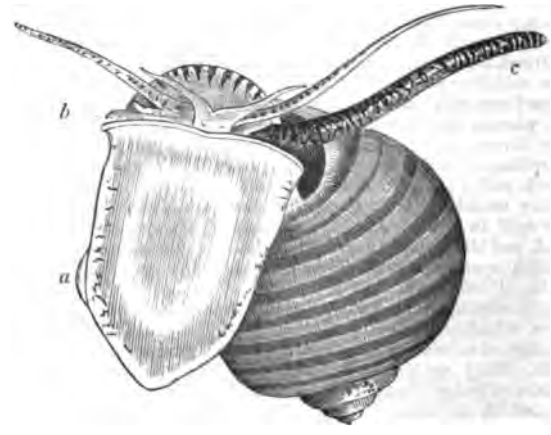
Ampullaria (Lamarck).—Animal globular or planorbiform; foot large, delicate, and subquadrangular, largely truncated anteriorly. Head flattened terminated anteriorly by a pair of conical buccal tentacula; two great subulate tentacula nearly as long as the foot, supporting at their base oculiferous peduncles, sometimes separated throughout their length. No jaws, but a lingual bristled ribbon. A respiratory canal formed by the mantle, but not leaving any trace on the shell. Branchial cavity of great size, largely open anteriorly, and whose upper wall is doubled so as to form a great aquiferous sac. (Deshayes, principally.)

Shell furnished with an epidermis, generally not stout, but globular, ventricose, and umbilicated; spire very short, the last whorl much larger than all the others put together; aperture oval, rather longer than it is wide, borders united, the right lip trenchant.

Operculum horny or shelly, rarely calcareous, rather delicate, composed of concentric elements, the apex submarginal and inferior.



Ampullaria dubia. Animal in the shell creeping. (Guilding.)
a, operculum; *b*, the right siphon; *c*, the left siphon.



Ampullaria dubia, showing the lower side of the foot, &c. (Guilding.) The animal is represented as ascending to the surface of the water to breathe, and with the respiratory siphon exserted. *a*, the operculum; *b*, the right siphon; *c*, the left siphon.

The species of this genus are not found in Europe, but they have been brought to Europe alive. The first was sent to Paris by M. Caillaud from the Nile. That naturalist, during his voyage to Meröe, collected several Egyptian *Mollusca*, which he distributed generously among collectors. One correspondent had been anxious for the fluviatile molluscs found in the Nile. The person employed to collect these, after having gathered a large quantity of river *Mollusca*, among which were some living *Ampullariæ*, put them all into a box of bran (son). This box was delayed on its road by the operation of the quarantine laws for four months, and when it reached M. Caillaud, was in such a state, from the putrefaction of the greater part of its animal contents, that he hastened to throw the whole into the water. To his no small surprise he found, a few hours after, the greater part of the *Ampullariæ*, which had been shut up with this mass of putre-

Animal and Shell of *Ceratodes fasciatus*, Guilding; *Ampullaria Cornu-Arietis*, Sowerby. (Guilding.) 1, the animal creeping. 2, the animal in a supine position; *a*, Operculum; *b*, the right siphon; *c*, the respiratory siphon. 3, head, tentacula, eyes at their base, and cervical alæ.

faction, quietly creeping about upon the mud. He gave many individuals to M. Deshayes, who kept them alive from four to five months.

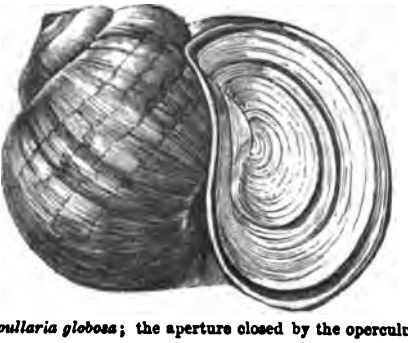
M. Deshayes relates that it became an object of inquiry how aquatic animals, unable to respire, except by means of a pectinated branchia, could remain alive so long out of the element apparently necessary to their existence. Nearly all the persons, he remarks, who occupied themselves with this phenomenon, thought that the animal on retiring into its shell carried with it a certain quantity of water, which could not escape owing to the retention of the operculum, which closes the aperture with great exactness. Others thought that the humid air carried upon the branchiæ was sufficient to keep up the respiratory action. "Wishing to know," continues M. Deshayes, "whether there were anything in the structure of the animal which could explain the singularity, we soon perceived that the upper wall of the branchial cavity was doubled, and formed a great pouch, the aperture of which was placed backwards, above the origin of the branchiæ. Plunged in the water, the animal has this pouch constantly filled with the ambient liquid, and on retiring into its shell and shutting itself up under its operculum, this bag still remains filled with water, and thus furnishes the necessary materials for the function of respiration. Everything leads us to believe that this is the only cause which permits the *Ampullariæ*, pectinibranchiated aquatic animals, to remain a long time out of the water without perishing, and this explains also how it happens that in certain lakes which are annually dry, *Ampullariæ* are always to be found. When the great heats approach and they plunge themselves into the mud or sand they preserve in their

branchial sacs the quantity of water necessary for them during the whole time of drought."

This is one of those beautiful provisions which meet the naturalist everywhere. The tropical torrent and lake may yield to the dry season and burning sun, but the *Ampullaria*, secure in the possession of his water-bag, can afford, like the camel in the desert, to wait till the rains furnish a fresh supply, and again fill the parched channel.

The species are found in the rivers and lakes of warm climates. Species, some of them very large (*A. Guyanensis*, *A. Urceus*, and *A. Gigas*, for example), have been found in Asia, Africa, and America, especially the southern portion of the latter.

A. globosa, Globose Apple-Snail, or Idol-Shell, is a good example of this genus. There are about 50 recent species of this genus. The following sub-genera have been formed out of it:—*Pomus*, *Marisa*, *Asolene*, *Lanistes*, and *Meladomus*.



Ampullaria globosa; the aperture closed by the operculum.

Ampullaria effusa of Swainson. Mr. Guilding is of opinion that this species forms the transition through *Ceratodes* to the *Planorbidæ*, and that it is probably more allied to that genus than to *Ampullaria*.

The genus *Ceratodes* of the last-named author is characterised as having a simple lip; a horny operculum; a discoid shell; a very large and deep umbilicus, and an evanescent columella. The sole species given by him is *Ceratodes Cornu-Arietis* above copied.

Mr. Swainson thus defines the genus *Ampullaria*:—Shell globose, rarely discoid, turbinate; spire very short; aperture oblong, pointed above, rounded below. The same author characterises the four sub-genera as follows:—

Ampullaria (Lamarck).—Outer lip thin; operculum horny. Ex. *A. fasciata* of Lamarck.

Pachylabra.—Outer lip thickened; operculum shelly. Ex. *P. globosa*, Swainson.

Lanites (Montf.).—Shell reversed; the body-whorl ventricose only in the middle; outer lip generally thin. Ex. *L. Guinaiaca*. Sowerby's 'Manual,' f. 319. ('Malacology,' 1840.)

The number of recent species recorded by M. Deshayes in his 'Tables' is 24: in the last edition of Lamarck the numbers given are 27, including *Ampullaria avellana* and *A. fragilis*, of which we shall presently have occasion to speak more at large. Neither Mr. Swainson's *Ampullaria globosa*, Captain King's *A. Cumingii*, nor Mr. Lea's *A. Pealiana* appears among these species. Mr. Swainson gives *Helix ampullacea*, var., Gmelin, as a synonym of his *A. globosa*, but the former stands as a synonym for *A. fasciata*, Lam., in the last edition of the 'Animaux sans Vertèbres.' Mr. Swainson considers it distinct, and quotes the description and figure of Chemnitz, who, like other authors, considered it a variety of *Helix ampullacea*. The rivers of India are given as the locality, by Mr. Swainson.

Some of the *Ampullariæ*, or Apple-Snails, are of large size.

Ampullacera, Quoy (*Amphibola*, Schumacher).—Animal spiral, globular, convex; the foot short, quadrilateral, and with a marginal anterior furrow. Head large, flattened, notched into two rounded lobes supporting two sessile eyes, without the appearance of tentacles. Pulmonary cavity limited anteriorly by a collar, and having its aperture at the right border. Mouth membranous. Both sexes united. Shell rather thick, globular, ventricose, deeply umbilicated, aperture round or oblique, with the borders united; spire short, but projecting. Operculum horny, delicate, but little spiral, sometimes with a heel or projection. (Quoy.)

M. Quoy says of this genus, "We have a mollusc breathing air although it lives in pools, possessing the two sexes united, but being, notwithstanding, an insufficient hermaphrodite. It is apathetic, and comes but little out of its shell, into which it retires very far upon the slightest touch. We found it sunk in the muddy sand, under some inches of saltish water, with its aperture full of earth. It is found in great abundance in New Zealand, where it is largely eaten by the natives."

M. Deshayes adopts this genus, which he thinks one of the most interesting that has been for a long time discovered. "It offers in fact," says he, "an entirely novel combination of an aquatic animal pulmonated and operculated, and fills up a lacuna. It is, with reference to the aquatic *Pulmonata*, what the *Helicinæ* are with reference to the terrestrial *Pulmonata*; *Ampullacera*, then, will constitute in

the system not only a genus but a family, which ought to be placed at the end of that of the aquatic *Pulmonata* without an operculum."

The only species known are *Ampullacera avellana*, Quoy (*Ampullaria avellana*, Lam.); and *Ampullacera fragilis*, Quoy (*Ampullaria fragilis*, Lam.), and another.

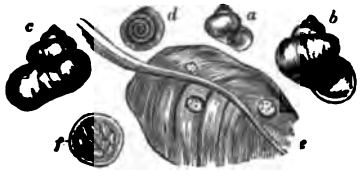
Valvata (Müller).—Animal with a very distinct head prolonged into a sort of widened proboscis; tentacles very long, subcylindrical, slightly curving outwards, very much approximated at the base, pointed at the extremity; eyes sessile at the posterior side of their base; foot bilobate anteriorly; branchiæ long, pectiniform, more or less capable of being exserted out of the cavity, which is largely open, and provided at the right of its inferior edge with a long appendage simulating a third tentacle; male organ retiring within the respiratory cavity. Shell discoid or conoid, umbilicated, the whorls rounded and distinct, the apex mammillated; aperture round or nearly round, its borders united and trenchant. Operculum horny, round; its elements concentric and circular.

Mr. Swainson regards *Valvata* as a sub-genus of *Paludina*.

This genus appears to have been found as yet in Europe and North America only. M. Deshayes, in his 'Tables,' makes the number of living species four, and names *V. piscinalis* as the only species living and fossil (tertiary). In his last edition of Lamarck the number of recent species recorded is six. There are 19 fossil species.

V. piscinalis. Shell conoid, globose, subtrochiform, umbilicated, white; whorls four or five; apex of the spine obtuse.

Valvata piscinalis, with its shell, creeping.
a, natural size; *b*, enlarged.



Valvata piscinalis.

a, Shell, natural size; *b*, *c*, magnified; *d*, operculum enlarged; *e*, glutinous masses of eggs on a leaf; *f*, mass of eggs enlarged.

This little shell, which has four complete whorls, without including the apex, inhabits rivulets and ponds in England and France, and is, in all probability, to be found in Europe generally.

PALYTHOA, a genus of *Zoophytes*.

PAMPAS CAT. [FELIDÆ.]

PANAX (intended to be formed from πᾶν, all, and ἄκος, a remedy), a genus of Plants belonging to the natural order *Araliaceæ*. The flowers are polygamous, the calyx obsolete and 5-toothed. It has 5 petals, 5 stamens inserted with the petals under the edge of the disc, and alternate with them. The fruit is succulent, compressed, orbicular, from 2- to 3-celled; the cells leathery and 1-seeded. The species are herbs and shrubs and trees, having the leaves and inflorescence variable.

P. quinquefolium, Five-Leaved Panax, or Ginseng, has a fusiform root more or less branched, of a whitish colour, and terminating in fibres. The stem is smooth, round, and green, often with a tinge of red, divided at the top into three petioles with a flower-stalk in their centre. The petioles are round, smooth, and swelling at their base. The leaves ternate, quinate, or septenate. The berries are kidney-shaped, of a bright red colour, and contain 2 semicircular seeds. The flowers are of a yellowish colour. It is a native of Chinese Tartary and North America. In China it has been considered an invaluable drug from time immemorial. In 1709 the Emperor of China commissioned 10,000 Tartars to go in quest of as much of this root as they could find; each one was to give two pounds of the best of it to the emperor, and to sell the rest for its own weight in fine silver. The roots enter into the composition of every Chinese medicine. It is reckoned a stimulant and restorative, and both rich and poor consider it a remedy for every disease. By Europeans and Americans however it is comparatively disregarded, and looked upon as a mere succulent, similar in its qualities to liquorice; hence the question arises, is the Chinese plant the same as the North American? For we cannot regard all that the Chinese say and practise as merely imaginary. The common name of the plant, Gen-seng, Jinchen, or Nindsin, signifies 'wonder of the world,' or the 'dose for immortality;' and the Chinese firmly believe that its powers are almost miraculous. [GINSENG.]

P. fruticosum is also used in China and Cochin-China as a febrifuge, and as an astringent tonic. It has a shrubby unarmed stem, pinnately decompound leaves; petiolate oval oblong leaflets, coarsely and dentately serrated, the ultimate ones deeply trifid, the panicle corymbose, with the branches umbelliferous at the apex. It is a native of the islands of Ternate, Java, and Amboyna.

(Lindley, *Flora Medica;* Burnett, *Outlines of Botany.*)

PANCRA'TIUM, a genus of Plants belonging to the natural order *Amaryllidaceæ*. It has a funnel-shaped flower with a long tube. Six superior sepals, and as many stamens, which are inserted on the edge of a 12-cleft membranous cup. Pistil single. The name was applied by the Greeks to some plant allied to *Scilla maritima*, but which has not yet been made out by botanists. The name is now applied to a genus of ornamental plants, found in the equinoctial parts both of the old and of the new world, and of which one species extends to the coasts of the Mediterranean. They are mostly highly ornamental plants with white flowers, many of them fragrant; they are commonly cultivated in stoves, and require a mixture of light loam and rich vegetable mould, with little water when not in a growing state.

PA'NCREAS is a secreting gland situated behind the stomach and extending from the spleen transversely across the vertebral column to the duodenum. In man it is of an elongated and slightly flattened form, broadest at its right extremity, and gradually diminishing in breadth towards the left. It is of a firm consistence, lobulated, and very similar in structure to the salivary glands, from which circumstance it is often called the salivary gland of the abdomen. It is chiefly composed of the ramifications of the main duct, through which its secretion is poured into the bile-duct, or into the duodenum by a separate aperture close to that of the bile-duct. [LIVER.] The ramifications terminate in little follicles, each cluster of which, with its bloodvessels, lymphatics, nerves, and connecting tissue, forms a lobule. It is in these follicles the pancreatic fluid is formed. This fluid has the following composition:—

Water		986·40
Solids:—		
Fat	0·26	
Alcohol Extract	0·15	
Albumen	3·09	
Alkaline (Chlorides, Phosphates, Sulphates)	8·90	
Carbonate and Phosphate of Lime and Magnesia	1·20	
		13·60
		1000·00

The office of this fluid appears to be the emulsifying and rendering absorbable the oily constituents of the food. On this subject M. Ch. Bernard has performed many experiments, and his conclusions are now very generally admitted as correct. [DIGESTION.]

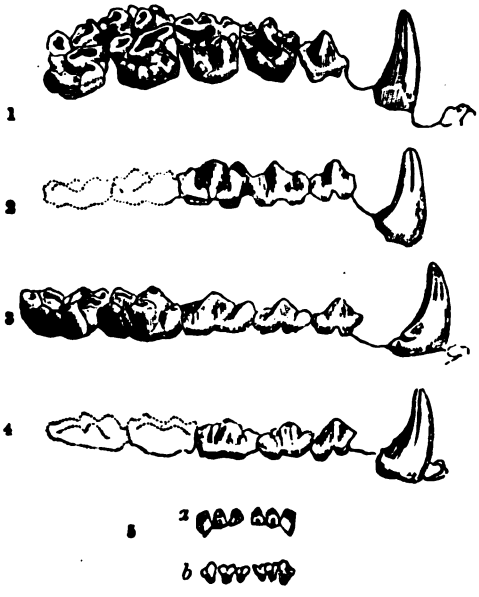
The pancreas is found in its least developed form in fish, in some of which it consists of simple or slightly branching tubes or sacs, attached to the duodenum very near its commencement, and commonly called Appendices Pyloricæ. In the *Amphibia* and Birds it gradually increases in the complexity of its arrangement, and it is most compact and most highly developed in the *Mammalia*.

PANDA, one of the names of the genus *Ailurus* (F. Cuv.), an Animal belonging to the class *Mammalia* and the order *Carnivora*. It has the following generic characters:—Head subglobose, great; face subrotund, cheeks tumid; forehead flat, elongated, broad; tongue rather rough; snout short, conical, very broad; rictus moderate; rhinarium obtuse; nostrils terminal; ears short, acute, distant, villous; eyes approximated to the rhinarium and placed anteriorly; maxilla intumescent; mandible subrecondite; a few white vibrissæ. Neck short. Body large, cylindrical, obese, clothed with a very villous under-fur, and long, equal, rather soft hairs, downy at their base. Tail of the length of the body, very large at the base, cylindrical, subattenuated at the tip and clothed with very long spreading hair. Feet plantigrade, 5-toed; the soles thickly clothed with a very fine down; claws falculate, compressed, arcuate, very sharp (retractile).

Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5}$ = 36.

A. fulgens (F. Cuvier) is the only species of the genus. It was first described by General Hardwicke.

"The peculiarities of our animal," says the General, "on which its rank as a genus depends, are striking and prominent; but its disposition in a natural series is still obscure, as it resembles in several characters the individuals of that subdivision of digitigrade carnassiers, from which it differs essentially both in its teeth and in its plantigrade walk. Among the peculiarities of our animal are to be noticed the great breadth of the rostrum and the singular structure of the teeth: but the most remarkable character, and that on which its distinction principally depends, is the form of the projecting points of the posterior grinders. This character, as far as our observation extends, is peculiar; it does not exist, except in a small degree, in any other genus of carnivorous quadrupeds. The truncation is owing, in our opinion, to original structure, and is not produced by the wearing down of the points. We observe it both in the skull of a young animal and in that of the adult specimen from which the annexed drawing was made; and our description is confirmed by a careful comparison of the relative elevation of the points of the two anterior



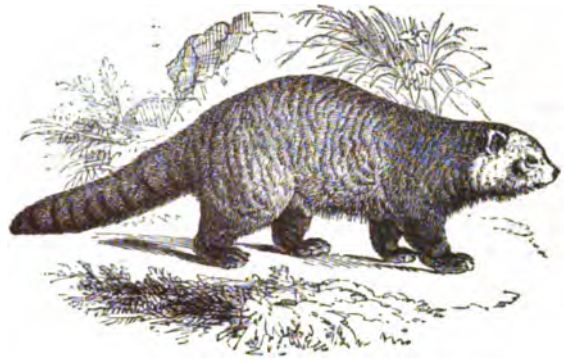
Teeth of *Ailurus*.

1, lateral view of the teeth of the upper jaw, as they are seen within. 2, the same as they are seen without. 3, lateral view of the teeth in the lower jaw, as they appear within. 4, the same as they appear without. 5, Front teeth: *a*, upper jaw; *b*, lower jaw. (Hardwicke, 'Linn. Trans.')

Feet of *Ailurus*.

1, Anterior foot, left side; 2, posterior foot, right side; 3, sole of one of the posterior feet, to show the hairy covering. (Hardwicke, 'Linn. Trans.')

grinders, in which, although they are equally exposed to attrition, this truncation is not observed. The margins bounding the truncated points, as is shown in the drawing, are circumscribed and perfect, exhibiting no signs of being worn down by attrition. In the disposition and even in the form of the teeth, our animal bears some resemblance to the genera *Nasua* and *Procyon;* but these differ essentially in the lengthened form of the head, and in the extended rostrum, which is terminated by a flexible rhinarium; they also differ in the number, character, and distribution of the grinders. *Nasua* and *Procyon* have in both jaws six grinders, of which the three anterior are false grinders; and of those which follow, none of the points, even in the adult state, exhibit the truncation above described. Our animal has only one false grinder with a compound crown, and the four posterior grinders are large and highly complicated: the first of these in the upper jaw corresponds with the fourth grinders in *Nasua* and *Procyon*, and the points are attenuated and acute; but the posterior grinders are quite peculiar and characteristic in their structure."



Ailurus fulgens. (F. Cuvier.)

General Hardwicke states that this animal's haunts are about rivers and mountain-torrents. It lives much in trees, and feeds on birds and the smaller quadrupeds, and is frequently discovered by its loud cry or call resembling the word Wha, often repeating the same. Hence is derived one of the local names by which it is known. It is also called the Chitwa.

It is found in the Himalaya chain of hills between Nepaul and the Snowy Mountains (Hardwicke, 'Linn. Trans.' vol. xv.). It is in Mr. Hodgson's Catalogue of the Animals observed in Nepaul ('Zool. Proc.,' 1834).

Cuvier declares the *Ailurus* to be one of the most beautiful of quadrupeds. He places *Ailurus* among the Bears, between *Procyon* (Racoon) and the Benturongs (*Ictides*). J. B. Fischer arranges it between *Gulo* (Glutton) and *Arctictis* (F. Cuv., *Paradoxurus* and *Ictides* of F. Cuv. and Valenciennes).

PANDANA'CEÆ, *Screw-Pines*, a natural order of Endogenous Plants. The species are arborescent or bushy plants, with long rigid sword-shaped leaves, resembling those of the pine apple, usually arranged in a manner so obviously spiral that they are commonly called Screw-Pines. In a natural arrangement they are classed with Endogens, among which they are, more especially in the genus *Pandanus*, remarkable for their stems forking repeatedly. Their flowers have the sexes separate, and quite covering the spadix on which they grow. The male flowers consist of single stamens with 2-celled anthers; the females of naked 1-celled ovaries, with solitary ascending or numerous parietal ovules. The fruit consists of a mass of ovaries collected into a tuberculated head, and either dry and fibrous or fleshy and succulent.

These plants chiefly abound in the Mascarene Islands and in the Indian Archipelago, of which they form a conspicuous feature. The species of *Pandanus*, Vaquois, or Screw-Pine, are readily known by their spiral leaves, dichotomous habit, and the long roots emitted by the sides of their trunk for the purpose of holding it down in the loose sand among which they grow, in order to assist in which each root is furnished with a partial exfoliation of the end, which, in the form of a cup, adheres to the root, for the purpose, as is supposed, of holding water during the period that the root is passing through the dry air. The genus *Freycinetia*, on the contrary, is composed of plants with long scrambling or rooting stems, not branching like *Pandanus*, indeed seldom becoming what can be called a tree; and, when in flower, adorned with gaily coloured spathes from which the young inflorescence protrudes. [PANDANUS.] Some of the species yield seeds which are edible. The order contains 7 genera and 74 species.

PA'NDANUS, a genus of Plants, the type of the natural order *Pandanaceæ*. This name is derived from the Malay Pandang, and that of a genus of Plants, from which the natural family of *Pandanaceæ*, or Screw-Pine tribe, has derived its name, being so named from their leaves, which resemble those of the pine-apple, and are inserted spirally along the stem. The species are found in the islands of the tropical ocean, in those of Mauritius and Bourbon, as well as in the southern parts of India. One species, *P. odoratissimus*, being highly fragrant, is much esteemed in all Asiatic countries, either where it will grow or where its essence is known. It is constantly referred to by the Sanscrit poets, as may be seen in Wilson's 'Hindu Theatre,' by the name Ketaka, and as the Keora and Ketgee of the Hindoos. The Arabs call it Kazee, and Avicenna describes it under the name of Armak. Oil impregnated with the odour of its flowers and the

distilled water are highly esteemed both for their odour and their medicinal use as stimulants. Dr. Roxburgh states that it is the tender white leaves of the flowers, chiefly those of the male, which yield the very delightful fragrance for which this plant is so celebrated. This species is common in the peninsula of India, where it is called Caldera Bush; in Mauritius it, as well as other species, is known as the Vaquois Plant; in Otaheite, a species is called the Wharra Tree, being in all highly esteemed for its odour, as well as for the useful purposes to which it may be applied. The lower pulpy part of the drupes is sometimes eaten, as is also the terminal bud, like that of the cabbage-palm, and likewise the tender white base of the leaves, either raw or boiled, during times of scarcity. It forms an excellent hedge, but occupies too much space. The roots are composed of tough fibres, which are used by basket-makers to tie their work, and are soft enough to be employed as corks. The leaves are composed of tough longitudinal fibres, white and glossy, a quality which adapts them for covering huts, making matting, as well as for cordage in the South Sea Islands, and in Mauritius for making sacks for their coffee, sugar, and grain.

PANDION. [FALCONIDÆ.]

PANDORA. [PYLORIDIA.]

PANGIACEÆ, *Pangiads*, a natural order of Diclinous Exogenous Plants. This order embraces three genera, the species of which are trees with alternate stalked entire leaves, polypetalous axillary monœcious flowers, with scales in the throat of those bearing pistils. The stamens are five, the seeds large and oily. Dr. Lindley says, "What the distinction is between these plants and Papayads, except that the last are monopetalous, and have no faucial scales in the ♀ flowers, it is hard to say."

The species are found in the hotter parts of India. They are all poisonous. The natives of India employ extensively in medicine the seeds of *Gynocardia odorata*, which are known by the name of Chaulmoogra and Petarkura. The genus *Hydnocarpus*, formerly referred to *Flacourtiaceæ*, belongs to this order. [FLACOURTIACEÆ.]

(Lindley, *Vegetable Kingdom*.)

PANGOLINS, a name in common use to designate the Scaly Ant-Eaters, said to be derived from the word Pangoeling, which signifies in the Javanese language, according to Seba, an animal which rolls itself into the form of a ball. The Bengalese name is Bedjarkita, or 'reptile of stone.' These animals form the genus *Manis* of Linnæus.

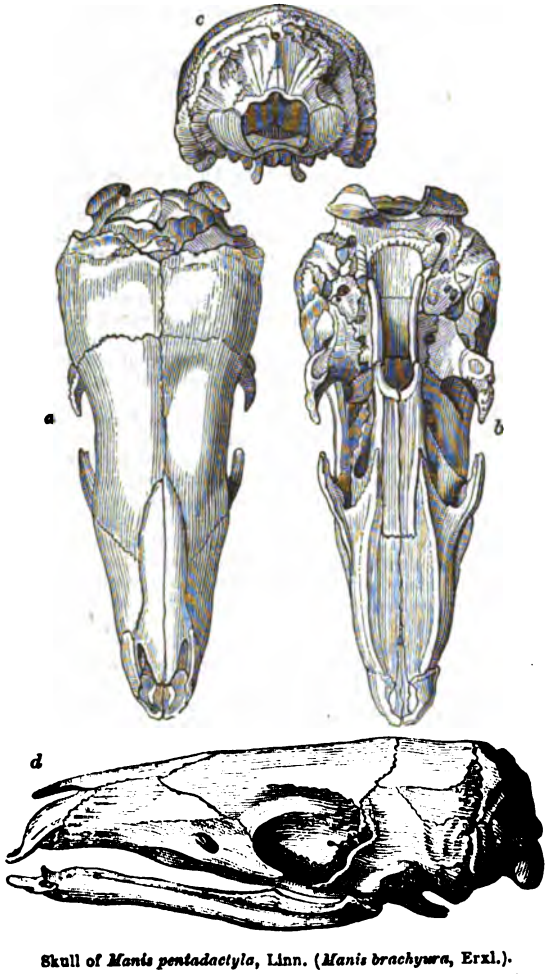
The Pangolins are toothless, and furnished with a very extensible tongue; but their tegumentary covering is very different, for their body, limbs, and tail are clad in a panoply consisting of great trenchant scales overlapping each other like tiles, so as to form a sort of scale-armour when the animal is on its feet. When it is vigorously attacked, and often on the first approach of danger, it rolls itself up in the shape of a ball; and then the trenchant scales are erected, and offer their sharp edges to the enemy.

The species are found in Asia and Africa.

The following are the principal points in their organisation:—The skull is a more or less elongated cone, with the base rounded. Orbits small, round, occupying nearly one-half of its length, and situated towards the lower parts of its sides: they are consequently very much separated from each other. The zygomatic arches are incomplete, and nearly on a level with the palate. The bones of the nose are notched on their inferor border, and enter above into a notch formed in the frontal bones. The articulation of these with the maxillary bones descends obliquely to the orbit, and is continued in the same direction with the palatine bone. The maxillary bone does not enter into the orbit; it terminates at the point where it gives off its zygomatic apophysis, which is short and pointed.

The skull of *Manis tetradactyla* (Linn.), *Manis macroura* (Erxl.), the Phatagin of Buffon, differs from the description above in being more slender, and also presents the singularity of having, where the lachrymal bone should be, a great oval piece without any hole, which, Cuvier believes, belongs to the ethmoid bone.

In the extremities there is a general resemblance of the skeleton in the Hairy Ant-Eaters [ANT-EATER] and the Pangolins; but there are particular differences, as in the scapula, &c., some of which we shall notice. Both of these groups are remarkable for the great size of the lower part of the humerus, produced especially by the projection of the internal condyle destined for the attachment for the powerful flexors which work the claws. In the Hairy Ant-Eaters the head of the radius is nearly as round as it is in man and the Quadrumanes, having a very complete rotatory power; but it is not so in the Pangolins, which have the articulation of this part by the method termed ginglymus. The orbit and radius are both robust, and are constructed



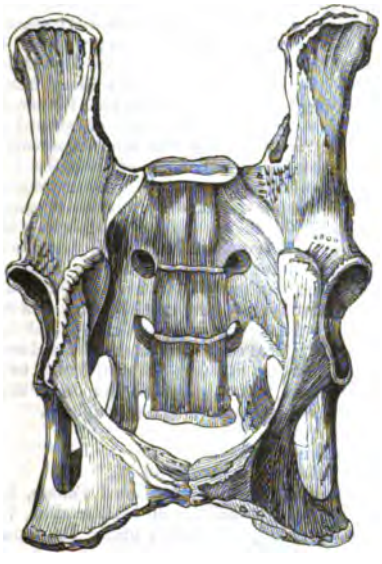
Skull of *Manis pentadactyla*, Linn. (*Manis brachyura*, Erxl.).

a, seen from above; *b*, seen from below; *c*, seen from behind; *d*, profile. (Cuvier.)

a, Fore foot of Pangolin; *b*, hind foot of the same. (Cuvier.)

with proportions and views very different from those to be observed in the Sloths, among which they are so greatly prolonged as to be hardly fit for anything but suspension from trees. [AL.] In the Ant-Eaters they have all the strength necessary for tearing down the nests of the Termites, on which they feed; and, as it might be expected, the fore feet of these quadrupeds is, next to their skull, the most remarkable part of their skeleton. The ungueal phalanges of their large toes are, like those of the Sloths, so disposed as not to be capable of curvature in any other direction than downwards; and are in effect held in that position, the state of repose, by strong ligaments. In the Pangolins their point is forked, whilst in the Hairy Ant-Eaters it is only furrowed, and has at its base a strong bony sheath for the insertion of the claw. In the Pangolins the general structure of the fore foot is the same as in the Hairy Ant-Eaters; but besides the differences above noticed, the scaphoid and semilunar bones of the carpus are confluent, forming a single piece, as in the Carnassiers. In the Pangolins there is, too, less irregularity in the proportions of the toes, though in them, as well as in the Hairy Ant-Eaters, the middle one is stoutest and longest.

The pelvis in all these animals exhibits the singularity of the ischium uniting with the last vertebra of the sacrum, which is furnished with apophyses for its reception, so that instead of the ischiatic notch there is a hole, which at first sight has the semblance of a second oval hole, a conformation observable in the Sloths and Armadilloes. In the Pangolins the os ilii, which is of a prismatic form and terminates in front by a tuberosity, is articulated also to the last lumbar vertebra; but this is not the case among the Hairy Ant-Eaters, where this bone is besides flatter; in both it is oblong, and not widened as in the Sloth.



Pelvis of Pangolin. (Cuvier.)

The great trochanter is less elevated than the head of the femur. The lower head of the bone is as wide as it is long, and the rotular pulley is wide but not deep. The tibia and fibula are very distinct. The astragalus corresponds to this in the form of its upper head, the lower only corresponds to the scaphoid bone, and is concave, as it is in the Sloths, which is remarkable. The calcaneum is compressed at its posterior apophysis, and is united to the astragalus as in most animals. In the tarsus there is a scaphoid bone, which is convex on the anterior side of its articulation with the astragalus, but curving behind that bone; a cuboid longer than it is wide; three cuneiform bones, the internal of which is double that of the others; and a supernumerary bone articulated on this internal cuneiform bone, and which in the Tamanoir, Tamandua, and the Pangolins is triangular and very small, but in the Little Ant-Eater is elongated and widened so as to form a sort of heel. This species of calcaneum, it is true, is very short, not going farther backwards than the astragalus itself. It is this supernumerary bone which gives to the sole of the foot of the Little Ant-Eater that concave form which renders it so fit for grasping branches and climbing trees.

The Pangolins are remarkable for the strength of their caudal vertebræ, and for the extended width of their transverse apophyses; there are 47 in the tail of *Manis macroura*, and only 26 in that of the Short-Tailed Pangolin, which has 3 sacral, 6 lumbar, 15 dorsal, and 7 cervical vertebræ; in the Phatagin Cuvier found only 13 dorsal and 5 lumbar vertebræ. The spiny apophyses of the back and loins of these two animals are square, as in the Tamanoir.

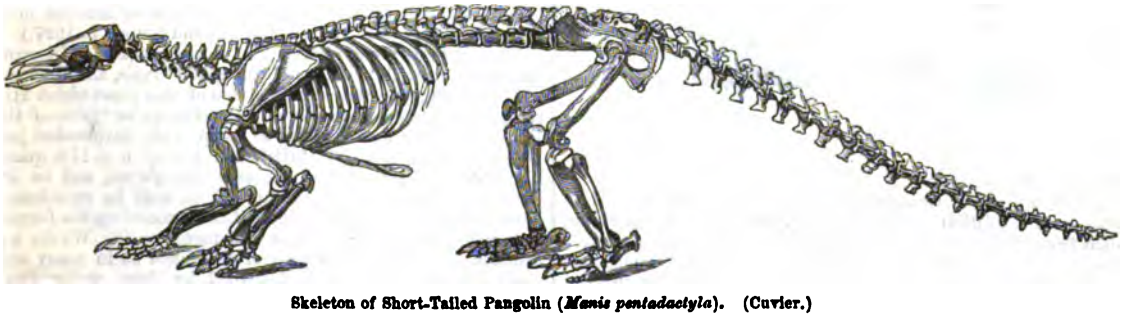
The Pangolins have the bones of the ribs flat, eight in number, of which the three penultimate are placed transversely, and the last of all, which is very long, cylindrical, and forked in the Pangolin (flattened in the Short-Tailed Pangolin), terminates in two strong tendons, which in the latter reach to the pelvis, and greatly assist the animals in rolling themselves into a ball.

Manis has the following characters:—Lower jaw very small; tongue very extensible. Body and tail entirely covered above with large triangular trenchant scales disposed quincuncially, and overlapping each other like tiles. Toes five, armed with robust claws. Body endowed with the faculty of rolling itself up more or less into the form of a ball. Dental Formula, 0.

The Pangolins are slow in motion, and live on worms and insects, especially termites and ants, which they seize by means of their extensible and glutinous tongue.

M. pentadactyla (*M. brachyura* of Erxleben, and probably the Phattage of Ælian, xvi. 6), Indian, Broad-Tailed, or Short-Tailed Mania. It has the head small, pointed, and conic; muzzle elongated and narrow. Body rather stout. Tail short and very broad at its base. Dorsal scales disposed in longitudinal rows to the number of eleven; under part of the body, head, and feet naked; some long fair-coloured hairs spring from under the scales. Middle claw of the fore feet far exceeding the others in its proportions.

It is a native of the East Indies, coast of Tranquebar, &c. It feeds much on termites, or white ants, for the destruction of whose conical nests the great middle claw is admirably adapted. Thunberg states that it is found much in Ceylon, especially near Negumbo. The Dutch call it the Negumbo Devil, and the Cingalese, Caballe. Its flesh was given to the sick to eat by way of remedy. Thunberg further informs us that the inhabitants have a method of making a hole in its skin with a knife, and thus of guiding and governing the animal at their pleasure, the point of the knife, which is kept in the hole, goading and irritating him. The cruelty of this proceeding does not however seem to have struck the traveller. The Land-Carp is also an Asiatic name for this species. It is the Kuwlee Manjar, or Tiled Cat, of the Mahrattas, according to Colonel Sykes, who notices it as very common in Dukhun (Deccan), and living on white ants. Mr. Hodgson, in his catalogue of the quadrupeds of Nepaul, mentions a new species of *Manis* allied to *M. Javanica* (Desm.), as being of frequent occurrence in the hills of the lower region, and in the mountains of the central tract. ('Zool. Proc.,' 1830, 1831, and 1834.)



Skeleton of Short-Tailed Pangolin (*Manis pentadactyla*). (Cuvier.)

M. tetradactyla, the Phatagin of Buffon, appears to be the Long-Tailed Pangolin (*M. macroura*, Erxleb.) This species is from two to three feet in length, and the tail is twice as long as the body; the scales are pointed.

It is a native of Senegal, Guinea, &c.

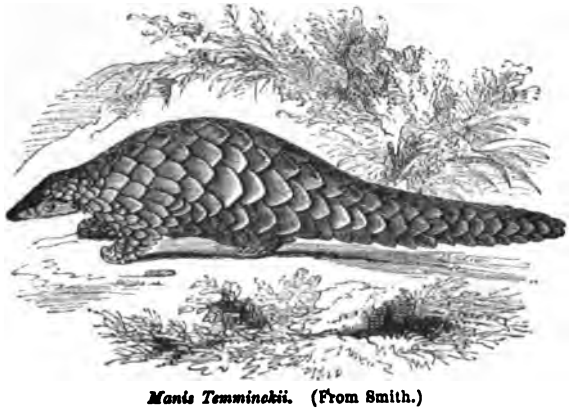
M. Temminckii (Smuts). Mr. Bennett described this species from a specimen in the collection made by Mr. Steedman in South Africa; and he stated that his object in calling the attention of the Society to it was to point out the external characteristics of a species known to its original describers by its skeleton alone and a few detached scales; and he characterised it as a *Manis* with a rather short head, a rather wide body; the scales large, and in 11 rows; the tail as long as the trunk, rather less than that in width, and hardly narrower at the subtruncate apex. Length 25½ inches; of the tail 12 inches; width of the back 8 inches; of the tail near the apex 5 inches.

Mr. Bennett observes that the most remarkable features of this

animal are the shortness of the head, the breadth of the body, and the breadth of the tail, which is nearly equal to that of the body, and continues throughout the greater part of its extent of nearly the same width, tapering only slightly towards the end, where it is rounded and almost truncate. Mr. Bennett further remarks that a peculiarity in the distribution of the scales of *M. Temminckii* is the cessation of the middle series of them at a short distance anterior to the extremity of the tail, so that the last four transverse rows consist of four scales each, each of the preceding rows having five. ('Zool. Proc.,' 1834.)

Dr. Andrew Smith says that only one solitary specimen of this species was obtained by the expedition before reaching 26° S. lat., and but two more between that parallel and the tropic of Capricorn, though others were known to have been captured in the latter tract, while the travellers were actually traversing it. He thinks it very questionable if the animal be so rare in nature as the result of their experience might incline men to believe. He is of opinion that its extreme scarcity probably arises from its having long been zealously sought after by the natives, who cherish a belief that it either has some influence upon cattle, or, at least, that certain observances in respect of it have an effect upon them. Whenever a specimen is secured it is submitted to the fire in some cattle-pen, apparently as a burnt offering, for the increase of the health and fertility of all cattle which may afterwards enter that fold. Dr. Smith states, that not many years ago a specimen was captured in the northern part of the Cape Colony, which renders it probable that the species was at one time scattered over the whole of South Africa, and that its almost total disappearance from the more southern districts had arisen from causes such as are now operating to effect a similar result in the interior. Here we have another cause for the obliteration of a species. Intolerance of their aggression has wrought up the shepherd or the agriculturist to the destruction of some; but in this case a species is probably dying out under the influence of a superstition.

Dr. Smith relates that when *M. Temminckii* is discovered, it never attempts to escape, but instantly rolls itself up into a globular form, taking especial care of its head, which is the only part that is easily injured. Ants constitute its chief and favourite food, and these it secures by extending its projectile tongue into holes which may exist in the habitations of these insects or which it may itself form; and when, by means of the glutinous matter with which its tongue is covered, a full load has been received, a sudden retraction of the retractor muscles carries both into its mouth, after which the ants are immediately swallowed. ('Illustrations of the Zoology of South Africa.')



Manis Temminckii. (From Smith.)

PANICLE. [INFLORESCENCE.]

PA'NICUM, a genus of Grasses the name of which is applied to one of the species (Millet) by the Romans, and which, Pliny states, is so-called from its flowers being in a panicle; though others derive the name from 'panis,' bread, from its uses as such. The genus contains a very large number of species, which abound in the hot parts of the world, though a few extend to higher latitudes and ascend the cool mountains of hot countries. They are chiefly valuable as pasture grasses, and for their seeds, which form a large portion of the food of the poorer classes of many nations, and thus engage a considerable share of the attention of the agriculturists of those countries.

The genus *Panicum* is distinguished by having a 2-flowered spikelet, with the lower flower masculine or neuter, and the upper hermaphrodite. Glumes 2, unequal, concave, blunt. Masc. paleæ 2, stamens 3, sometimes neuter, the upper palea and the stamens abortive. Fertile flowers, paleæ 2, unequal, concave, the lower one embracing the upper; scales 2; stamens 3; styles 2, ovary sessile.

P. miliaceum, Millet, is the best known species, being cultivated in the south of Europe as well as in tropical countries. Two varieties are well known, one brown, the other yellow-coloured, imported from the Mediterranean chiefly for feeding poultry, but forming in the south of Europe as well as in India a portion of the food of the inhabitants. In the latter country it is cultivated in the cold weather with wheat and barley, and the only one of the small grains that is so at that season of the year. It is the Cheena of the Hindoos, Arab Dukhun, Persian Urzun. *P. Miliare* is another species generally cultivated on an elevated rich soil in the peninsula of India: the seed is one of the sorts of dry or small grain which forms an article of diet of the Hindoos who inhabit the higher lands, and cattle are fond of the straw.

P. frumentaceum, the Shama or Samwuk of the natives of India, is a wholesome and nourishing grain, and forms there an article of diet chiefly of the lower classes. There are several varieties of it, which yield from 50 to 60 fold; it delights in a light, tolerably dry, rich soil; the same ground yields two crops between the first of the rains in June, July, and the end of January, in the Circars, but only one crop in the northern provinces. Besides these, which are the most commonly cultivated species, the grains of other species of *Panicum* growing in a wild state are collected, and form articles of diet with the poorer classes of the natives of India, as of *P. floridum* (Burtee), *P. Helopus* (Kooree), *P. hispidulum* (Dhand).

The uses of this genus are not confined to its grain, for the herbaceous part of several species forms the most valuable pasture grasses of the hot countries both in the Old and New World. Some of the species of *Panicum* of the Brazils are of gigantic stature, and yet tender and delicate in their herbage. The Coapim de Angola of Brazil grows 6 or 7 feet high, and other equally gigantic species constitute the field crops on the banks of the Amazonas; while *P. maximum*, or Guinea Grass, forms the most valuable pasture for cattle in Jamaica. This is said to have been introduced into that island from the coast of Africa, the seeds having been transmitted as food for some birds which were sent to Chief Justice Ellis. The straw of several of the species is esteemed as fodder for cattle in India, but no pasture grass in any country is probably more highly thought of than the Doob of India, which by the Brahmins is held sacred to Ganesha (Janus?) under the name of Doorwal. This is fortunately the most common species throughout India, and forms probably three-fourths of the food of their horses and cows. It is seldom cultivated, but Europeans in the northern parts frequently form lawns by planting small pieces of this grass, which forms excellent hay. The usual mode of obtaining it is to send out the grass-cutters into the uncultivated parts of the country, who scrape off the ground the creeping stems and leaves of this species, which is easily distinguished by its smooth and creeping habit; its spikes being fascicled and digitate, filiform, from 1 to 2 inches long, with the flowers disposed in two rows on the under side. It is the *P. dactylon* of botanists, and occurs also in England.

PANOPEA. [PYLORIDIA.]

PANORPA. [NEUROPTERA.]

PANORPES. [BEMBEX; CHRYSIDIDÆ.]

PANSY, a corruption of the French word Pensee, is a name now chiefly applied to the garden varieties of *Viola tricolor*, *V. Altaica*, and others, which are commonly cultivated under the name of Heart's-Ease. [VIOLA.]

PANTHER. [FELIDÆ.]

PANTHOLOPS. [ANTILOPEÆ.]

PANTODA'CTYLUS, a genus of Saurian Reptiles.

PAPA'VER, a genus of Plants the type of the natural order *Papaveraceæ*. The history of this, like that of many other cultivated plants, is little known, as well as the time when it began to be cultivated for the sake of its inspissated juice, though it was well known to the Greeks, and cultivated at very early periods on account of its seeds. (Theoph., lib. ix. cap. xiii., ed. Bodæus and Stapel, p. 1097.)

Some authors are of opinion that it is the Μήκων of Dioscorides, and that the kind with black seeds was called Ἀγρία, and that with white seeds Ἥμερος; and that it is the juice of this plant which Hippocrates recommends under the name of ὀπὸς μήκωνος, or 'juice of the poppy.' Pliny (xx. c. 18) uses 'opium' to express the inspissated juice of the poppy. Sprengel, in his 'Hist. Rei Herb.,' i. p. 176, quotes Diosc., lib. iv. c. 65, as referring to *Papaver somniferum*, and to *P. Rhœas;* but in his edition of that author (ii. p. 600) he mentions only the latter plant; hence we may infer that he conceives the former to have been unknown, as he nowhere else mentions it. We do not in this instance get the same degree of assistance as in many others from Arab authors. Opium is described by them under the name of Afeeyon, while Apaynum is quoted by Dr. Ainslie as its Sanscrit name. The poppy plant is described by the Arabs under the name of Khushkhush, while the Sanscrit is Chosa; and the Persian and Hindoo, Post. The species of *Papaver* are chiefly found in European countries; but a few species extend to the Caucasus and Armenia, and one species grows in the Himalayas, though Egypt is the country where we find the earliest notice of the opium poppy. This species is now common in most parts of Europe, but having been so long cultivated, it may appear indigenous in many countries where it has only escaped from cultivation. It is, as is well known, extensively cultivated in India, but it can nowhere be seen in a wild state, as the climate is too hot to support it except for a few months in the year.

The genus *Papaver* has two convex deciduous sepals; petals 4; stamens numerous; style wanting; stigmas 4 to 20, radiating and sessile upon a disc which crowns the germen; capsule obovate, 1-celled, opening under the crown of the stigmas with short valves; placentæ intervalvular, incomplete; flower-stalks inflexed at the apex before the flowers have expanded; the flowers of all are large and showy, but

last a short time. Herbaceous plants abounding in milky juice. The species are numerous.

The English species are distinguished as having a rough and a smooth capsule; of the former, *P. hybridum* has an obovate globose capsule, and *P. Argemone*, an elongated club-shaped capsule; of those with smooth capsules, *P. Rhœas* and *P. dubium*, the former has a globose and the latter an oblong capsule.

P. somniferum, or the White Poppy, is a native probably of Asia Minor, or of some part of the Persian Region of botanists, but having been so long cultivated, it is found wild in many parts of Europe. The species is distinguished by its obovate or globular capsules, smooth as well as the calyx, the stem smooth and glaucous, leaves embracing the stem incised and repand, with subobtuse teeth. There are two distinct varieties, which by some botanists are considered to be distinct species: the dark, the red-flowered, and black-seeded is called by Gmelin *P. somniferum;* and the white-flowered with white seeds, *P. officinale*. The latter is characterised as having an ovate globose capsule; foramina under the stigma either none or obliterated; peduncles solitary. The former (*P. somniferum*) has globose capsules, opening by foramina under the stigma; seeds black; peduncles many. The flowers are usually red of different tints, though sometimes white. Dr. Royle states that he has seen only the white-flowered variety in the plains of India, and the red-flowered in the Himalayas, and both cultivated for the sake of the opium.

The poppy is cultivated in many parts of Europe on account of its seeds, which yield a bland oil much esteemed in France; and in this country chiefly on account of the capsules, which are used medicinally. It is extensively cultivated in Turkey and Asia Minor, Egypt, Persia, and India, on account of its inspissated juice, so well known as opium, though this is occasionally prepared also in Europe.

The cultivation of the poppy is very simple, though the weeding requires care, and the plants must not be crowded too much together. They are carefully watered and manured, the watering being more copious as the period of flowering approaches, and until the capsules are half grown. [Opium, in Arts and Sc. Div.]

PAPAVERA'CEÆ, *Poppyworts*, a natural order of Hypogynous Exogenous Plants. The species are readily known by their deciduous calyx, usually tetramerous flowers, indefinite hypogynous stamens, and parietal placentæ; added to which, they have leaves without stipules, and their stems discharge a turbid white, yellow, or orange-coloured juice when wounded. Their seeds moreover contain a bland oil, lodged in a copious albumen, within which is stationed a minute embryo. They consist for the most part of herbs, which are usually of only annual duration; but a few are shrubby, the most remarkable case of that kind being a genus called *Dendromecon* a native of California, which is a true shrub, with the aspect of a *Cistus*. The greater part of the species inhabit the temperate parts of the Old World; but a few also occur in Australia, at the Cape, and in South America. Their active qualities are usually deleterious, but are for the most part of little moment, except in the case of the *Papaver somniferum*, or Opium Poppy. [Papaver.] It is however probable that in most cases the milky juice is narcotic, and the oil of the seeds harmless. An apparent exception to the latter statement occurs in *Argemone Mexicana*, the seeds of which are said to be narcotic, especially when smoked; but it is probable that in this case it is in the coats of the seed that the poisonous principle resides, rather than in the oil itself.

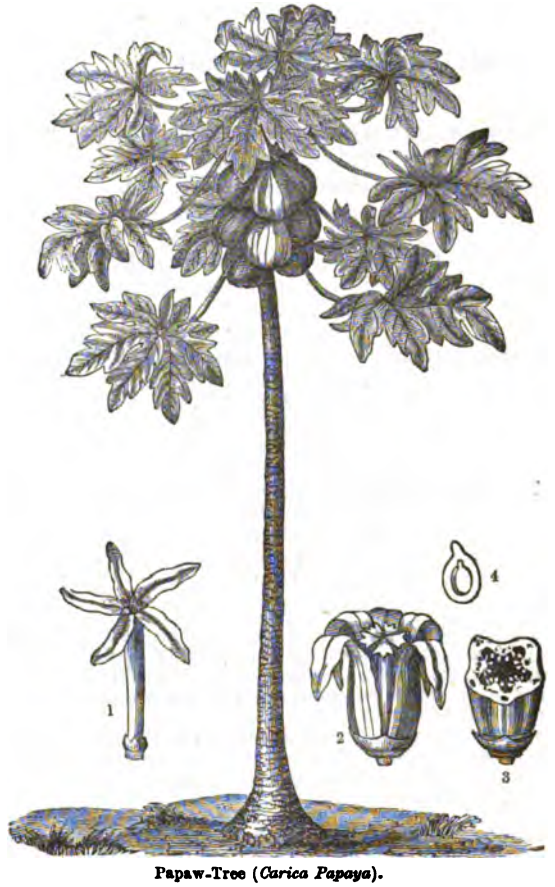
White Poppy (*Papaver somniferum*).

1, the stamens and pistil; 2, a transverse section of the capsule; 3, a seed; 4, the same divided, so as to show the embryo.

Some *Papaveraceæ* have no petals, as *Bocconia*, thus corresponding with *Thalictrum* and other apetalous *Ranunculaceæ*, with which order they are closely connected through *Platystemon*, a Californian annual with disjointed carpels. They are also related to *Nymphæaceæ* and *Sarraceniaceæ*. The order embraces 18 genera and 130 species. A description of the British species is given under Papaver, Glaucium, Meconopsis, Roemeria, Chelidonium.

PAPAW. [Carica.]

PAPAYA'CEÆ, *Papayads*, a small natural order of Exogenous Plants. The species are apparently allied to *Cucurbitaceæ* and *Passifloraceæ*, with the former of which it corresponds in its gourd-like fruit, with parietal placentæ, and in its disunited sexes; while it approaches the latter also in placentation, in its superior succulent fruit, and in the structure of its seeds. The order is remarkable in its fructification for having monopetalous male flowers and polypetalous females, and in its vegetation for its simple unbranched stems, growing only by the gradual development of a terminal bud. The species of most importance in this order is the Papaw-Tree, *Carica Papaya*. [Carica.] The order as at present constituted contains 8 genera and 25 species.



Papaw-Tree (*Carica Papaya*).

1, a monopetalous male flower; 2, a polypetalous female flower; 3, a transverse section of the ovary; 4, a longitudinal section of a seed.

PAPER-MULBERRY. [Broussonetia.]

PAPER-NAUTILUS. [Octopoda.]

PAPI'LIO, a genus of Lepidopterous Insects, established by Linnæus, and divided by subsequent entomologists into many groups and genera. It includes that very natural and beautiful assemblage of insects popularly known as Butterflies. The first section of *Lepidoptera*, named *Rhopalocera* (club-horned) in the arrangement of Boisduval, and *Diurna* in that of Latreille, corresponds with the Linnæan genus *Papilio*. The insects composing it have mostly thin and elongated antennæ terminated by a club. They are all day-fliers. Their larvæ, which are variously shaped, have six pectoral, eight abdominal, and two anal feet. The pupæ are usually angulated and, with a few exceptions, naked. The perfect insect varies in size from less than an inch across the wings when expanded, to nearly a foot in breadth. Equally variable are their colouring and outlines. They

are short-lived. Their powers of flight are very great, and the mode of flight varies in the several species. The males are usually more gaily coloured than the females.

The arrangement according to natural relations of the species of butterflies has been attempted by many naturalists. Even in the time of Linnæus the number and variety of known species was such as to render it necessary to subdivide his great genus *Papilio*. He constituted five principal groups. In the first of these, named *Equites*, he included such butterflies as have the fore wings longer from the posterior angle to the apex than to the base. In the second, the *Heliconii*, the wings are narrow, entire, and almost naked. The *Danai* have also entire wings. The *Nymphales* have dentated wings; and the group of *Plebeii* is composed of small species, whose larvæ are usually short and thick.

Dr. Horsfield has proposed an arrangement of these insects into five groups or stirpes, characterised by the peculiarities of the larvæ. He names the first stirps Vermiform, the second Iuliform, the third Scolopendriform, the fourth Thysanouriform, and the fifth Anopluriform.

Perhaps the most valuable arrangement of the Diurnal *Lepidoptera* is that proposed by M. Boisduval, who divides them into three great sections and fifteen tribes, as follows, founding his classification upon the characters of the larva:—

Section I. *Succincti.*
Chrysalis attached by the tail, and also girt.

A. Six feet in both sexes: caterpillars elongated.
Tribe 1. *Papilionides.*
2. *Pierides.*

B. Six feet in both sexes: caterpillars short.
Tribe 3. *Eumenides.*
4. *Lycenides.*

C. The males with four feet, the females with six. Caterpillars short.
Tribe 5. *Erycinides.*

D. Four feet in both sexes: caterpillars elongated.
Tribe 6. *Peridromides.*

Section II. *Suspensi.*
Chrysalis suspended by the tail only.

A. Ungues of tarsi simple. Four feet in both sexes.
Tribe 7. *Danaides.*
8. *Helionides.*

B. Ungues of tarsi strongly bifid. Four feet in both sexes.
Tribe 9. *Nymphalides.*
10. *Brassolides.*
11. *Morphides.*
12. *Satyrides.*
13. *Biblides.*

C. The males with four feet, the females with six. Caterpillars elongated.
Tribe 14. *Libythides.*

Section III. *Involuti.*
Chrysalis inclosed in a cocoon.
Tribe 15. *Hesperides.*

(See Boisduval in the *Suites à Buffon* and his other works; Wood, *Index Entomologicus;* Horsfield, *Catalogue of Lepidoptera in the Museum of the East India Company;* and Westwood's *Modern Classification of Insects*, where an enumeration of the principal treatises on butterflies may be found.)

PAPILIONA'CEÆ, a fanciful name given to the principal division of Leguminous Plants, from an imaginary resemblance between their flowers and a *Papilio*, or Butterfly. [FLOWER; LEGUMINOSÆ.]

PAPPUS. [CALYX.]

PAPY'RUS, a genus of Plants belonging to the natural order *Cyperaceæ*. This generic term has been derived from the name of a water plant, whose soft cellular flower-stem afforded the most ancient material from which paper was prepared, and our English word paper is derived from it. It has a stem from 3 to 6 feet high, with 3 acute angles, one of which, according to Bruce, is always opposed to the current of the stream in which it grows, as if to break its force. Its leaves are long and grassy, with a sharp keel. The flowers, which are green, are produced in very large compound umbels, with extremely numerous drooping triangular slender radii, terminated by very long filiform involucral leaves, within which are placed the spikes of flowers, each consisting of from 6 to 13 florets. It has been regarded as a species of *Cyperus*, and called *C. Papyrus*. It is also considered a distinct genus, and is named *Papyrus antiquorum*. It is a very common plant in Abyssinia, Egypt, and Syria, and is also met with in Calabria and Sicily; in gardens it is not uncommon. It inhabits both stagnant waters and running streams, and, independently of its ancient employment in the fabrication of paper, has been applied to other uses. The flowering stems and leaves are twisted into ropes; the roots are sweet, and have been employed as food. In Abyssinia boats are constructed from it, according to Bruce. In Syria the plant is called Babeer.

PARACENTROSTOMATA. [ECHINIDÆ.]

PARACEPHALOPHORA. [MALACOLOGY.]

PARADISE, GRAINS OF. [AMOMUM.]

PARADISEA. [BIRDS OF PARADISE.]

PARADOXI'DES. [TRILOBITES.]

PARAGUAY TEA. [ILEX; TEA, PARAGUAY.]

PARALLEL ROADS OF GLEN ROY. Glen Roy and several other valleys of the Highlands of Scotland exhibit very distinctly a series of parallel and nearly horizontal lines, embracing the sides of the hills and entering many of the lateral glens, at levels from a few to several hundred feet above the general bed of the valley. The nature of these terraces, or roads, has been the subject of much discussion amongst geologists, of which we propose to give an outline.

Glen Roy is a valley in the district of Lochaber, whose head-waters gather on a wild mountain tract near the source of the Spey. The water of Roy runs nearly south, and joins the Spean, which turns westward to enter the Great Valley of Scotland, below the south-western extremity of Loch Lochy. Passing from Fort William to the foot of Glen Roy, we have porphyry, gneiss, mica-schist, primary limestone, and quartz-rock, much disguised by diluvial accumulations. Glen Roy divides, not indeed exactly, the mica-schist and gneiss systems, the former predominating on the western and the latter on the eastern side. About the source of the Spey is a limited tract of granite; and the low summit of drainage between Glen Roy and Glen Spey is formed of this rock. From this flat and boggy summit the descent is gradual to Loch Spey on the east, and sudden into Glen Roy on the west. Upper Glen Roy, as MacCulloch terms the part near the head, is an oval valley, about four miles in length and one or more in breadth, and bounded on two opposite sides by high mountains, yielding two streams from the north-west and south-east, which meet near the middle of the valley. From their junction the united water of Roy flows in a gradual manner to the south-west for about two miles, when the valley contracts to a low rocky pass, in which the river runs a troubled course, and then emerges into the wide and long and rather sinuous valley of Lower Glen Roy. At the extremity of the rocky gorge which separates the upper from the lower glen, MacCulloch directs attention to a remarkably flat rock; and observes that above this gorge, in Upper Glen Roy, no distinct terrace or shelf was seen, but a line was noticed extending from near the junction of the streams which form the Roy towards Loch Spey; and it was proved by the spirit-level that this line was level with the remarkable flat rock at the gorge which terminates Upper Glen Roy, and also with the uppermost of three such lines, terraces, or shelves in Lower Glen Roy. Passing from Upper to Lower Glen Roy, the single line of Upper Glen Roy ascends from the valley, and girdles the sides of the hills, right and left, with seemingly higher and higher sweeps, and is followed by two other perfectly parallel and equally continuous lower lines, till Glen Roy expands into Glen Spean. Here the two upper lines end; but the lower one appears on the north and south sides of Glen Spean as far towards the source of the river Spean as the singular pass of Muckul, and turns southward a little way up the Gulban River, and still farther along the sides and round the head of Loch Treig. In a westward direction this line continues down Glen Spean on both sides, about half the distance from the Roy to the Lochy, and then ceases; nor has it been noticed in the Great Valley between Fort William and Inverness. Another line however, a few feet higher than the highest in Glen Roy, appears in the upper parts of Glen Gluoy, which, running parallel to Glen Roy, enters Loch Lochy. Mr. Darwin notices a line in another smaller tributary to Loch Lochy, near Kilfinnin; and describes a short terrace which appears on the south side of Loch Spey, about sixty feet above that lake, and higher than the highest terrace of Glen Roy. Sir D. Brewster has also observed shelves resembling those of Glen Roy in a part of the valley of the Spey, several miles below its source.

The elevation of these lines above the sea is known approximately, but not with the exactness demanded by a phenomenon so curious in itself and so fertile of subjects for geological speculation. In the following table we have combined the statements of MacCulloch, Sir T. L. Dick, and Mr. Darwin. The last writer thinks Dr. MacCulloch's measures of the terraces in Glen Roy 100 feet in excess:—

Relative levels of the various lines in Scotland.

	Darwin. ft.	Dick. ft.	MacCulloch. ft.
Kilfinnin	1202	—	1302
Glen Gluoy	—	292	1274
Upper Terrace, Glen Roy	1162	280	1262
Middle Terrace, Glen Roy	—	200	1182
Lower Terrace, Glen Roy	—	0	972
Loch Lochy	82	—	—
The sea at Loch Eil	0	—	0

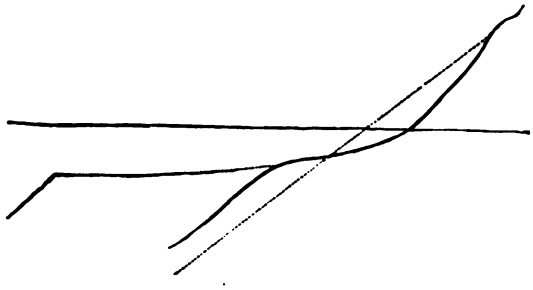
The lines, shelves, or terraces (for each of these names is locally appropriate) must not be confounded with the more ordinary occurrences of short successive level terraces of gravel, or with the longer declining gravel-banks which margin the sides of many valleys where they pass from the mountains to plain countries or the sea; they should be distinguished also from the similar little terrace-heaps which often appear at the summits of drainage in mountain countries. Such

gravel-terraces are seen both at the summit and at the foot of Glen Roy, and in each case appear intelligible as the result of fluviatile action at higher levels than the present water-channel.

The lines of Glen Roy and the other valleys are not short protruding terraces connected with the several lateral affluents, nor declining planes of gravel, but almost perfectly continuous shelves, sloping toward the valley from a level line, and almost perfectly parallel through all the various windings of their linear extent, and round the hollows and projections of the hills, whether these are small or great, sudden or otherwise; and each respective range, on one side of the glens, is exactly on the same level with that corresponding to it on the other side. This almost perfect horizontality and continuity of range is the grand feature of the phenomenon, and though easily admitted on ocular inspection, it is satisfactory to know that Sir T. L. Dick has proved it by careful levelling with Mr. Maclean on each of the shelves in Glen Roy. With such characters it is not wonderful that these mysterious works of nature should be supposed the effect of art, and the term of Parallel Roads is far from inapt, and is certainly very descriptive.

The shelves generally appear distinctly and even sharply defined when viewed from below or from a distance; but when inspected more narrowly, they appear very indistinct, and one may be actually treading on a shelf without being aware of it. This arises in a great measure from the fact that the surface of the shelves is far from level, but being often a little concave above and a little convex below, easily on a near view loses itself in the general slope of the mountain.

Sir T. L. Dick represents the general figure of a section of the shelf thus:—



Dr. MacCulloch gives many representations on a small scale, which show the really sloping character of the shelf or terrace, the angle of declination from the horizon varying from 12° to 30°, while the breadth of the terrace part varies from 10 to 70 feet. Where the slopes of the lines are steepest, their surface is narrowest; and generally where the ground slopes the least the terraces are the broadest. A real profile of one part is given below by the black line.

According to Mr. Darwin's view of the relation between the actual form and the original outline of the fundamental rock, one part will appear to be formed by excavation of the rock, and another part by accumulation of detritus, very slightly projecting beyond the slope of the mountain. MacCulloch's drawings indeed represent the shelves as hardly in any case projecting into a mound. Another part is drawn to represent a valley terrace composed of gravel, to which the shelves, (where they cross valleys) occasionally unite on a level, and thus form broad expansions.

"The shelves entirely disappear when crossing any part of the mountains in which the bare rock is exposed; for loose matter cannot accumulate there, and the rocks themselves, from their laminated structure, do not readily become worn into any regular form. They likewise disappear when crossing any part which is greatly inclined; for their own slope then coincides with that of the alluvial covering, and cannot be distinguished from it." (Darwin.)

The actual surface of the shelves is very irregular: they are composed of the same kind of alluvium with that covering the whole surface of the mountain. (Darwin.) They commonly contain rounded pebbles, and are in many places covered with large masses of stone, some of them many tons in weight, lying for the most part quite detached on the surface, and having their acuter angles rounded off in the greater number of instances; in short, in every respect resembling those fragments generally found strewed on the margin and on the shallow edge of alpine lakes. In some places, where the stones are large and the shelf narrow, a single block covers its whole breadth. When rock appears anywhere on a shelf, its angles are also rounded. (Sir T. L. Dick, from whom the above description is taken, states that the soil above the highest line of shelf is materially different from that below, which has more gravel, pebbles, and alluvial clay; but Mr. Darwin's subsequent observations do not confirm this.) The cases are few in which the solid rocks are much worn away in this manner; indeed they are not visible on the shelves. Some of the blocks of stone on the shelves have fallen from the heights above; others belong to far-removed sites, and are in fact erratic boulders. Among these latter are large granite blocks.

It must be evident, from the foregoing description, that the Parallel Roads of Glen Roy, and the lines resembling them or connected with them in the neighbouring regions, are marks of the ancient level of water filling the valleys to their summits or nearly so, and extending towards their mouths till within a few miles of the sea, or the great interior valley of Scotland. As many lines as we see, so many successive effects are there of water oscillating about particular levels through all the extent of the lines. This is freely admitted by all writers and all observers on the subject. Sir T. L. Dick, who gives abundance of illustrations of similar shelves being actually formed on the steep sides of modern lakes, adopts the hypothesis which most easily and obviously suggests itself, and ascribes the lines in all the valleys to the operations of a lake whose waters were successively lowered. Dr. MacCulloch discusses very ably two other modes of watery action whereby the lines may be supposed to have been formed; first, by a sort of local deluge filling the valley; secondly, by the excavating power of water in a valley previously filled by alluvial sediments to a particular height; and shows each hypothesis to be unsuitable and untenable.

On the view of the lacustrine origin of the parallel roads it is to be conceived that a lake had existed at the uppermost level of Glen Roy for so long a period as to have accumulated on its margin that alluvium which now forms the uppermost of the lines in question, and that by a subsequent sinking through two successive and similar periods, the two lower ones had been formed in the same manner. (MacCulloch.)

Mr. Darwin explains the phenomenon of these roads on the same principle as Sir Charles Lyell explains the formation of the parallel roads of Coquimba in South America. Sir Charles says—"The three parallel roads were formed by the waves of the Pacific, and not by the waters of a lake; in other words, they bear testimony to the successive rise of the land, not to the repeated fall of the waters of the lake."

From a series of appearances below the lowest shelf of Glen Roy, continued into Glen Spean—such as the nature and distribution of detritus, the form and position of many short terraces, some related to the shelf or ancient beach, others unconnected with the actions of the streams now running—Mr. Darwin concludes, apparently with reason, that every appearance in the sides of Glen Roy and Glen Spean, below the lowest shelf, will be explained on the supposition of a gradually subsiding sheet of water which received detritus from lateral streamlets. By observations of accumulated sand and pebbles in other valleys, as the sides of Loch Ness, Loch Dochart, &c., Mr. Darwin endeavours to extend this inference to a large portion of the Highland valleys, where no horizontal shelves make it a matter of certainty. Having rejected the hypotheses of separate and connected fresh-water lakes, on account of the difficulties attending them, which even in a single case are great (but if extended to many of the Highland valleys, insurmountable), Mr. Darwin adopts the alternative, that it was the sea-water, in the form of narrow arms or lochs, such as those now deeply penetrating the western coast, which once entered and gradually retired from these several valleys.

That there has been a change of level between the land and sea in Scotland, to the extent of several hundred feet, is proved by Mr. Smith's and Mr. Prestwich's observations at Banff and near Glasgow and other places; and, thus fortified, Mr. Darwin traces in hypothesis the effect of an elevation of the land equably or by intermitting effects, showing that by this means the main phenomena of the Lochaber valleys would certainly be occasioned.

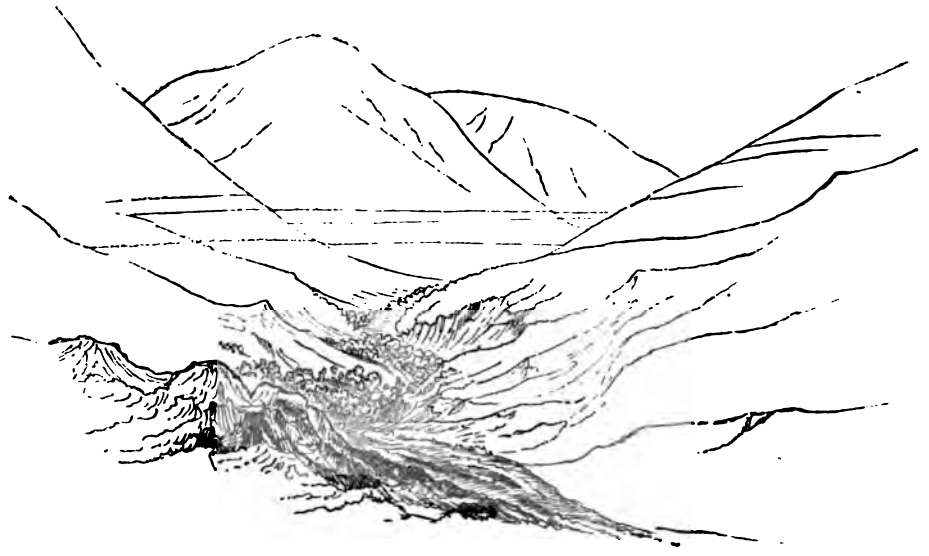
Objections to this speculation easily arise.—Why, for example, are shelves, the marks of intermission in the elevating forces, which affected a large area with extraordinary equality, confined to a few valleys? Why, after encircling in complete belts the upper ends of the valleys, do they cease toward the outlets? Why has Glen Roy three shelves, and the neighbouring Glen Gluoy but one, and that at a different level from any in Glen Roy? Why, if the sea for so long a time laved the mountain sides, are no marine shells found except at comparatively small elevations?

Mr. Darwin answers to these objections: first, that the conservation and even the original formation of beaches (for such the shelves certainly are) might rather be the exception than the rule, requiring particular slopes, loose materials, and freedom from erosive currents; secondly, that the difference of level between the Glen Gluoy shelf and the highest in Glen Roy may be explained as an effect of unequal tidal oscillation; thirdly, that instances of the absence of marine shells from the upper parts of marine deposits occur in Sweden, Scotland, and elsewhere.

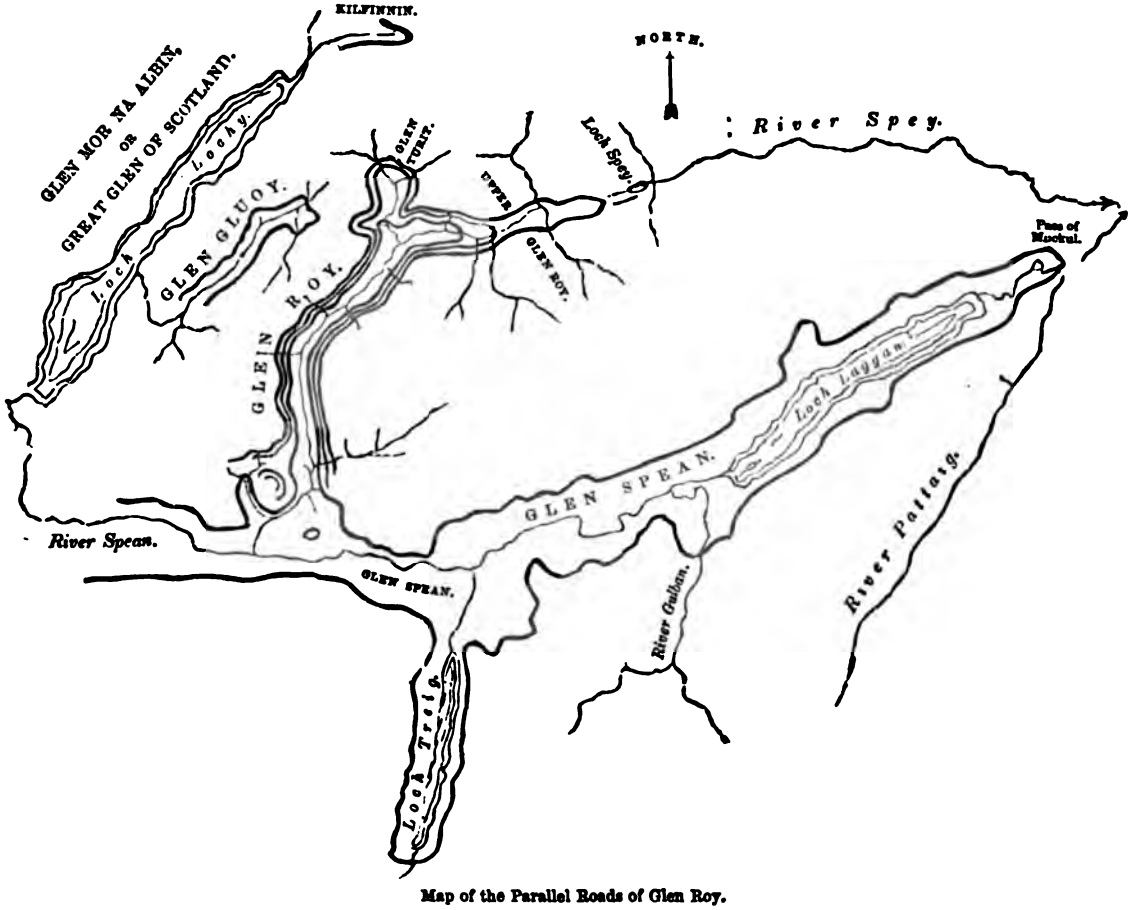
Such are the speculations to which the Parallel Roads of Glen Roy have given rise. The progress of modern geology has revealed so many proofs of the instability of the level of land and sea, and so many examples in which this change of level has been occasioned by a real displacement of land, that it is probable Mr. Darwin's explanations, drawn from the most general consideration, will be preferred to those which are more obviously suggested by the features of any one of the terraced glens.

It has been also suggested more recently that the Parallel Roads of Glen Roy have been formed by the action of glaciers; the parallel roads being the moraines which are left by the melting of these masses of ice.

(MacCulloch, in *Geological Transactions*, vol. iv.; Sir T. Lauder Dick, in *Transactions of Royal Society of Edinburgh*, vol. ix.; Darwin, in *Philosophical Transactions for* 1839.)



View of the Parallel Roads of Glen Roy. Sketched from nature, in 1826, by Professor Phillips.



Map of the Parallel Roads of Glen Roy.

PARAMICIPPA. [MAIDÆ.]

PARAMITHRAX. [MAIDÆ.]

PARASITICAL PLANTS are those which grow upon the living parts of other plants, from whose juices they derive their nutriment, a circumstance by which they are immediately distinguished from

false parasites, or Epiphytes, which merely fix themselves upon other plants without deriving food from them.

Parasitical Plants, properly so called, are extremely numerous, and belong to various parts of the vegetable kingdom. Some attack their victims externally, others are insidiously introduced into the interior, where they flourish until they pierce through the skin, place themselves in communication with the open air, and disseminate themselves; hence, physiologists divide them into intestinal and superficial. The former are exclusively fungi, and appear under the forms to which the popular names of mildew, rust, brand, smut, &c. [FUNGI; ENTOPHYTA; MILDEW] are applied; it is among the latter that parasites of so many different kinds are met with. These are again divisible into such as have true leaves, green, and capable of acting, in the manner of ordinary leaves, as organs of respiration and digestion; and such as have scales, brown or some colour not green, in the room of true leaves, without any powers of digestion or assimilation, except in a low degree. The first, or leafy or green parasites, elaborate their food for themselves; the second, or scaly or brown parasites, obtain it in a state of elaboration from other species.

Green leafy parasites belong exclusively, as far as is yet known, to the genera *Viscum* and *Loranthus*. [VISCUM; LORANTHUS.]

Brown scaly parasites always attack the roots of plants, and their underground habits have caused them to be little examined. The most common species in Europe are various kinds of *Orobanche*, which attack hemp, clover, lucern, and many other crops; *Monotropa* and *Lathræa*, which infest the roots, the first of the fir, and the second of the ash; in other countries Rhizanths abound [RHIZANTHEÆ], and probably many others of which we have no sufficient knowledge. To these are usually added *Neottia Nidus Avis* and *Corallorhiza innata*, two Orchidaceous plants, concerning whose real habits we have however no precise information. The best account of the manner of growth of brown parasites is by Mr. Bowman, who studied with care the habits of *Lathræa squamaria*. In that plant he found that the fibres of the roots are each tipped by a tubercle about as large as a pin's head, which tubercle attaches itself to the roots of the ash-tree, and gradually buries itself in the bark until it gets into communication with the wood, from which it derives its nutriment. One of the most remarkable peculiarities of such plants as these is the constant absence of all green colour, although exposed to the brightest light. Orobanches grow in pastures and open places, and yet their scale-like leaves indicate no visible tendency to any colour except brown or purple; and in *Lathræa* Mr. Bowman has shown that the same thing always happens, although the plants associated with it in its growth are as green as usual. Connected with this is another curious property, that of resisting the attraction of light, towards which all the green parts of plants irresistibly tend; in *Lathræa*, when the flower-stems have acquired their full stature, they are always perpendicular, and in groups of 20 or 30; in the most umbrageous situations the rows of flowers, which have always a unilateral direction, are as frequently turned from the only side on which light is admitted as towards it.

PARATHORITE, a variety of *Thorite*.

PARDALOTUS. [PIPRINÆ.]

PAREIRA. [CISSAMPELOS.]

PARELLA (sometimes written 'Perelle'), the French name of a Crustaceous Lichen, *Lecanora Parella* of botanists, but which is applied to several species similar to it in habit, and employed for the same purpose, that is, for yielding a rich dye known by the name of Litmus. [LITMUS, in ARTS AND SC. DIV.]

PARENCHY'MA is the term which was applied by the old anatomists to an imaginary substance, through which they supposed the blood at the ends of the veins to be strained. It is seldom now used in animal physiology, but it is retained by botanists to distinguish some forms of cellular tissue. [TISSUES, VEGETABLE.]

PARE'XUS, a genus of Fossil Fishes. [FISH.]

PARGASITE. [HORNBLENDE.]

PARIAS. [CROTALIDÆ.]

PARIDÆ, a natural family of Perching Birds. [INSESSORES.]

Linnæus, in his last edition of the 'Systema Naturæ,' placed the genus *Parus* between *Pipra* and *Hirundo*, in his order *Passeres*.

Latham arranges it also at the end of the same order.

Pennant too gives it a place in the Passerine section, between the Warblers and the Swallows.

M. De Lacépède places it immediately before the Larks; M. Duméril in the eighth family of the Passeres (*Subulirostres*, or *Raphioramphes*), in company with the Manakins, Larks, and Bec-Fins; M. Meyer, in the third sub-order (*Subulatæ*) of his fifth order (Oscines), between *Alauda* and *Regulus*; Illiger, at the head of the *Passerini*, among the *Ambulatores*, immediately before *Alauda*; Cuvier, among the *Conirostres*, directly after the Larks; Vieillot, in the family of *Ægithales* in the tribe *Anisodactyli*; Temminck, in the order *Granivores*, between the Larks and Buntings; and Latreille in the family *Conirostres*, also between the Larks and the Buntings. Selby arranges it between the same two forms.

Mr. Vigors places the genus *Parus* among the *Pipridæ*. [SYLVIADÆ; PIPRIDÆ.]

Mr. Swainson ('Classification of Birds') enters among the Titmice by the American genus *Sciurus*, remarkable for the motion of its tail. One species, *Sciurus aquaticus* (Sw.), frequents the sides of streams and runs upon the ground, whilst another, *S. aurocapillus* (Sw.) is, he observes, confined to damp woods, and runs along the low branches of trees. Here Mr. Swainson sees a change of economy, which, he says, plainly shows that nature has assumed a new form; and as the habit of running along branches of trees is the chief faculty of the Scansorial Birds, or of their representatives, so, he remarks, we may suppose that the group next in succession to the *Motacillinæ* would possess something of the same characters. These he finds manifested in the genus *Accentor*, and he adverts to an unpublished notice which he heard read at a meeting of the Linnean Society of London, relating to the habits of an *Accentor* which was killed near one of the public buildings at Oxford, and which was seen to climb so adroitly round the steep abutments of those buildings as to baffle for a considerable time the aim of the person who shot it. He also states that he has seen the common Hedge-Sparrow frequently hop along the whole length of a strong oblique branch, pecking into the crevices of the bark so as to remind the observer of a scansorial creeper, or of a Woodpecker; and he makes the Titmice a sub-family of the *Sylviadæ*. [SYLVIADÆ.]

Mr. Yarrell places the *Paridæ*, or True Tits, between the Warblers, *Sylviadæ*, and the *Ampelidæ*, the latter being represented by the Bohemian Waxwing. [BOMBYCILLA.]

Prince Bonaparte ('Birds of Europe and North America,' 1838) arranges the *Parinæ* as the seventh sub-family of the *Turdidæ*, placing it between the *Motacillinæ* (Wagtails), and the *Sylvicolinæ*. The following genera are included by the Prince under the *Parinæ*:—

Regulus, Ray (Wren, including Gold-Crests); *Parus*, Linn.; *Mecistura*, Leach (*Paroides*, Brehm—Long-Tailed Titmouse); *Calamophilus*, Leach (*Mystacinus*, Brehm—Bearded-Titmouse); *Ægithalus*, Vigors (*Penduliuus*, Cuvier—Penduline Titmouse).

Mr. G. R. Gray ('List of the Genera of Birds,' 1841) makes the *Parinæ* the fifth sub-family of his *Luscinidæ*, and places it between the *Accentorinæ* and the *Sylvicolinæ*. The *Parinæ*, according to him, consist of the following genera:—*Ægithalus*, Vig.; *Melanochlora*, Lesson; *Parus*, Linnæus; *Megistina*, Vieill.; *Tyrannulus*, Vieill.; *Sphenostoma*, Gould; *Calamophilus*, Leach; *Orites*, Mæhr (*Mecistura*, Leach; *Paroides*, Brehm—Long-Tailed Titmouse); *Parisoma*, Swainson; *Psaltria*, Temminck; *Ægithina*, Vieill.; *Hylophilus*, Temminck.

In this article we shall confine ourselves to those examples of the family which are more commonly known as Titmice.

The following species are found in Europe:—

The Great Tit, *P. major*; the Sombre Tit, *P. lugubris*; the Siberian Tit, *P. Sibericus*; the Toupet Tit, *P. bicolor*; the Azure Tit, *P. cyaneus*; the Blue Tit, *P. cæruleus*; the Coal-Tit, *P. ater*; the Marsh-Tit, *P. palustris*; the Crested Tit, *P. cristatus*; the Long-Tailed Tit, *P. caudatus* of authors (genus *Orites*); the Bearded Tit, *P. biarmicus* (genus *Calamophilus*); the Penduline Tit, *P. pendulinus* of authors (genus *Ægithalus*).

The Great Tit, the Blue Tit, the Crested Tit, the Coal-Tit, the Marsh-Tit, the Long-Tailed Tit, and the Bearded Tit, are British.

There is little doubt that the Tits are the Αἰγιθαλοί of Aristotle. The Great Tit, the Long-Tailed Tit, and the Blue Tit, are referred by Belon to the Αἰγιθαλός, the Αἰγιθαλὸς ἕτερος, and the τρίτος Αἰγιθαλός of that author, and we think with good reason.

The Great Tit, the Blue Tit, the Coal-Tit, and the Marsh-Tit, are too well known to require description; but a sketch of their habits may not be unacceptable. White, speaking of the English Tit, says:—"Every species of titmouse winters with us: they have what I call a kind of intermediate bill between the hard and the soft, between the Linnæan genera of *Fringilla* and *Motacilla*. One species alone spends its whole time in the woods and fields, never retreating for succour in the severest seasons to houses and neighbourhoods; and that is the delicate Long-Tailed Titmouse, which is almost as minute as the Golden-Crowned Wren; but the Blue Titmouse, or Nun (*P. cæruleus*), the Coal-Titmouse (*P. ater*), the Great Black-Headed Titmouse (*Fringillago*), and the Marsh-Titmouse (*P. palustris*), all resort at times to buildings, and in hard weather particularly. The Great Titmouse, driven by stress of weather, much frequents houses; and in deep snows I have seen this bird, while it hung with its back downwards (to my no small delight and admiration), draw straws lengthwise from out the eaves of thatched houses, in order to pull out the flies that were concealed between them, and that in such numbers that they quite defaced the thatch, and gave it a ragged appearance. The Blue Titmouse, or Nun, is a great frequenter of houses, and a general devourer. Besides insects, it is very fond of flesh; for it frequently picks bones on dunghills: it is a vast admirer of suet, and haunts butchers' shops. When a boy, I have known twenty in a morning caught with snap mouse-trap baited with tallow or suet. It will also pick holes in apples left on the ground, and be well entertained with the seeds on the head of a sun-flower. The Blue, Marsh, and Great Titmice will, in very severe weather, carry away barley and oat-straws from the sides of ricks." ('Selborne.')

We can confirm, if confirmation were needed, the account of this admirable observer relative to the straw-extracting labours of the Great Tit. The thatch of a root-house in Gloucestershire was nearly destroyed by those fly-seekers. But they have more to answer for than fly-catching: they are small-bird murderers, and frequently kill

their victims by repeated blows on the head with their strong, sharp, and hard beak, for the sake of feasting on the brains.

The Great Tit, without any compass to speak of, is a songster, not unadmired by some for its few but lively notes heralding the spring early in February. The quatrain in the 'Portraits d'Oyseaux' is loud in its praise:—

"Au temps d'Autonne il y a des mesanges
En grand foison, qui hantent par les boys,
Et font des œufs douze ou quinze par fois;
Oyseaux petits, et qui chantent comme anges.

The habits of the Blue Tit are recorded by White with equal truth. This is the bird that fights so stoutly pro aris et focis, hissing like a snake or an angry kitten when her nest in the hollow of some decayed tree is invaded by the school-boy, who, if not deterred by the ominous sounds, often rues his temerity, and draws back his hand with more celerity than he stretched it forth, well pecked by the irritated matron. Hence he calls it 'Billy Biter:' by the way, Montagu gives 'Willow Biter' as one of its names. The latter name does not convey much meaning to any one acquainted with the habits of the bird, the former does; may not Montagu have heard it imperfectly?

The gardener who sees this little bird busy about the buds likes it not, and in some parishes a reward has been set upon its head. Mr. Knapp, in his interesting 'Journal of a Naturalist,' notices such a case where the stimulus appears to have operated to some purpose against these innocent little birds, for one item passed in the churchwardens' account was "for seventeen dozen of Tomtits' heads." They may now and then knock off a bud in their busy search for insects, but the great good they do in ridding the plants of these far outweighs any casual harm that may result from their industry.

The song of the Tomtit has but little variety; the vivacity of the bird seems however to have found favour for its song with our neighbours, for the 'Portraits d'Oyseaux' notices it with applause:—

"L'Esté es bois la mesange bleuë est,
Et nous vient voir en Hyver et Autonne,
Le doux chanter d'icelle plaisir donne
A tout esprit, à qui l'escouter plaist."

P caudatus, the Long-Tailed Titmouse. This is the Pendolino, Paronzino, Codibugnolo, and Paglia in Culo, of the Italians; Mesange à la Longue Queue and Perd sa Queue of the French; Langschwänzige Meise, Schwanzmeise, and Belzmeise Pfannenstiel, of the Germans; Staartmees of the Netherlanders; Alhtita of the Swedes; Jenaga of the Japanese; Bottle-Tit, Bottle-Tom, Long-Tailed Farmer, Long-Tail Mag, Long-Tail Pie, Poke Pudding, Huckmuck, and Mum-Ruffin, of the English; and Y Benloyn Gnyffonhir of the Welsh.

Long-Tailed Titmouse (*Parus caudatus*), male and female. (Gould.)

Male.—Head, neck, throat, and breast, pure white; upper part and centre of the back, rump, and the six middle tail-feathers, deep black; scapulars reddish; belly, sides, and abdomen, reddish-white; quills black; greater wing-coverts bordered with pure white; lateral tail-feathers white on their external barbs and at their end; tail very long and wedge-shaped. Length, 5 inches 7 or 8 lines.

Female.—A large black band above the eyes, which is prolonged upon the nape, and proceeds to unite itself with the black of the upper part of the back.

Young.—Small black spots on the cheeks and brown spots on the breast; black of the back not so decided. (Temminck.)

This bird is found in Siberia, Russia, and Japan; the whole of Europe; England, Scotland (near Edinburgh at least), and Ireland.

Insects, their larvæ and eggs, form the food of these pretty little birds. When White says that the Long-Tailed Titmouse never retreats for succour in the severest seasons to houses and their neighbourhood, he must not be supposed to mean that the bird avoids the haunts of men. We have seen in a nursery-garden in Middlesex a whole family of them within a few yards of the nurseryman's cottage, and close to his greenhouse, which visitors were constantly entering; and we have found its exquisitely-wrought nest in a silver fir about eight feet high, in a pleasure-ground in the same county, little more than a hundred yards from the house. Pennant well describes its appearance in flight, when, after stating that the young follow the parents the whole winter, he says, "from the slimness of their bodies, and great length of tail, they appear while flying like so many darts cutting the air. They are often seen passing through our gardens, going progressively from tree to tree, as if on their road to some other place, never making any halt."

Yarrell is equally happy in describing the nest and manners of this interesting little bird. "The nest of this species," says he, "is another example of ingenious construction, combining beauty of appearance with security and warmth. In shape it is nearly oval, with one small hole in the upper part of the side by which the bird enters. I have never seen more than one hole. The outside of this nest sparkles with silver-coloured lichens adhering to a firm texture of moss and wool, the inside profusely lined with soft feathers. The nest is generally placed in the middle of a thick bush, and so firmly fixed, that it is mostly found necessary to cut out the portion of the bush containing it, if desirous of preserving the natural appearance and form of the nest. In this species the female is known to be the nest-maker, and to have been occupied for a fortnight to three weeks in completing her habitation. In this she deposits from ten to twelve eggs, but a larger number are occasionally found; they are small and white, with a few pale red specks, frequently quite plain, measuring seven lines in length and five lines in breadth. The young family of the year keep company with the parent birds during their first autumn and winter, and generally crowd close together on the same branch at roosting-time, looking, when thus huddled up, like a shapeless lump of feathers only. These birds have several notes, on the sound of which they assemble and keep together: one of these call-notes is soft and scarcely audible; a second is a louder chirp or twitter; and a third is of a hoarser kind."

Nest of Long-Tailed Titmouse.

In the 'Portraits d'Oyseaux,' the qualities of this species are thus summed up—

"Ceste mesange est à la longue queue,
Oyseau petit, comme est le Roytelet:
Du demeurant, inconstant, et follet,
Par son hault chant sa voix est bien cogneue."

P. biarmicus, the Bearded Titmouse. This is the Mesange Barbue ou Moustache of the French; Bartmeise of the Germans; Least Butcher-Bird of Edwards; Reed Pheasant (provincial) of the English; and Y Barfog of the Welsh.

Male.—Black between the bill and the eye, and these black feathers are very long and prolonged on each side on the lateral part of the

neck; head and occiput bluish-ash; throat and front of the neck pure white, which blends on the breast and the middle of the belly into a rosy hue; nape, back, rump, feathers of the middle of the tail and sides, fine rust colour; great coverts of the wings deep black, bordered with deep rusty on the external barb, and reddish-white on the internal barb; quills bordered with white; feathers of the under part of the tail deep black; lateral tail-feathers bordered and terminated with gray; tail long, much graduated: bill and iris fine yellow. Length, 6 inches and 2 or 3 lines.

Female.—No black moustaches; throat and front of the neck tarnished white; upper parts of the head and body rusty, shaded with brown; on the middle of the back some longitudinal black spots; under tail-coverts bright rusty.

Young at their leaving the nest, and before their first moult, with nearly the whole of the plumage of very bright reddish; a good deal of black on the external barbs of the quills and tail-feathers; on the middle of the back a very large space of deep black. After the first moult nothing of the deep black of the back remains but some longitudinal spots.

Varieties.—More or less marked with white or whitish; the colours of the plumage often feebly developed. (Temminck.)

M. Temminck remarks that the Zahnschäblige Bartmeise of Brehm is a species or sub-species founded only on individuals which have been long caged, such as may be seen in the Dutch markets, where numbers are sold. Some of these captives come to London, where they may be bought for some four or five shillings a pair. The iris and bill in the living bird are of a delicate orange colour.

It is found in the north of Europe, England, Sweden; Asia, on the shores of the Caspian Sea; nowhere so abundant as in Holland; accidentally, on passage, in France.

Bearded Titmouse (*Parus biarmicus*), male and female. (Gould.)

Dr. Leach had observed the fondness of this species for marshy and reedy spots, the shape of its open cup-shaped nest placed on the ground, and the nature of its food—seeds, insects and their larvæ, and small-shelled snails. He had also remarked that the sides of the stomach in this bird were muscular and much thickened, forming a gizzard which the true Tits do not possess; and that this structure of the stomach afforded the power of breaking down the shells of the Testaceous Molluscs—*Succinea amphibia* and *Pupa muscorum*—many of which had been found comminuted therein. Still, from the comparative rarity of this bird in Great Britain, and the impervious nature of its haunts, its habits were comparatively little known. Mr. Hoy and Mr. Dykes have supplied much interesting information on this head.

The former states that the Bearded Tit begins building towards the end of April, and that the nest is composed on the outside of dead leaves of the reed and sedge, intermixed with a few pieces of grass, and lined with the top of the reed. He describes it as generally placed in a tuft of coarse grass or rushes near the ground, on the margin of the dykes, in the fens; and sometimes as fixed among the reeds that are broken down, but never suspended between the stems. Their food, he says, is principally the seed of the reed, and so intent were they on their search for it, that he had taken them with a bird-limed twig attached to a fishing-rod. When alarmed by any sudden noise, or the passing of a hawk, they uttered their shrill musical notes and concealed themselves among the thick bottoms of the reeds; but they soon resumed their station, climbing the upright stems with the greatest facility.

Mr. Dykes had an opportunity of examining three specimens, and he found their crops completely filled with the *Succinea amphibia* in a perfect state, the shells unbroken and singularly closely packed together. The crop of one, not larger than a hazel-nut, contained twenty *Succineæ*, some of them of a good size, and four *Pupæ muscorum*, with the shells also entire. The stomach was full of small fragments of shell in a greater or less degree of decomposition. Numerous sharp angular fragments of quartz which had been swallowed had, with the action of the stomach, effected the comminution of the shells.

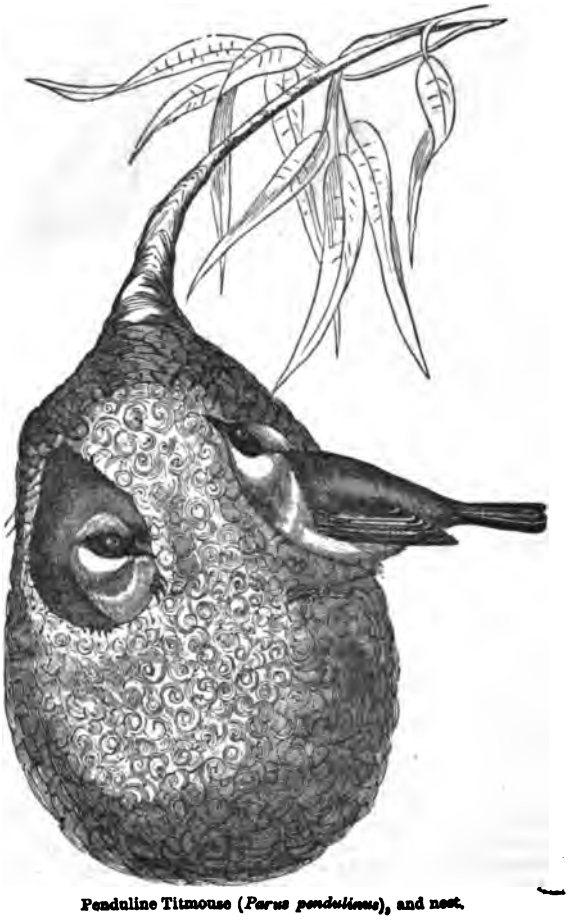
Two nests obtained by Mr. Yarrell from the parish of Horsey were sustained only an inch or two above the ground by the strength of the stems of the coarse grass on which they were fixed. Each was composed entirely of dried bents, the finer ones forming the lining; others increasing in substance made up the exterior. Mr. Yarrell states the number of eggs at from four to six, rather smaller than those of the Great Titmouse, and less pointed; 8¼ lines long by 6½ lines in breadth; white, and sparingly marked with pale red lines or scratches. ('British Birds.')

P. pendulinus, the Penduline Titmouse. This is the Rémiz or Mésange de Pologne of the French, and Beutel Meise of the Germans.

Male.—Bill black, straight, a little elongated, and pointed; tail short; top of the head and nape pure ash-colour; forehead, space between the eye and the bill, region of the eyes, and feathers of the orifices of the ears, deep black; back and scapulars reddish-gray; rump ash-colour; throat white, the other lower parts whitish with rosy tints; coverts of the wings chestnut, bordered and terminated with whitish-rusty and white; wings and tail blackish, bordered with whitish-rusty; tail-feathers terminated with white; iris yellow. Length 4 inches 3 or 4 lines.

Female.—Rather less than the male; the black on the forehead not so large nor so pure; the band which passes over the eyes and terminates at the ears bluish-black; ash-colour of the head less pure; upper parts more clouded with rusty, but there is a yellowish tint on the middle of the belly.

The Young up to their first moult have the colours brighter; they have not the forehead black.



Penduline Titmouse (*Parus pendulinus*), and nest.

It is found in the southern and eastern provinces of Europe principally; also in Russia, Poland, Hungary, Austria (along the banks of the Danube, where it breeds), the south of France, and Italy.

M. Temminck has placed this species, together with the Bearded Tit, in his second section of Titmice, the Riverains; and indeed the Penduline Titmouse, both in habits and in the choice of its food, has many points in common with the other species above described. Like the Bearded Tit, the Penduline Titmouse haunts the reedy banks of rivers, or the margins of wide-watered shores; and its food consists not only of the seeds of the reeds, but of aquatic insects and molluscs. It derives its name from its pensile purse-like or flask-like nest, generally suspended at the end of some willow twig or other flexible branch of an aquatic tree. This skilfully-wrought cradle is woven from the cotton-like wool or down of the willow or poplar, with an opening in the side for the ingress and egress of the artificers and their young, and mostly overhangs the water; sometimes however it is interwoven among the reed-stems. The eggs, which are pure white marked with some red spots or blotches, are generally six in number.

P. xanthogenys has the head with a full crest of black feathers; occiput, superciliary stripe, and cheeks, yellow: ear-coverts black; back olive; wings and tail black, the former spotted, and the latter tipped with white; a broak black line passing down the throat, and extending along the middle of the abdomen; sides of the chest and flanks pale-yellow; bill and feet black; size rather less than that of the Greater Tit, *P. major*. (Gould.)

This bird is a native of the Himalaya Mountains.

Parus xanthogenys. (Gould.)

P. atricapillus, the Black-Cap Titmouse. The male has the upper aspect of the head, nape, chin, and throat, velvet-black. A white line from the nostrils through the eye, spreads out on the side of the neck; back lead-coloured, glossed with yellowish-gray, quill and tail-feathers blackish-gray, edged with grayish white; under-plumage brownish white, deepening in some specimens to yellowish-gray; bill pitch black; legs bluish; total length 5 inches 6 lines. ('Fauna Boreali-Americana.')

Some ornithologists have considered this bird identical with the Marsh-Titmouse, *P. palustris*, of Europe. M. Temminck in the first part of his 'Manuel' declares that individuals sent to him from North America had absolutely the same distribution of colours on their plumage as those killed in Europe, only the hues of the American individuals were more pure. In the third part, where he notices *P. palustris*, and adds to its synonyms, he says nothing to contradict his original observation; and in the first part he gives *P. atricapillus*, La Mésange à Tête Noire du Canada (Briss.), and the Black-Cap and Canada Titmouse (Lath.), as synonyms of *P. palustris*.

Mr. Swainson and Sir John Richardson however, after referring to the opinions of those who have considered the European and the American bird as the same, state that the two species appear to them to be sufficiently distinct. According to them this Tit is the *P. atricapillus*, Linn., who by the way gives Canada as its habitat; Mésange à Tête Noire de Canada, Buff.; *P. atricapillus*, Wils., Black-Capt Titmouse; *P. atricapillus*, Bonap.; Peechehkeeskæshees of the Cree Indians; and Mésange of the Canadian voyageurs: and they observe that its loose plumage, like that of the Canadian Jay, is well qualified for its protection in the severe arctic winters. According to Nuttall, 'Chicadee' is the familiar name for this bird.

Supposing this bird to be a distinct species, it is found throughout

the whole width of the American continent, from 65° N. lat. to the southern districts of the United States, throughout the year. It is one of the most common birds in the Fur-Countries, a small family inhabiting almost every thicket. ('Fauna Boreali-Americana.') In winter it is resident around Hudson's Bay, and has been met with at 62° N. lat. on the north-west coast. It is difficult to say in what part of the United States it is most common, so generally and equally has it colonised the temperate parts. In winter it is abundant in all the forests of the southern states to Florida, and probably extends its visits into Mexico. (Nuttall.)

Black-Cap Titmouse (*Parus atricapillus*).

Nuttall gives a graphic description of the manners of this Titmouse in his 'Manual of the Ornithology of the United States and of Canada.' "In all these countries," he says, "in autumn families of them are seen chattering and roving through the woods, busily engaged in gleaning their multifarious food, along with the preceding species (*Parus bicolor*), Nuthatches, and Creepers, the whole forming a busy, active, and noisy group, whose manners, food, and habits, bring them together in a common pursuit. Their diet varies with the season; for besides insects, their larvæ and eggs, of which they are more particularly fond, in the month of September they leave the woods and assemble familiarly in our orchards and gardens, and even enter the thronging cities in quest of that support which their native forests now deny them. Large seeds of many kinds, particularly those which are oily, as the sun-flower, and pine, and spruce-kernels, are now sought after. These seeds in the usual manner of the genus, are seized in the claws and held against the branch until picked open by the bill to obtain their contents. Fat of various kinds is also greedily eaten, and they regularly watch the retreat of the hog-killers in the country to glean up the fragments of meat which adhere to the places where the carcasses have been suspended. At times they feed upon the wax of the candle-berry myrtle (*Myrica cerifera*), they likewise pick up crumbs near the houses, and search the weather-boards and even the window-sills familiarly for their lurking prey, and are particularly fond of spiders and the eggs of destructive moths, especially those of the canker-worm, which they greedily destroy in all its stages of existence. It is said that they sometimes attack their own species when the individual is sickly, and aim their blows at the skull with a view to eat the brain; but this barbarity I have never witnessed.

"On seeing a cat, or other object of natural antipathy, the Chicadee, like the peevish jay, scolds in a loud, angry, and hoarse note, like ''Tshe, dăigh, dăigh, dăigh.' Among the other notes of this species, I have heard a call like ''Tshe-de-jay, 'tshe-de-jay,' the two first syllables being a slender chirp, with the 'jáy' strongly pronounced. The only note of this bird which may be called a song, is one which is frequently heard at intervals in the depth of the forest, at times of the day usually when other birds are silent. We then may sometimes hear in the midst of this solitude two feeble, drawling, clearly-whistled, and rather melancholy notes, like ''te-dĕrry,' and sometimes 'ye-pĕrrit,' and occasionally, but much more rarely, in the same wiry, whistling, solemn tone, ''phēbé.' The young in winter also sometimes drawl out these contemplative strains. In all cases the first syllable is very high and clear, the second word drops low, and ends like a feeble

plaint. This is nearly all the quaint song ever attempted by the Chicadee; and is perhaps the two notes sounding like the whetting of a saw, remarked of this bird in England by Mr. White, in his 'Natural History of Selborne' (vol. i.) On fine days about the commencement of October, I have heard the Chicadee sometimes for half an hour at a time, attempt a lively petulant warble, very different from his ordinary notes. On these occasions he appears to flirt about, still hunting for his prey, but almost in an ecstacy of delight and vigour. But after a while the usual drawling note again occurs. These birds, like many others, are very subject to the attacks of vermin, and they accumulate in great numbers around that part of the head and front which is least accessible to their feet.

"The European bird is supposed to be partial to marshy places. Ours has no such predilection, nor does the American bird, that I can learn, even lay up or hide any store of seeds for provision—a habit reported of the foreign family."

Prince Bonaparte notes *Parus palustris* and *P. atricapillus* as distinct species, in his 'Birds of Europe and North America.'

P. niger, Vieill. (*P. leucopterus*, White-Winged Tit, Sw.), has a deep uniform glossy black with slight bluish reflection in certain lights, except the wings, on which the black is relieved by the snowy white of the lesser and greater coverts and of the quills. Total length nearly six inches. It is abundant in the Kaffir country, South Africa.

Le Vaillant describes the note of this species, his Mésange Noire, as the same with that of *P. major*. The nest, he says, is made in the trunks of trees, where the bird also roosts. The pure white eggs, he adds, are from six to eight in number.

White-Winged Tit (*Parus niger*). Le Vaillant.

PARIETA'RIA, a genus of Plants belonging to the natural order *Urticaceæ*. It has polygamous flowers, surrounded by an involucre, a bell-shaped 4-parted perigone, 4 stamens, and a filiform style.

P. officinalis, Wall-Pellitory, has ovate or oblong-ovate leaves, without lateral ribs at the base, two axillary bifid cymes, the segments of the involucre ovate-obtuse. The leaves are alternate, the flowers small and reddish, the fruit black and shining. It is a British plant, and is found on old walls and rubbish. It is the *P. erecta* of Koch and Reichenbach.

(Babington, *Manual of British Botany.*)

PARIS, a genus of Plants belonging to the natural order *Asparageæ*. It has a patent horizontal perianth, 8-parted to the base, the four inner parts, or corolla, narrower than the others. There are 8 stamens, the anthers fixed to the middle of a subulate filament. The styles are 4 in number, the berry 4-celled, the cells with from 4 to 8 seeds.

P. quadrifolia, Herb-Paris, the only British species, has usually four leaves in a whorl, a stem about a foot high springing from the extremity of a long rhizoma usually with four, occasionally from three to six leaves at its summit. The flowers are solitary and terminal, the sepals lanceolate, the petals subulate. It has no root-leaves, and is found in damp woods in England. It is considered to be a narcotico-acrid poison.

P. polyphylla, a native of Nepaul, possesses similar properties.

(Babington, *Manual of British Botany.*)

PARISITE, a carbonate containing cerium. [*See* SUPP.]

PA'RKIA, a genus of Plants belonging to the natural order *Leguminosæ* and the tribe *Mimoseæ*. It was named by Mr. Brown in honour of the great African traveller Mungo Park. The genus contains only a few unarmed trees, which are found on the west coast of Africa, the peninsula of India, Silhet, and in the islands to the eastward of the Bay of Bengal. *Parkia* is distinguished among the Mimosa-like *Leguminosæ* by the tubular 5-cleft calyx and the corolla with 5 distinct petals having a more or less imbricate æstivation; stamens 10, hypogynous, monadelphous. Legume many-seeded, 2-valved, with a farinaceous pulp around and between the seeds. Inflorescence an axillary peduncled and club-shaped spike.

P. Africana is the Nitta, or Doura-Tree of Soudan. The farinaceous matter surrounding the seeds is eaten, and also made into a pleasant drink when steeped in water. The seeds are roasted as coffee is with us, then bruised and allowed to ferment in water. When they begin to become putrid, they are well washed and pounded, and the powder is made into cakes resembling chocolate, which form an excellent sauce for all kinds of meat. (Brown, in Denham.) A species of this genus, the *Mimosa pedunculata* of Roxburgh, is said by him to be similarly valued by the Malays, that is, they eat the mealy matter which surrounds the seeds, as well as the seeds themselves, which are said to taste like garlic.

PARKINSO'NIA, a genus of Plants belonging to the natural order *Leguminosæ*. *P. aculeata*, the Barbadoes Flower-Fence, is a well known West Indian shrub, very generally employed in such climates as an ornamental plant, and especially for the construction of hedges, for which its strong spines render it well adapted. It has long pinnated leaves, with a winged petiole, and grows as much as 12 or 15 feet high. The flowers are large, yellow, very numerous, and a little variegated with red spots, and are succeeded by long narrow knotted pods. When in flower it is said to be one of the most splendid objects in the vegetable kingdom.

PARMACELLA. [LIMAX.]

PARMELIA. [LICHENS.]

PARMOPHORUS. [FISSURELLIDÆ.]

PARNASSIA (from the name of Mount Parnassus), a genus of Plants belonging to the natural order *Droseraceæ*. It has a 5-cleft deeply-cut calyx, 5 petals, and 5 stamens, with 5 scales fringed with glandular setæ interposed. The stigmas are sessile and 4 in number, the capsules 1-celled with 4 valves. The species are smooth herbs. The leaves ovate, cordate, cauline ones usually clasping the stem or sessile. The flowers are all white striped with green; the tuft of the glands yellow.

P. palustris, Marsh or Common Grass of Parnassus, has cordate stalked radical leaves, the stem-leaves amplexicaul, the filaments of the petaloid scales from 9 to 13; the petal has a short claw, and is white and veined; the glands of the scales yellow. It is native throughout Europe, in marshy and damp places, and in Britain in mountainous countries.

P. fimbriata is a very elegant species; the leaves are remarkably hollowed out at the base close to the lateral ribs, which are connected with one another by a common base like the divisions of a pedate leaf. It has palmate glandless appendages, obovate petals fringed at the base. It is a native of the western coast of North America.

(Don, *Dichlamydeous Plants;* Babington, *Manual.*)

PARONYCHIACEÆ, Meisner's name for the family of Plants called by Lindley *Knotworts*. Brown named this tribe after *Illecebrum*, *Illecebreæ*, which is now most commonly adopted. [ILLECEBRACEÆ.]

PAROTIA. [BIRDS OF PARADISE.]

PAROTID GLAND (from παρά, 'near,' and οὖς, 'the ear') is the largest of the three principal glands by which the saliva is secreted and poured into the mouth. The parotid glands are situated, one on each side of the face, behind the ascending part of the lower jaw, and below and in front of the ear. The most anterior portion of each lies upon a part of the masseter muscle, immediately beneath the skin of the face, at the most backward part of the cheek; and hence the main duct passes forwards, penetrating obliquely through the fat of the cheek and through the buccinator muscle, to open into the cavity of the mouth nearly opposite to the second molar tooth of the upper jaw. The more posterior part of the gland is placed in an intricate manner among the tissues behind the jaw and beneath the outer part of the base of the skull, fitting into the irregularities that are left between them, and in some parts passing very deeply down beneath the skin.

The structure of the parotid, like that of all the glands secreting saliva, is lobular, being made up of a number of minute cells, the terminations of the branches of the main duct, upon whose walls a net-work of capillary bloodvessels is arranged, and which are collected together in uncertain numbers to form the several lobules of which the whole gland is made up. [DIGESTION; GLAND.]

PARRA. [RALLIDÆ.]

PARROT. [PSITTACIDÆ.]
PARROT-FISH. [LABRIDÆ.]
PARSLEY. [PETROSELINUM.]
PARSLEY, FOOL'S. [ÆTHUSA.]
PARSLEY PIERT, the common name for *Alchemilla arvensis*.
PARSNIP. [PASTINACA.]
PARTHENIUM. [PYRETHRUM.]
PARTHENOPE. [PARTHENOPIDÆ.]

PARTHENOPIDÆ, or *Parthenopians* of Milne-Edwards. This tribe, in the arrangement of M. Milne-Edwards, corresponds nearly to the genus *Parthenope* as established by Fabricius, but the species are separated by Milne-Edwards into the genera *Eumedonus*, *Eurynome*, *Lambrus*, *Parthenope*, and *Cryptopodia*, forming a natural group which, in the opinion of the last-named zoologist, establishes the passage between the Maians [MAIIDÆ] and the Cyclometopes.

The following are the characters of this tribe :—Carapace ordinarily triangular, and hardly longer than it is wide; its latero-posterior borders in general nearly transverse, and the latero-anterior borders following the same direction as the edges of the rostrum; but the lateral parts of the carapace are sometimes rounded, and its surface is nearly always bossy and tuberculous. Rostrum in general small and entire, or only notched at the end; the eyes are nearly always perfectly retractile; the basilary joint of the external antennæ sometimes presents the same disposition as in the Maians, but in the great majority of cases it is quite otherwise; it is short, and is not joined to the neighbouring parts of the shell; its external border does not concur to form the lower orbital wall, and its extremity does not reach to the front; the moveable stem of these antennæ is short, and takes its origin in a gap of the internal orbital angle. The epistome is much wider than it is long, and the form of the external jaw-feet is nearly the same as in the Maians. The anterior feet are very much developed, and widen so as nearly to make a right angle with the body: in the male they are always more than twice as long as the post-frontal portion of the carapace, and sometimes four times as long; the hand is nearly always triangular, and the claw suddenly curved downwards, so that its axis forms a very marked angle with that of the hand. The succeeding feet are, on the contrary, short; the second pair in general are less than once and a half of the length of the post-frontal portion of the carapace, and the others progressively diminish. The abdomen in the male presents considerable differences in the number of distinct joints, whilst in the female there are always seven.

The tribe is widely distributed, and species are found in the English Channel, the Mediterranean Sea, and the Indian Ocean.

Eumedonus (Edwards).—This genus, in the opinion of the last-named author, establishes in some sort the passage between the Stenorhynchs and the Acheans on one side, and *Eurynome*, *Lambrus*, and *Parthenope*, on the other.

The carapace is nearly pentagonal, as in *Parthenope*, but it scarcely ever goes beyond the level of the third pair of feet. Body depressed; rostrum very wide and very much advanced, and divided at its extremity only; eyes very short, their peduncle entirely filling the orbits, which are circular, a character which again approximates this genus to the Stenorhynchs; internal antennæ bent back very obliquely outwards; external antennæ but little developed; their first joint does not distinctly concur in the formation of the lower wall of the orbit; their moveable stem arises in the slit which the two internal angles of that cavity leave between them nearly as in the Parthenopes, and their terminal joint is very short.

E. niger is the only known species. It is remarkable for the great prolongation on each side of the carapace; these points are directed outwards, and their base occupies the whole of the hepatic region. It is a native of the coasts of China.

Eumedonus niger.

Eurynome (Leach).—This genus, in the opinion of M. Edwards, establishes the passage between the *Lambri* and the other Oxyrhyncha. The general form of the body and its aspect approximates these Crustaceans to *Parthenope*, whilst the disposition of their external antennæ is similar to what is seen in *Maia*. The carapace nearly triangular, with a rounded base, very much embossed and covered with asperities. Rostrum horizontal and divided into two triangular horns. Eyes small; orbits deep, their upper border very projecting, and separated from the external angle by a slit. The internal antennæ bent back longitudinally; the first joint of the external ones terminating at the internal angle of the orbit and supporting the succeeding joint at the upper edge of its extremity, so that the moveable stem of these antennæ, which is prolonged under the rostrum, appears to spring from the internal canthus of the eye.

E. aspera has the carapace with the regions very distinct, rugose, with a great triangular tooth at the external angle of the orbit, and three or four smaller ones along the lateral border on the branchial region; moveable stem of the external antennæ very short, and its two first joints very small.

It is a native of the coasts of Noirmoutier and of the British Channel, at rather considerable depths.

Eurynome aspera.

M. Milne-Edwards refers to the *E. scutata* of M. Risso, from the Mediterranean, as having much in common with the species above noticed; but the details are not, in his opinion, sufficient to enable us either to refer it with certainty to this genus or to distinguish it from *E. rugosa*.

Lambrus (Leach).—Carapace nearly as long as it is wide, rounded on the sides and narrowed forwards; branchial regions very much developed, tumid, and separated from the median portion of the carapace by a deep furrow; stomachal region, on the contrary, very narrow; upper surface of the edge of the shell always more or less tuberculous or spiny. Rostrum small, but rather advanced. Eyes perfectly retractile, and orbits nearly circular, the walls of these cavities presenting a fissure above and a wide and deep gap below the internal canthus of the eye. The internal antennæ bend back obliquely, and the fossets which lodge them are in general continuous with the orbits, for the space which separates the internal angle of the lower orbital border from the front is far from being filled by the peduncle of the external antennæ, whose first joint is extremely small and scarcely longer than it is wide; the second is more elongated, but never reaches to the front, and advances between the basilary joint of the internal antennæ and the internal border of the lower wall of the orbit; the third joint has its origin in the gap which occupies the internal angle of this cavity; and the fourth or terminal filament is very short.

The species are found in the Mediterranean Sea and Indian Ocean, where they live among the rocks at considerable depths.

§ *A*. Carapace nearly as long as it is wide.

a. Carapace rugose, covered above with spines or tubercles.

a.* Four first pair of feet having the third joint armed with spines.

Ex. *L. longimanus*. It is found at Pondicherry, Amboyna, &c.

Lambrus longimanus.

*a.*** Four last pair of feet without spines.

Ex. *L. angulifrons.* Inhabits the Gulf of Naples and coasts of Sicily.

aa. Carapace nearly quite smooth above.

Ex. *L. Messana.* It inhabits the volcanic rocks of the coasts of Sicily.

§ *B.* Carapace much wider than it is long.

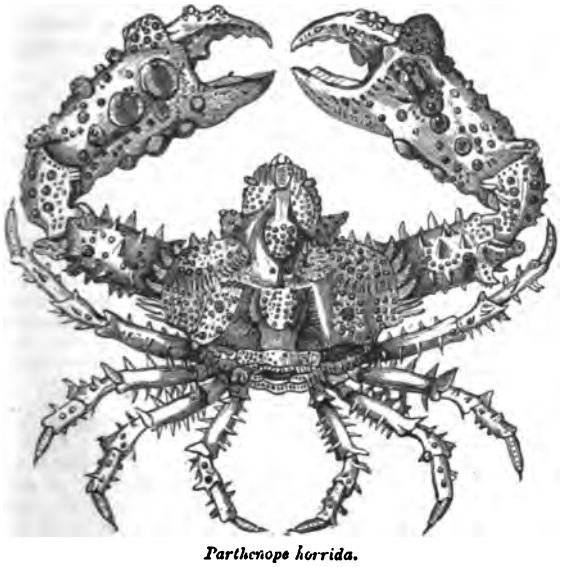
b. Upper surface of the hands rough with spines, which are more or less ramose, and having their upper and internal borders armed with spines like each other, and neither compressed nor united into a crest.

Ex. *L. echinatus.* It is found on the coasts of Pondicherry.

bb. Upper surface of the hands more or less smooth, and never with ramose spines; their upper and external borders armed with teeth, which are compressed, and so disposed as to form a crest.

Ex. *L. serratus.* It inhabits the Indian Ocean.

Parthenope.—This genus, as limited by modern authors, consists but of one species, distinguished principally by the disposition of the



Parthenope horrida.

external antennæ, whose basilary joint is not soldered to the neighbouring parts, but nearly reaches the front, and whose second joint, more than half as short as the first, is lodged in the gap of the lower orbital angle; the smallness of this gap, which makes the orbit communicate with the antennary fosset; the regularly triangular form of the carapace; and the existence of seven distinct joints in the abdomen of both sexes.

Cryptopodia fornicata.

P. horrida. Carapace pentagonal, wider than it is long, horizontal, strongly embossed, and tuberculous above; rostrum short, triangular, and armed below with a strong interantennary tooth; orbits circular, with a fissure on the upper border; latero-anterior borders of the carapace very oblique, and armed with spines; anterior feet very large, of unequal size, and covered with large spiniferous tubercles; claws less compressed and less inflected than in *Lambrus.* The four succeeding pair of feet armed to the origin of the tarsus with sharp and very large spines, forming one row above and two below.

It is a native of the Indian and Atlantic oceans.

Cryptopodia (Edwards).—M. Milne-Edwards is of opinion that this singular genus establishes in some respects the passage from *Lambrus* to *Œthra* [ŒTHRA]; and, in fact, he observes, the form of its feet is the same as in the first; while the carapace presents, as in the last, lateral expansions which extend above those organs and hide them. Fabricius therefore placed these Crustaceans among his Parthenopes, Lamarck among the *Œthræ*, and Bosc among the *Calappæ* and *Maiæ.*

Ex. *C. fornicata.* Inhabits the Indian Ocean.

PARTRIDGE. [PERDICIDÆ.]

PARTRIDGE-WOOD, a kind of Wood much esteemed for cabinet-work on account of its beautiful variegated and hatched appearance, is commonly said to be furnished by *Heisteria coccinea* of botanists, a small inelegant tree, about 20 feet high, found in Martinique by the side of torrents; but this appears to be a mistake which has arisen out of the name given to *Heisteria* in that colony. In the corrupt French of Martinique it is called Bois Perdrix, a name which, as Jacquin tells us, does not signify Partridge-Wood, but Partridge-Pea, bois being used for pois; and the name is given to the plant, not because of the variegated wood resembling a partridge's wing, but because the wild pigeons are fond of the berries. Partridge-Wood is said by Guibourt, who does not however give any authority for the statement, to be really a product of Cayenne, where it forms a tree 60 feet high, and is called Booo. Of this plant, called by Aublet *Bocoa provacensis,* an account will be found in that author's 'Plantes de la Guiane Française,' Supp., p. 38, t. 391; but it is now wholly unknown to botanists, its very name being omitted even in the most complete botanical systems. Aublet says it is found in the woods of Caux; and he supposes that its hard heart-wood would be a good material for the blocks or pulleys used in machinery; but he says nothing of its being exported to Europe.

PARTULA, a genus established by Férussac for a form of the family *Colimacea,* Lam. (*Auriculacea* of Férussac).

PARUS. [PARIDÆ.]

PASENG. [CAPREÆ.]

PASIPHÆA. [PALEMONIDÆ.]

PASITHEA (Lea), a genus of Pyramidal Shells allied to *Melania.*

PASPALUM (from one of the Greek names for Millet), a genus of Grasses, which, like some species of *Panicum,* forms one of the small grains cultivated in tropical countries as food for the poorer classes of the community. The genus is characterised in habit by having a continuous spiked rachis, on one side of which the spikelets are attached. The glume is 2-valved, 1-flowered, closely pressed to the two plane converse paleæ. Seed adhering to the paleæ.

P. scrobiculatum, the Koda of the natives of India, is cultivated over almost all parts of India. It delights in a light, dry, loose soil, but will grow in a very barren one. The seed is an article of diet with the Hindoos, particularly with those who inhabit the mountainous parts of the peninsula, as well as in the most northern parts of the country, or where the soil is barren and unsuited to the cultivation of those grains which are more beneficial. Dr. Roxburgh states that the boiled grain is as palatable as rice. He distinguishes from this another species, which Linnæus called *Paspalum Kora,* but it appears to be only a variety growing in moist situations. Both species are much relished by cattle either in a green or dry state.

PASQUE FLOWER. [ANEMONE.]

PASSALODON, a genus of Fossil Placoid Fishes.

PASSENGER PIGEON. [COLUMBIDÆ.]

PASSER, a genus of Birds belonging to the *Fringillidæ,* a family of Conirostral Insessores. It has the following characters:—Beak strong, conical, longer than deep; the upper mandible slightly curved; the lower mandible compressed, and smaller than the upper. Nostrils lateral, basal, rounded, partly concealed by the short feathers on the base of the mandible. Wings with the second quill-feather rather the longest. Legs with the tarsi nearly as long as the middle toe; claws sharp and curved, that of the hind toe rather larger than that of the middle toe. Tail nearly square.

P. domesticus (*Fringilla domestica,* Linn.; *Pyrgita domestica,* Cuv.). This well-known bird, the constant attendant on civilised man wherever it is found, is the Moineau and Passereau of the French, Passero of the Italians, Gorrion of the Spanish, Haus-Sperling of the Germans, Huis-Musch of the Netherlanders, Grasparf of the Swedes, Graaee-Spurre of the Danes, Huus-Kauld of the Norwegians, Common Sparrow and House-Sparrow of the English, and Aderyn and Golfan of the Welsh.

Belon makes it the Στρουθός of the Greeks and *Passer* of the Romans, but it is by no means clear that this was the species meant. The Cisalpine Sparrow (*Pyrgita Italica,* Vieill.; *Fringilla Cisalpina,* Temm.; Passero, Passera, Passero Commune, and Passero Tettajuolo

of the Italians) is much more abundant at the present day in Italy, where the Common Sparrow is comparatively scarce; and there are two other European species.

It is found in Denmark, Norway, and Sweden, in which last country it is more numerous if possible than with us, the whole of the British Islands, France, Spain, Portugal, Italy (rare), Liguria, and Dalmatia, in small numbers, and a stranger, as it were, in the midst of the numerous flocks of the Cisalpine Sparrow, according to Temminck; North Africa; the Levant, according to Mr. H. E. Strickland; Trebizond; the Nubian Mountains; the Deccan, according to Colonel Sykes, the Himalaya Mountains, and other parts of India.

The bird is everywhere before our eyes, even in our most populous cities, and cannot need description; but a London sparrow requires to be well cleaned before the true colours of his plumage appear. If one of these begrimed soot-collectors be placed near a bright trim sparrow from a barn-door, it is difficult to conclude that the rustic and the citizen are birds of the same feather.

There are many accidental varieties—pure white; yellowish-white, with the colours hardly indicated; rusty-yellow variegated with white; some part of the body white, ash-colour or black-brown more or less deep. The *Fringilla candida* of Sparrmann, *Passer flavus* of Brisson, and Black Sparrow of Latham, are founded on some of these variegated individuals.

The habits of the Common Sparrow, its amazing fecundity, its strong attachment to its young, the truculent battle-royal in which they will occasionally engage in troops, when excited upon some difference of opinion arising out of questions of love or nest-property, their familiarity, not to say impudence, and their voracity, are familiar to all; but few pause to inquire what service the sparrows do for the unlimited tolls they take. Mr. Knapp gives the following account of this bird :—

"The natural tendency that the sparrow has to increase will often enable one pair of birds to bring up fourteen or more young ones in the season. They build in places of perfect security from the plunder of larger birds and vermin. Their art and ingenuity in commonly attaching their nests beneath that of the rook, high in the elm, a bird whose habits are perfectly dissimilar, and with which they have no association whatever, making use of their structure only for a defence, to which no other bird resorts, manifest their anxiety and contrivance for the safety of their broods. With peculiar perseverance and boldness, they forage and provide for themselves and their offspring; will filch grain from the trough of the pig, or contend for its food with the gigantic turkey; and if scared away, their fears are those of a moment, as they quickly return to their plunder; and they roost protected from all injuries of weather. These circumstances tend greatly to increase the race, and in some seasons their numbers in our corn-fields towards autumn are prodigious; and did not events counteract the increase of this army of plunderers, the larger portion of our bread-corn would be consumed by them; but their reduction is as rapidly accomplished as their increase, their love of association bringing upon them a destruction which a contrary habit would not tempt. They roost in troops in our ricks, in the ivy on the wall, &c., and are captured by the net: they cluster on the bush, or crowd on the chaff by the barn-door, and are shot by dozens at a time, or will rush in numbers, one following another, into the trap. These and various other engines of destruction so reduce them in the winter season, that the swarms of autumn gradually diminish, till their numbers in spring are in no way remarkable. I have called them plunderers, and they are so; they are benefactors likewise, seeming to be appointed by nature as one of the agents for keeping from undue increase another race of creatures, and by their prolificacy they accomplish it. In spring and the early part of the summer, before the corn becomes ripe, they are insectivorous, and their constantly increasing families require an increasing supply of food. We see them every minute of the day in continual progress, flying from the nest for a supply, and returning, on rapid wing, with a grub, a caterpillar, or some reptile; and the numbers captured by them in the course of these travels are incredibly numerous, keeping under the increase of these races, and making ample restitution for their plunderings and thefts. When the insect race becomes scarce, the corn and seeds of various kinds are ready; their appetite changes, and they feed on these with undiminished enjoyment."

P. montanus (*Fringilla montana; Pyrgita montana*), the Tree-Sparrow, or the Mountain-Sparrow; the Bec-Fin Friquet of the French. This bird is very like the last, but not so numerous. It is smaller than the Common Sparrow, and is found frequenting trees remote from houses, and building in the holes of decayed pollards. It is much more local in England than the last, and is found mostly in Surrey, Suffolk, Norfolk, Cambridgeshire, Rutland, Lincolnshire, Yorkshire, Durham, and Northumberland.

(Yarrell, *British Birds.*)

PASSERELLA (Swainson), a sub-genus of *Fringilla*. Ex. *P. Iliaca.* (Wills., iii. 22, f. 4.)

PASSERI'TA (Gray), a genus of Serpents.

PASSIFLORA, a genus of Twining Plants, the species of which are called Passion Flowers. This name is derived from a fancied resemblance between the parts of their flower and the emblems of Our Saviour's crucifixion. In the five anthers the Spanish monks saw his wounds, in the triple style the three nails by which he was fixed to the cross, and in the column on which the ovary is elevated the pillar to which he was bound; a number of fleshy threads which spread from a cup within the flower were finally likened to the crown of thorns. "There are cuts," says Sir James Smith, "to be found in some old books, apparently drawn from description, like the hog in armour upon our signs to represent the rhinoceros, in which the flower is made up of the very things themselves." In reality the flower of *Passiflora* consists of a calyx and corolla, each of five divisions, consolidated into a cup, from within the rim of which spread several rows of filamentous processes, by some regarded as barren stamens; within these, from the sides of the cup, there proceed one or more elevated rings, notched or undivided, and in various degrees of development in different species, and evidently of the same nature as the filamentous processes themselves. In the centre of the flower stands a column, or gynophore, with the sides of which five stamens are united, but spread freely from it beyond its apex, and bear five oblong horizontal anthers. At the apex of the column is the ovary, a 1-celled case, with three parietal polyspermous placentæ, and bearing three club-shaped styles at its vertex. Eventually a gourd-like fruit is produced containing many seeds, each having its own fleshy aril, and usually enveloped in a subacid mucilage.

Passion Flower (*Passiflora Horsfieldii*).

1, a flower cut open vertically, so as to show the calyx, corolla, filamentous crown, interior rings, central gynophore, stamens, and ovary.

The genus comprehends a large number of species, chiefly found in a wild state in America, and within or near the tropical parts of that continent. They are all twining plants, often scrambling over trees to a considerable length, and in many cases are most beautiful objects on account of their large gaily- or richly-coloured flowers. This makes them favourites in gardens, where many are cultivated, particularly the *P. alata, P. quadrangularis, P. edulis, P. cærulea, P. racemosa, P. Loudoni, P. onychina, P. palmata,* and *P. filamentosa,* all of which are strikingly handsome. It is however chiefly for their fruit that they are valued in the countries where they grow wild, in consequence of the pulp which envelopes the seeds being cool and refreshing, with something of a fragrant bouquet. Under the name of Granadilla the *P. quadrangularis* is well known in Brazil, where its fruit is as large as a child's head; the Water-Lemon of the West Indies is the produce of *P. laurifolia; P. maliformis* bears what is called the Sweet Calabash; and the pleasant pulp of *P. edulis* furnishes the confectioner with the most delicate material for the flavouring of ices. Many however are of no value for their fruit, and some are actually fœtid.

PASSIFLORACEÆ, *Passion-Worts*, a natural order of Hypogynous Exogenous Plants. This order is included by Lindley in his alliance *Violales*. It is characterised by possessing polypetalous or apetalous coronetted flowers; perigynous imbricated petals; stamens on the stalk of the ovary; simple terminal styles; arillated seeds; and stipulate leaves. The species are herbaceous plants or shrubs, usually climbing, very seldom erect.

Considerable difference of opinion exists among botanists as to the real nature of the floral envelopes of this remarkable order. Jussieu and De Candolle, regarding the parts called petals as a second row of sepals, have made the order apetalous; whilst Lindley and others have regarded the second row of floral envelopes as petals, and made it polypetalous. Lindley makes the affinities of this order with *Samydaceæ*, *Capparidaceæ*, *Malesherbiaceæ*, and *Papayaceæ*.

Most of the useful properties of this order are included in the genus *Passiflora*. [PASSIFLORA.] *Murucuja ocellata*, a West Indian Climber, is said to be anthelmintic and diaphoretic. Besides the fruit of several species of *Passiflora*, the fruit of *Tacsonia mollissima*, *T. tripartita*, *T. speciosa*, and *Paropsia edulis* are all of them edible. The species are principally found in South America. There are 10 genera and about 216 species.

(Lindley, *Vegetable Kingdom.*)

PASSION FLOWER. [PASSIFLORA.]

PASTINA'CA (from *Pastinum*, the Latin name for a two-pronged fork), a genus of Plants belonging to the natural order *Umbelliferæ* and the tribe *Peucedaneæ*. It has a calyx with 5 very small or nearly obsolete teeth; round entire petals, involute, with an acute point. The fruit has a dilated flat margin; the carpels with slender ridges, 3 dorsal equidistant, 2 lateral distant, near the outer edge of the dilated margin; the interstices with single linear vittæ.

P. sativa, the Parsnip, has an angular furrowed stem; pinnate leaves, downy beneath: ovate-oblong leaflets, crenate, serrate, often with a lateral lobe at the base. The stem from two to three feet high. The flowers are yellow. The leaves generally shining above, sometimes downy beneath. It is a native of Great Britain and of Europe, even to the Caucasus, on hillocks and dry banks, in a chalky soil. The root is spindle-shaped, white, aromatic, mucilaginous, and has a sweet taste. A variety of this species, *P. edulis*, is the Common Edible Parsnip, and is much cultivated in our gardens. [PARSNIP, in ARTS AND SC. DIV.] Another variety, called *P. Coquaine*, has roots from 3 to 4 feet long and upwards of 6 inches in circumference. It is extensively cultivated in Guernsey and Jersey as fodder for cattle. In the north of Ireland parsnips are used in the composition of a kind of beer brewed with hops. Wine and ardent spirits are likewise made from the roots.

P. Sekakul is another edible species of this genus, and is a native of Syria and Egypt. It has a gray root; a terete downy branched stem; pinnate downy leaves; pinnatifid cut leaflets, blunt and unequally toothed. It is cultivated in the Levant, under the name of Sekakul.

(Babington, *Manual of British Botany;* Burnett, *Outlines of Botany.*)

PASTOR. [STURNIDÆ.]

PASY'THEA (Lamouroux), a group of *Sertularidæ*.

PATELLIDÆ, a family of Prosobranchiate Gasteropodous *Mollusca*. The shell is conical with the apex turned forwards; the muscular impression horse-shoe-shaped, open in front. The genera belonging to this family are *Patella*, *Acmæa*, *Gadinia*, and *Siphonaria*. M. De Blainville referred these Molluscs to his order *Cervicobranchiata*, and Cuvier to his order *Cyclobranchiata*.

Patella, Limpet, has the body more or less circular, conical above, flat below, and furnished with a large oval or round foot, which is thick and overpassed on the whole of its circumference by the edges of the mantle, which are more or less fringed. There is a complete series of vertical membranous plaits in the line of junction of the mantle with the foot.

Shell oval or circular, with an upright summit, or more or less curved forwards. The cavity simple, and more or less deep: the border entire and horizontal. Muscular impression narrow, in the form of a horse-shoe, opening forwards.

Animal of *Patella*.

Cuvier thus describes the genus:—"The *Patellæ* have the body entirely covered by a shell made of one entire piece, shaped like a widened cone (on cône évasé). Under the edges of the mantle is a border (cordon) of small branchial leaflets (feuillets). The vent and the outlet of the generative organs are a little to the right above the head, which is furnished with a large and short proboscis, and two pointed tentacula, carrying the eyes at their external bases. The mouth is fleshy, and contains a spiny tongue, which goes backwards, and is folded back deeply in the interior of the body. The stomach is membranous, and the intestine is long, delicate, and very much folded. The heart is forwards, above the neck, a little to the right."

G. B. Sowerby ('Genera of Recent and Fossil Shells') says, "there is no canal for the passage of water to the branchiæ, as there is in *Emarginula* and *Siphonaria*, for in this genus the branchiæ are external, surrounding the animal."

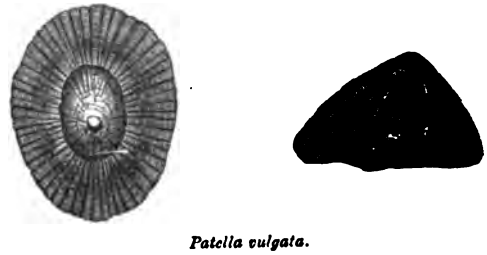
Rang follows Cuvier, and his description of the animal differs but little from that given above. The thorny tongue he terms not inaptly "un long ruban lingual épineux." He thus defines the genus:—"Animal furnished with tentacula and eyes at their external bases; branchiæ formed by a cordon of leaflets; shell univalve." He afterwards gives a more detailed description of the shell, and makes the following observation:—"M. De Blainville believes that he has perceived the branchiæ of the *Patellæ* in a vascular network attached to the roof of a branchial cavity. Not having been able to distinguish this network, we think with Cuvier that the organ of respiration shows itself in these animals in the circle of leaflets which surrounds the body between the foot and the mantle, as in the Phyllidians.

"There is a curious genus named *Patelloida* by Messrs. Quoy and Gaimard. In these molluscs the shell is absolutely like that of the *Patellæ*, and the animal has not only a cervical sac, but moreover a pectinated branchia on the right and anterior side of the body; and, what is remarkable, it is deprived of those vascular leaflets disposed around the foot in the *Patellæ*. The abolition of these leaflets, as soon as a true pectinated branchia is developed, while the cervical sac undergoes no alteration, and remains the same in both genera, affords, by a rational induction, the strongest presumption for believing that the leaflets of the *Patellæ* are in fact respiratory organs. These two methods of induction of which we have spoken would of themselves be sufficient to combat victoriously the opinion of M. De Blainville; but there is a third method still more preferable—that which anatomical investigation furnishes. When by a minute dissection we have traced in the *Patella* the principal branches of the vessels, we find constantly, in the thickness of the muscles of the lateral parts of the foot, two large vessels which reach along the whole circumference, and furnish a strong branch to each membranous leaflet. This disposition is like that which is seen in the Chitons. The vessels which in the *Patellæ* are given off to the cervical sac are very small, and not to be compared with the development of those of the *Helices*, the *Limaces*, or even of the *Terebratulæ* and *Orbiculæ*, whose respiratory organ, though framed for breathing water only, is formed of a vascular network on a flattened membrane. In the *Patellæ* the cervical vessels are not more developed than in the other molluscs, which, possessing a pectinated branchia, have also a cervical sac. It seems to us that we may conclude from the preceding observations that, in the *Patellæ*, the cervical sac is not branchial; and that the branchiæ consist of the floating lamellæ between the borders of the foot and of the mantle. By a natural consequence then it becomes necessary to reject the opinion of M. De Blainville, and to place the *Patellæ* near the Chitons, forming a small family for each of these genera."

We have only to add that recent observations leave no doubt, if any could have existed after the luminous remarks of Deshayes, that Cuvier and his followers were right, and that M. De Blainville is wrong. The series of simple laminæ attached within the circular border of the mantle fulfil the office of branchiæ, and to that end are endowed with cilia, which keep up a perpetual current of sea-water over them. This current flows from the outer to the inner edge over the surface of each branchial lamina.

The following is De Blainville's arrangement of the species:—

α. Species whose summit is obtuse, vertical, very nearly mesial, and which are conical. Ex. *P. vulgata*. It inhabits the coasts of European seas, and is common in the Channel. Its varieties are almost endless.



Patella vulgata.

β. Species a little less conical, and whose summit is placed a little anterior to the position of the last, with a slight inclination forwards. Ex. *P. deaurata*. It is found in the Straits of Magelhaens, Falkland Isles, &c.

γ. Species which are oval, elongated, and compressed at the sides. Ex. *P. compressa*. It inhabits the Indian Seas. Lam.

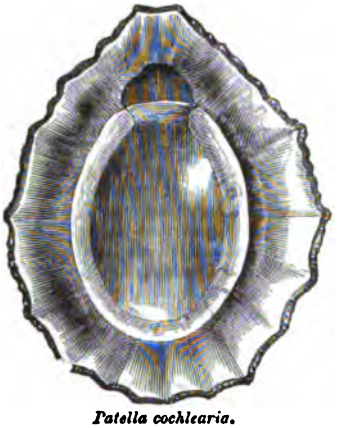
δ. Species whose summit is sub-anterior and very little developed, and which are entirely flat or depressed. Ex. *P. scutellaria*.

Patella deaurata.

Patella compressa.

Patella scutellaria.

c. Depressed species, whose summit is scarcely indicated, and which are much narrower before than they are behind. Ex. *P. cochlearia* (Cochlear); *Helcion*, De Montfort.



Patella cochlearia.

ç Oval species, with a well marked summit, evidently inclined forward and sub-marginal; border a little convex in the middle. Ex. *P. pectinata.* A native of the Mediterranean Sea.

Patella pectinata.

ɯ. Species which are oval, delicate, nacreous, and with a festooned border; the summit still more marginal and distinct. Ex. *P. cymbularia.*

Patella cymbularia.

The other British species are *P. athletica* and *P. pellucida.*

The *Patellæ* are very widely spread, and few seas are without them. None however appear to have been observed in the Arctic Seas, either by Captain Parry (1819) or Captain Ross. The larger species are found principally in warm climates.

This genus is one of those which has the power of absorbing the shells of other molluscs or rocks, and thus forming cavities or depressions on them. "The *Patella cochlea*," says Dr. Gray ('Phil. Trans,' 1833), "is often found at the Cape of Good Hope, where it lives almost exclusively, attached to a large species of the same genus, on the surface of which it forms a flat disc, exactly the size of its mouth. To form these flat discs (of which they are so generally two, one on each side of the apex of the larger *Patella*, as almost to form a character of the species), and to assist in the increase of its size, the animal appears also to absorb the coralline or other similar substances with which the larger shells are abundantly covered. The common *Patella* of our own coast, when long adherent to another shell of its own species, to chalk, or to old red-sandstone or limestone, also forms for itself a deep cavity of the same form as its shell, and evidently produced by the dissolution of the surface to which it is affixed." These observations will strike every one who may take an interest in such subjects, and has opportunities of examination.

Patella has been found principally on rocky coasts, stones, and shells, at a depth ranging from the surface to thirty fathoms. Their food is *Fuci* and other sea-weeds, in the separation and comminution of which their rasp-like tongues are probably highly active.

Siphonaria and *Patelloida* differ strongly in their organisation from *Patella*, for instead of having a circle of branchial laminæ like that genus, they have a single pectinated branchia on the right side. To these Dr. Gray adds the genus *Lottia* (*Acmæa*, Eschscholtz), which, as he observes, "must be extremely perplexing to those systematists who attend only to the form of the shell without paying any regard to its animal inhabitant. The shells of *Patella* and *Lottia* do not in the least differ in external form, and yet their animals belong to very different orders, the one having the branchiæ placed round the foot, as in the Chitons, and the other having them placed on the side of the neck, like the *Fissurellæ*, from which indeed it chiefly differs in having only one branchia." This description, by the way, accords with the genus *Patelloida* of Quoy and Gaimard. [PATELLOIDEA.]

The genus *Scutella*, brought home by Mr. Cuming from the Pacific Ocean, and described by Mr. Broderip in the 'Proceedings of the Zoological Society for 1834,' part 2, should here be mentioned. There is no doubt that the animal is marine; but unfortunately none of the soft parts were found, though the shells were in very fine condition; and, as we have seen, it is difficult in their absence to fix the precise place of the shell. It has the following generic characters:—Shell ancyliform, shining within. Apex posterior, central, involute. Muscular impressions two, oblong-ovate, lateral. Aperture large, ovate.

Gadinia (Gray) has the shell conical, muscular impression horse-shoe-shaped, the right side shortest, terminating at the siphonal groove. There are eight living species and one fossil.

Fossil Patellæ.—Deshayes, in his Tables, gives 104 living species and 10 fossil (tertiary); one fossil species, *P. equalis*, now living in the European ocean, in the English Crag (Pliocene Period of Lyell), two at Dax, and one at Valognes. Sowerby says that the fossil species are not numerous, and that they occur in the great Oolite, in the Lias, and perhaps in the Oxford Clay and Chalk Marl of the secondary series; in the Calcaire Grossier, and probably in the London Clay of the tertiary series; and also in the Crag of the diluvian formation. De la Bèche gives the following as being found among the organic remains in blue marls of the south of France:—*Patella vulgata* (?), Lam., *P. Bonardii*, Payrandeau (analogous to the existing species), also in the Calcaire Moellon; *P. umbella*, Lam. (also an analogue), and also in the Calcaire Moellon; *P. glabra*, Deshayes, Paris. Among the organic remains of the cretaceous group he enumerates *P. ovalis*, Nils., from Balsberg, Scania; an undetermined species from the Lower Greensand of Sussex, Mantell, and another from the Lower Greensand of Wilts, Lonsdale. In the oolitic group he places *P. latissima*, Sow., Oxford Clay, Yorkshire, and middle and south of England; *P. rugosa*, Sow., Forest Marble, middle and south of England and Normandy; *P. lævis*, Sow., Lias, middle and south of England; *P. lata*, Sow., Stonesfield Slate; *P. ancyloides*, Sow., Great Oolite, Ancliff, Wilts; *P. nana*, Sow., same locality; *P. discoïdes*, Schlot, Lias, Gundershofen; and *P. papyracea*, Goldf., Lias, Banz. The grauwacke group, according to the same author, affords *P. Neptuni*, Goldf., Eifel, Olpe; *P. primigena*, Goldf., Pfaffrath; *P.* (?) *conica*, Wahl., Kinnekulle, Westrogothia; *P.* (?) *pennicostis*, Wahl., Ulanda, Westrogothia; *P.* (?) *concentrica*, Wahl., Mosseberg, &c., Westrogothia; and an undetermined species, Keswick, and near Kirby Lonsdale, Phil. Woodward states the number of fossil species of *Patellidæ* to be above 100.

PATELLOI'DEA, a genus of *Mollusca* proposed by Messrs. Quoy and Gaimard for certain *Gasteropoda*, which have shells exactly resembling those of limpets, but whose animals are cervicobranchiate. It is synonymous with the genus *Lottia* of Dr. J. E. Gray. The *Patella testudinalis* of Otho Fabricius, a shell not uncommon on the northern coasts of Britain, is the type. Numerous species are known, inhabiting all latitudes and living in various depths of water. Their shells are

gaily coloured, often tessellated, and rayed with purple, orange, or pink. The animals are usually of a uniform tint of white, orange, or pale red.

PATRI'NIA, a genus of Plants to which the Spikenard of the East was referred, but which has been formed into a new genus, *Nardostachys*. [NARDOSTACHYS.]

PAU'SSIDÆ, a family of Coleopterous Insects, the precise affinities of which have not yet been satisfactorily determined. By Latreille the *Paussi* are placed between the *Scolytidæ* and the *Bostrichidæ;* but Mr. Westwood (who has devoted much attention to this group of beetles, and has published a monograph on them in the sixteenth volume of the 'Linnean Transactions') is of opinion that the *Paussidæ* possess affinities with the *Trogositarii*, and are still more nearly allied to the *Cucujidæ*.

These insects are usually of small size, the largest known species being less than half an inch in length; and their colouring generally consists of various shades of brown, and they are not unfrequently adorned with black markings. The form of the body is generally short, rather broad, and somewhat depressed; the head, in most of the species, is free (that is, not hidden by the thorax), and joined to the thorax by a kind of neck; the thorax is narrower than the elytra, and is almost always divided transversely near the middle by an indentation, in which case the fore part is usually broader than the hinder, produced at the sides so as to form projecting angles; the elytra are rather soft, and in most of the species are of subquadrate form, truncated at the apex, and leaving exposed the terminal segment of the abdomen; the outer posterior angle of the elytra is generally furnished with a small tubercle. The legs are in most species broad and compressed, and of moderate length; the tarsi are five-jointed in some, and apparently in others there are but four. The antennæ are remarkable for their large size and curious forms; in most of the species they consist of a large inflated club, about equal in size to the head and thorax taken together, and varying in form according to the species: the most common form of this knob is that of an oval more or less elongated, and with an angular projection on the outer side at the base; this club is joined by a smaller joint to the head.

Between twenty and thirty species of this family are known, a great portion of which are figured and described by Mr. Westwood in the monograph before alluded to, and in a supplement to this monograph published in the second volume of the 'Transactions of the Entomological Society,' to which works the reader is referred for a more detailed account of these very curious insects. Of their habits little is known; they are confined to the Old World, and almost entirely to the tropical portions. They are said to be nocturnal, and are supposed to live in wood or under the bark of trees: most of the specimens in cabinets have been found in newly-built houses. One species is said, when touched, to make discharges of some volatile fluid, in the same manner as the species of *Brachinus*.

The family *Paussidæ* contains the six following genera—*Paussus*, *Hylotorus*, *Platyrhopalus*, *Cerapterus*, *Pentaplatarthrus*, and *Trochoideus*. In the first three of these genera the antennæ are two-jointed, and the abdomen is of a quadrate form.

The genus *Paussus* is distinguished by the absence of ocelli on the head, and by the ultimate joint of the labial palpi being elongated.

In *Hylotorus* the head is furnished with two ocelli, and this genus moreover differs from *Paussus* in having the head immersed in the thorax; the great club of the antenna is thickest at the base, and somewhat curved and pointed at the opposite extremity.

Platyrhopalus has all the essential characters of *Paussus*, but differs in having the joints of the labial palpi equal.

In the genus *Cerapterus* the antennæ are large, broad, and compressed, and appear to be composed of ten joints, most of which are very distinct; the terminal joint is the largest; the preceding joints (if we except the basal one) are transverse and all of equal width.

In *Pentaplatarthrus* the antennæ gradually increase in size from the base to the apex, and are composed of six joints. The basal joint is longer than broad; the second is transverse; the three following joints are nearly equal in width and length, and the terminal joint is almost spherical.

The genus *Trochoideus* differs from all the preceding genera in having an ovate form of body; the thorax is rather narrower than the elytra; its sides are rounded, the broadest part in front, and there is apparently no transverse indentation. The head is large and rounded, and deeply inserted in the thorax. The antennæ are composed of two small basal joints, which are longer than broad, and terminate in a large oval club. The legs are more slender than in other species of this family, and the tarsi are represented as having only four joints.

PAUXI. [CRACIDÆ.]

PA'VIA is a small division of the natural order *Æsculaceæ*, differing from *Æsculus* itself in little except its converging petals and spineless fruit. It consists of small trees or bushes with yellow or red flowers, inhabiting North America, where they are called Buck's-Eye Chestnuts. They are often cultivated in shrubberies under the name of the Yellow or Scarlet Horse-Chestnut. Two species, *P. Indica* and *P. Punduana*, have also been found in the colder parts of India, but they have not yet been introduced into our gardens. With us the American species are usually short-lived and of no value for their timber; the former circumstance is probably owing to their being grafted upon the Common Horse-Chestnut, a stock that does not suit them. They should always, if possible, be raised from seeds, which are annually imported from the United States.

PAVO. [PAVONIDÆ.]

PAVONIA. [MADREPHYLLIEA.]

PAVONIA (in honour of Don Joseph Pavon, M.D., of Madrid, a traveller in Peru, and one of the authors of 'Flora Peruviana'), a genus of Plants belonging to the natural order *Malvaceæ*. It has a 5-cleft persistent calyx, surrounded by an involucel from 5- to 15-leaved. The ovarium has 5, and rarely 4, 1-ovuled cells. It has 10 stigmas, 5 carpels, capsular, 2-valved, and 1-seeded.

P. diuretica has cordate acuminate serrated leaves, velvety on both sides, and full of pellucid dots. The flowers are axillary, solitary, and sulphur-coloured. It is a native of Brazil, in the province of Minas Geraes. A decoction of this plant is used in Brazil as a diuretic. This is the only species of *Pavonia* used in medicine; many others are however worth cultivation for the beauty of their blossoms.

(Lindley, *Flora Medica.*)

PAVO'NIDÆ, a family of Rasorial Birds, to which the Peacock belongs.

The genus *Pavo* of Linnæus stands next to *Didus* [DODO] in the 'Systema Naturæ,' and is immediately succeeded by *Meleagris*, which is followed by *Crax*, *Phasianus*, *Numida*, and *Tetrao*.

Cuvier makes his Paons consist of the true Peacocks (*Pavo*, Linn.) and *Lophophorus*. This group is followed by the Dindons (*Meleagris*, Linn.); the Peintades (*Numida*, Linn.); and the Faisans (*Phasianus*, Linn., including the Cocks and Hens—*Gallus*, Briss.; the true Pheasants (*Phasianus Colchicus*, &c., including *Argus*, Temm.); the Crested Pheasants (Houppifères, Temm., *Phasianus ignitus*, &c.); the Tragopans (*Tragopan Satyrus*, &c.); and *Cryptonyx*. The *Tetraonidæ* immediately follow.

Mr. Swainson makes the *Pavonidæ*, the first family of the order *Rasores*, according to his arrangement, consist of the genus *Pavo*, with the sub-genera *Argus*, *Polyplectron*, and *Meleagris;* the genus *Phasianus*, with the sub-genera *Phasianus*, *Nycthemerus*, and *Ceriornis* (*Tragopan*); the genus *Gallus;* the genus *Lophophorus;* and the genus *Numida*.

In this work, *Phasianus*, with its sub-genera, *Tragopan*, *Gallus*, and *Euplocamus*, are treated of under the title PHASIANIDÆ.

Pavo (Linn.) has the following generic characters:—Bill convex, rather stout, curved towards the end, smooth at the base; cheeks partially naked; nostrils basal and open; head plumed and surmounted with an aigrette-like crest; sixth quill longest; tail-feathers 18; tail-coverts very long, large, and extensible in the male.

Two species only of this magnificent genus are recorded, *P. cristatus* and *P. Japonensis*.

P. cristatus, the Common Peacock. This is the *Taών* and *Taós* of the Greeks; *Pavus* and *Pavo* of the Romans; Pavon and Pavone of the Italians; Pavon of the Spanish; Paon of the French; and Pfau of the Germans. The head is surmounted by an aigrette of 24 upright feathers. In the male the tail-coverts consist of feathers with loose barbs and of unequal size, the upper one shortest, each terminated by numerous eyes or circlets of a metallic iridescent brilliancy: these the bird has the power of erecting into a circle or wheel, which presents, when the sun shines on it, an object of dazzling splendour which sets all description at defiance. The female has the aigrette, but has not the splendid ornament with which the male is gifted: her colours generally are sombre.

People usually talk of the peacock spreading its tail, but the rich display is composed principally of the tail-coverts. White soon saw the distinction. "Having to make a visit to my neighbour's peacocks, I could not," says he, "help observing that the trains of those magnificent birds appear by no means to be their tails, those long feathers growing not from the uropygium, but all up their backs. A range of short brown stiff feathers, about six inches long, fixed in the uropygium, is the real tail, and serves as the fulcrum to prop the train, which is long and top-heavy when set an end. When the train is up, nothing appears of the bird before but its head and neck; but this would not be the case were those long feathers fixed only in the rump, as may be seen by the turkey-cock when in a strutting attitude. By a strong muscular vibration these birds can make the shafts of their long feathers clatter like the swords of a sword-dancer; they then trample very quick with their feet, and run backwards towards the females."

This species is spread over the north of India and the islands of Malaisia in its natural state. It is the Mohr of the Mahrattas, according to Colonel Skyes, who describes the wild bird as abundant in the dense woods of the Ghauts; it is readily domesticated, and many Hindoo temples in the Dukhun (Deccan) have, he tells us, considerable flocks of them. On a comparison with the bird as domesticated in Europe, the latter, both male and female, was found by the Colonel to be identical with the wild bird of India.

Colonel Williamson, in his account of peacock-shooting, states that he had seen about the passes in the Jungletery district surprising quantities of wild pea-fowls. Whole woods were covered with their beautiful plumage, to which the rising sun imparted additional brilliancy. Small patches of plain among the long grass, most of them cultivated, and with mustard, then in bloom, which induced the birds to feed, increased the beauty of the scene. "I speak within bounds,

continues Colonel Williamson, "when I assert that there could not be less than twelve or fifteen hundred pea-fowls, of various sizes, within sight of the spot where I stood for near an hour."

Buffon and others say that the bird was introduced into Greece, whence it has been spread throughout Europe, in the time of Alexander the Great. Others again, with greater show of reason, assert that it was brought to Greece before the time of Pericles. Certain it is that the peacock is mentioned in two plays of Aristophanes, the 'Acharnians' and the 'Birds,' the first of which was represented in the third year of the 88th Olympiad, and the last in the second year of the 91st Olympiad. Now Alexander was not born till the second year of the 98th Olympiad. Athenæus quotes from other old poets—Eupolis, for instance; nor does Aristotle speak of the bird in any other terms than those which would indicate that it had become very well known when he wrote: "Some are jealous and vain like the peacock," says Aristotle, when speaking of the qualities exhibited by certain animals. ('Hist. Anim.,' i, l.)

Although not often eaten in this country, the peacock when young is said to be juicy and sapid. In ancient times no great feast was complete, even in this country, without this bird, which was presented by the sewer well cooked, but in all its gorgeous plumage; and the adventurous knight made his solemn vow before the peacock and the ladies.

P. Japonensis, Aldrov. (*P. Javanicus*, Horsfield). Mr. Bennett, who had an opportunity of examining two living birds in the garden of the Zoological Society of London, in addition to stuffed specimens, gives the following accurate description of this species. Prevailing tints blue and green, varying in intensity and mutually changing into each other according as the light falls more or less directly upon them. In size and proportions the two species are nearly similar, but the crest of *P. Javanicus* is twice as long as that of *P. cristatus*, and the feathers of which it is composed are regularly barbed from the base upwards in the adult bird, and of equal breadth throughout. Head and crest interchangeably blue and green. A naked space on the cheeks, including the eyes and ears, is coloured of a light yellow behind, and bluish-green towards its fore part. The feathers of the neck and breast, which are broad, short, rounded, and imbricated like the scales of a fish, are at their base of the same brilliant hue as the head, and have a broad, lighter, somewhat metallic margin; those of the back have still more of the metallic lustre. The wing-coverts are of the general hue, with a deeper tinge of blue; the primary quill-feathers are light chestnut. The tail-feathers and their coverts (train) are of a splendid metallic brown, changing into green; their barbs are extremely long, loose, silky, and somewhat decomposed; and the latter are almost all terminated by ocellated spots similar to those which mark the tail (train) of the common species, and of nearly the same size. As in it, they are of beautiful deep purple in the centre, which is about the size of a shilling; this is surrounded by a band of green, becoming narrow behind, but widening in front and filling up a kind of notch that occurs in the blue; then comes a broad brownish band; and, lastly, a narrow black ring, edged with chestnut, all beautifully metallic, or rather representing the hues of various precious stones when viewed in certain lights. Bill of a grayish horn-colour, rather longer and more slender than in the common species; iris deep hazel. Legs strong, naked, reticulated, dusky black; spurs large, and of the same hue. ('Gardens and Menagerie of the Zoological Society.')

The bird above described is the *Pavo muticus* of Linnæus, who, as the name implies, described it as being devoid of spurs, relying probably on Aldrovandus, whom he quotes, and who figures it without spurs, describing it under the name of *Pavo Japonensis*. It is the Japan Peacock of Latham, the *Pavo spiciferus* of Vieillot, the *Pavo Aldrovandi* of Wilson, and *Pavo Javanicus* of Dr. Horsfield, who saw it in Java. Of these names, that of Aldrovandus has the priority; then comes that of Linnæus, which may mislead; then that of Horsfield; then that of Vieillot. We do not see anything objectionable in the name given by Aldrovandus, and therefore we have retained it.

Meleagris (Linn.).—The Meleagris of the ancients was not a turkey, but a guinea-fowl (*Numida*). Linnæus however having given this as the generic name for the Turkeys, which were not known to the ancients, ornithologists have continued it. Nor is this now of much consequence, certainly not of sufficient importance to change the name; for notwithstanding the confusion and doubt thrown over the subject by the learned discussions of the earlier modern ornithologists, it is generally known and satisfactorily proved that the Turkeys were only known to Europeans after the discovery of America, from which one species has been spread in a domesticated state over the greatest part of the civilised globe. It has the following generic characters:—The bill rather short, strong, curved, convex, vaulted, its base furnished with a naked skin; a fleshy caruncle surmounting the bill of an erectile nature and conical form. Head and neck surrounded with a wrinkled mammillated skin, hanging loose like a dewlap as far as the upper part of the breast. Hind toe touching the ground.

Two species are known: one, *M. Gallopavo*, the original stock from which the domesticated turkey is derived; the other, *M. ocellata*, a much more beautifully plumaged bird, did not exhibit in the only known specimen any trace of the tuft of hair on the breast. That character therefore is omitted above; but it is not certain that the last-mentioned species is entirely without this tuft, for the plumage of the specimen was damaged.

M. Gallopavo. This is the *M. occidentalis* of Bartram; *M. fera* of Vieillot; Gallo d'India, Gallinaccio (male), Gallina d'India (female), of the Italians; Coq d'Inde and Dindon, Dinde (female), of the French; Indianische Hahn of the Germans; Wild Turkey and Domestic Turkey of the British and Anglo-Americans. In its wild state it has the following characters:—

Male.—Head small in proportion to the body, covered with a naked bluish skin, continued over the upper half of the neck and uneven with warty elevations, changeable red on the upper portion and whitish below, interspersed with a few scattered black hairs. The flaccid and membranous naked skin, also changeable on the lower part of the neck, extends downwards into large wattles. A wrinkled conical fleshy protuberance, capable of elongation and with a pencil of hairs at the tip, takes its rise from the base of the bill, where the latter joins the front. When this excrescence is elongated under excitement, it covers the bill and depends several inches below it. A tuft of long rigid black hair springs from the lower part of the neck at its junction with the breast, shooting out from among the plumage to the length of 9 inches. The base of the feathers of the body, which are long and truncated, consists of a light fuliginous down; this part of the feather is succeeded by a dusky portion, which is again followed by a broad shining metallic band, varying from copper-colour or bronze to violet or purple, according to the play of the light, and the tip is a broad velvety band; but this last is absent in the feathers of the neck and breast. The general plumage presents a glancing metallic lustre, which is however least glossy on the lower part of the back and tail-coverts. The wings are concave and rounded, not extending much if at all beyond the base of the tail. Quills 28; primaries blackish banded with white, secondaries whitish banded with blackish, tinged towards the back particularly with brownish-yellow. Tail 15 inches in length at least, rounded at the extremity, the feathers 18, broad, and capable of expansion and elevation into a fan-shape. The general colour of these feathers is brown mottled with black, crossed by numerous narrow undulating lines of the same. There is a broad black band near the tip, then a short mottled portion, and lastly a broad dingy yellowish band. The bird stands rather high on its robust red legs, the scales of which have blackish margins, and the blunt spurs are about an inch long: the claws are dusky. Bill reddish, but horn-coloured at the tip. Irides dark-brown. Length nearly four feet; expanse of wings more than five.

Female.—Irides similar to those of the male. Bill and spurless legs less stout. Head and neck with less of naked skin, being partially covered with dirty gray feathers. Those on the back of the neck have brownish tips, and so produce a longitudinal band there. The short caruncle on the front is incapable of elongation; and though the tuft on the breast is not present in young hens, it is highly developed in the older ones, as may be seen in Mr. Audubon's celebrated plate. Prevailing hue of plumage dusky gray, each feather having a metallic band duller than in the male, then a blackish band, and lastly a grayish fringe. The blackish band is almost obliterated on the neck feathers and under surface. The whole plumage is more sombre than that of the male; there is less white on the primaries, and there are no bands on the secondaries. The colour of the tail is much as it is in the male. Length not exceeding 3½ feet.

Young.—The sexes are not easily distinguished till the skin of the head and neck begins to be tinged with red; but a tubercle on the breast of the young males at the approach of the first winter shows where the tuft is to be; during the second year the tuft becomes some three inches long; and during the third the bird is adult. It continues however to grow in dimensions and beauty for several years. The females attain their full size and colouring at the end of four years, when they have the breast tuft, which is not so full as it is in the male, and seldom exceeds the length of 4 or 5 inches.

The weight of these birds must either be now greatly diminished or the older writers must have been given to exaggeration, which last is the probable case. From 50 lbs. to 60 lbs. has been mentioned, and a modern ornithologist of some celebrity, relying on old authorities, goes beyond the latter weight, as the maximum, putting however the minimum at 20 lbs. Prince Bonaparte states that birds of 30 lbs. weight are not uncommon, and that he had ascertained the existence of some which weighed 40 lbs. Mr. Audubon gives the average at from 15 lbs. to 18 lbs., and mentions a single instance, in the market at Louisville, where the weight was 36 lbs.

Prince Bonaparte, in his continuation of Wilson's 'North American Ornithology,' informs us that the males, usually termed Gobblers, associate in parties of from ten to a hundred, and seek their food apart from the females, which either go about singly with their young, at that time about two-thirds grown, or form troops with other females and their families, sometimes to the amount of 70 or 80. These all avoid the old males, who attack and destroy the young, whenever they can, by reiterated blows on the skull. But all parties travel in the same direction and on foot, unless the dog of the hunter or a river in their line of march compel them to take wing. When about to cross a river, they select the highest eminences, that their flight may be more sure, and in such positions they sometimes stay for a day or more, as

if in consultation. The males upon such occasions gobble obstreperously, strutting with extraordinary importance, as if to animate their companions; and the females and young assume much of the pompous air of the males, and spread their tails as they move silently around. Having mounted at length to the tops of the highest trees, the assembled multitude, at the signal note of their leader, wing their way to the opposite shore. The old and fat birds, contrary to what might be expected, cross without difficulty even when the river is a mile in width; but the wings of the young and meagre, and of course those of the weak, frequently fail them before they have completed their passage, when in they drop, and are forced to swim for their lives, which they do cleverly enough, spreading their tails for a support, closing their wings, stretching out their neck, and striking out quickly and strongly with their feet. All do not succeed in such attempts, and the weaker often perish.

The wild turkeys, according to the same interesting author, feed on maize, all sorts of berries, fruits, grasses, and beetles; tadpoles, young frogs, and lizards, are occasionally found in their crops. The pecan-nut is a favourite food, and so is the acorn, on which last they fatten rapidly. About the beginning of October, whilst the mast still hangs on the trees, they gather together in flocks, directing their course to the rich bottom-lands, and are then seen in great numbers on the Ohio and Mississippi. This is the Turkey-Month of the Indians. When the turkeys have arrived at the land of abundance, they disperse in small promiscuous flocks of every sex and age, devouring all the mast as they advance. Thus they pass the autumn and winter, becoming comparatively familiar after their journeys, and then venturing near plantations and farm-houses. They have been known on these occasions to enter stables and corn-cribs in search of food. Numbers are killed in the winter, and are preserved in a frozen state for distant markets. The beginning of March is the pairing time, for a short time previous to which the females separate from their mates, and shun them, though the latter pertinaciously follow them, gobbling loudly. "The sexes," continues the Prince, "roost apart, but at no great distance, so that when the female utters a call, every male within hearing responds, rolling note after note in the most rapid succession; not as when spreading the tail and strutting near the hen, but in a voice resembling that of the tame turkey when he hears any unusual or frequently repeated noise. Where the turkeys are numerous, the woods, from one end to the other, sometimes for hundreds of miles, resound with this remarkable voice of their wooing, uttered responsively from their roosting places. This is continued for about an hour; and, on the rising of the sun, they silently descend from their perches, and the males begin to strut for the purpose of winning the admiration of their mates. If the call be given from the ground, the males in the vicinity fly towards the individual, and, whether they perceive her or not, erect and spread their tails, throw the head backwards, distend the comb and wattles, strut pompously, and rustle their wings and body-feathers, at the same moment ejecting a puff of air from the lungs. Whilst thus occupied, they occasionally halt to look out for the female, and then resume their strutting and puffing, moving with as much rapidity as the nature of their gait will admit. During this ceremonious approach, the males often encounter each other, and desperate battles ensue, when the conflict is only terminated by the flight or death of the vanquished." The usual fruits of such victories are reaped by the conqueror, who is followed by one or more females, which roost near him, if not upon the same tree, until they begin to lay, when their habits are altered with the view of saving their eggs, which the male breaks if he can get at them. They are usually from 9 to 15 in number, sometimes 20, whitish and spotted with brown like those of the domestic bird. The nest consists of a few dried leaves placed on the ground, sometimes on a dry ridge, sometimes in the fallen top of a dead leafy tree, under a thicket of shumach or briars, or by the side of a log. The females are particularly attentive to their young.

The range of the wild turkey appears to extend from the North-Western Territory of the United States to the Isthmus of Darien; the birds which have been taken for it to the south of the Isthmus were probably Curassows [CRACIDÆ]; and the improbability of its extension beyond the Rocky Mountains, or even so far, is shown not only by the absence of notice of it by the travellers in those parts, but from more positive evidence.

The time of the first appearance of the turkey in Europe is doubtful. The French writers attribute its introduction to the Jesuits somewhat hastily, for there is evidence that turkeys were known in Europe about 1530, if not before that year; whereas it was not before 1534 that Ignatius Loyola, being at Paris, entered into a solemn compact with six of his friends and fellow-students to promote his great object, the foundation of that religious order. The probability is that the Spaniards were the first to bring this bird to Europe, whence it has spread over the whole civilised world; but it is not impossible that it may have been brought to England by Cabot, or some of the subsequent expeditions.

In a domesticated state the plumage varies as much or more than it does in the common poultry. White is far from uncommon; buff is more rare. But the most curious variety is that mentioned by M. Temminck, which was in Madame Backer's aviary at the Hague. This bird had a topknot springing from the crown of the head; and a flock

of a pale reddish tint, with an ample crest of pure white, were reared by the same lady.

The royal forests of this country would afford ample shelter to these fine birds, and there, with little trouble, they might be kept in a state of nature. They would soon return to their wild habits, even if it should be thought too much trouble to import some of the true wild breed; and a noble addition they would make to the game in such royal preserves as Windsor and the New Forest. Formerly many were thus kept in Richmond Park, and Windsor Forest was much frequented by them.

M. ocellata. Cuvier first described this beautiful bird from the specimen formerly in Mr. Bullock's museum, and now in that of Paris, for which it was bought at the breaking up of Mr. Bullock's collection, and lost to this country.

The crew of a vessel were cutting wood in the Bay of Honduras, when they saw three individuals, and captured one alive, which was sent to Sir H. Halford, and met with an accident after its arrival in the Thames, and before it reached Sir Henry, which caused its death. Sir Henry presented it to Mr. Bullock, who then exhibited his museum in the Egyptian Hall, Piccadilly, of which it was one of the most distinguished ornaments.

Its size is nearly that of the common turkey; but the tail is not so much developed, nor is it known whether the bird can spread it or not: the probability is that it can. Bill of the same form with that of the common turkey, having a caruncle at its base, apparently capable of elongation and contraction like that of the common sort. Head and two-thirds of the neck naked, and, apparently, livid, but without fleshy tubercles on the lower part. There are five or six above each eye, five upon the centre of the crown, and six or seven in a line one above the other at nearly equal distances on the sides of the neck. No trace of a tuft on the breast could be perceived; but the plumage was rather damaged. Feathers rounded at the ends; those of the lower part of the neck, upper part of the back, scapulars, and all the lower part of the body, bronze-green, with two terminal bands, the first black, and the last, or that next to the tip, of a golden-bronze hue. The tints on the other parts of the back are the same, but near the tail-coverts they are more vivid, the bronze becoming of a rich blue or emerald-green, according to the incidence of the light, whilst the outer band becomes broader and more golden. Red mingles with the tints on the rump, where the plumage almost assumes the brilliant character of that of some humming-birds, and the bright border is separated from the blue by a band of velvety black. The hidden part of each feather is gray, mottled with black; and indeed upon the tail and upper coverts this gray is shown, forming bars, one of which, immediately succeeding the blue band, surrounds it, and gives each feather an ocellated appearance. The tail-coverts and lower feathers of the rump are so disposed that there are four rows with these ocellated tips. The tail, consisting of 14 feathers only, is rounded. Lower parts of the body banded with bronze, black, and green, but wanting the lustre of the upper parts. Quills and bastard wing black, edged obliquely with white, which occupies the external margin of the first almost entirely. Outer webs of the secondaries pure white, not showing the bands in the centre when the wings are closed; the uppermost blotched in the centre with black shot with green, which as the feathers shorten extends more over their surface, so as to leave only a white edge. Greater coverts chestnut. Feet and legs lake-red. (Cuvier; Temminck.)

Meleagris ocellata.

Polyplectron (Temm.).—Bill moderate, slender, straight, compressed, the base covered with feathers, convex above, where it is rather thick; orbits and part of the cheeks naked; nostrils lateral, placed towards the middle of the bill, and half-closed by a membrane. Two spurs on the feet; tarsi long and slender, the hind toe not touching the ground. Tail-feathers long and rounded, the fifth and sixth longest.

This beautiful form was raised to the rank of a genus by M. Temminck, who established it upon the bird which was named *Pavo Tibetanus* by Brisson, the Chinese Peacock-Pheasant by Edwards, *Pavo bicalcaratus* by Linnæus, and L'Eperronier by Buffon. Cuvier placed it among the Peacocks, properly so called, but other species have been since discovered, which, throwing further light upon the modifications of form, well justify its genuine separation. It is the *Diplectron* of Vieillot.

P. Emphanum. Male. Length about 19 inches. Forehead and crown ornamented with a crest of long, narrow, loose feathers, which, together with the plumage of the neck and breast, are rich bluish-black with metallic reflections. Above the eyes a large pure white shining stripe, and a patch of the same colour upon the ear-feathers. Back and rump brown, with irregular paler waved bands. Belly and vent deep black. Wing-coverts and secondaries brilliant blue, each feather tipped with velvety-black. Tail rather long, much rounded, brown, thickly spotted with ochraceous-white, and distinguished by large ocellated oval spots of a brilliant metallic-green. Towards the end of each feather there is a blackish bar. This beautiful and ample tail is supposed not to be erectile, but to be capable of very wide expansion. This is the Eperonnier à Toupet of M. Temminck; the Crested Polyplectron. Probably inhabits Sunda and the Molucca Isles.

Crested Polyplectron (*Polyplectron Emphanum*).

P. Tibetanum. This is the *Pavo Tibetanus* of Brisson and Gmelin, the Chinquis of Buffon, the Thibet Peacock of Latham, the Peacock Pheasant of Edwards, and the Eperronier Chinquis, Polyplectron Chinquis of Temminck.

Tibet Peacock (*Polyplectron Tibetanum*).

It is supposed to be a native of the mountain chain which separates Hindustan from Tibet.

In the *Polyplectron Chalcurum* the plumage is comparatively sombre. The ocellated spots on the wings and tail are absent, and the latter, instead of being rounded, has a more elongated pheasant-like form, approaching to that of *Argus*.

The beautiful birds above briefly noticed, and inhabiting the Indian Islands or China, are described as being almost as hardy as the Peacock, and there is little doubt that they might be domesticated in this country. The Tibetian Polyplectron is procured for the aviaries of the wealthy Chinese, and M. Temminck's drawing was taken from a bird that had lived for five or six years in an aviary at the Hague.

Dr. J. E. Gray ('Illustrations of Indian Zoology') has figured two other species, *Polyplectron Hardwickii*, nearly allied to *P. bicalcaratum*, and *P. lineatum*, which appears to Sir W. Jardine to be the young of some other species; there are, he observes, no spurs on the tarsi. Dr. Gray's figures were taken from General Hardwicke's drawings by native artists.

Argus (Temm.).—Bill compressed, straight except at the extremity, where it is curved, vaulted, and naked at its base; nostrils placed in the middle of the upper mandible, half-closed; head, cheeks, and neck, naked. Tarsi long, slender, spurless. Two middle tail-feathers longest, secondary quills much more developed than the primaries.

Head of *Argus*.

The only species known is *Argus giganteus*.

This bird is remarkable for the beauty of its plumage. The wings, the secondaries of which are three times as long as the primary quills, are painted and ocellated in a manner that defies description. A very faint idea of the pattern of one of these secondaries may be derived from the accompanying cut.

Secondary quill of *Argus giganteus*.

This bird is the beautiful Chinese Pheasant described in 'Phil. Trans.,' vol. 55, p. 88; L'Argus ou Luen of Buffon; Argus Pheasant, *Phasianus Argus* of Latham; L'Argus, *Argus giganteus* of Temminck.

The unwieldy size of the secondaries forms an impediment to the bird in its progress through the air, but they assist its pace when running, which it does swiftly with their aid. Its flight, when it does rise on the wing, is heavy and short. When the bird is at rest or unexcited, the beauty spots on the secondaries are hardly visible; but when showing himself off in the presence of his females, the wings of the *Argus* are expanded, and trailed upon the ground to display their beauties; and at this time the tail is comparatively spread, and is raised erect; when at rest it is carried in a line with the body, and

with the two long feathers folded together. The rest of its habits are not known, but it is said not to thrive well in confinement.

It is a native of Sumatra, and probably other Indian Islands, but principally of Malacca. No proof appears of its having been brought from China and Chinese Tartary, although ornithological writers name those countries as the places of its habitation. The feathers and drawing of the bird described in the 'Phil. Trans.' by G. Edwards were sent from Canton to Dr. Fothergill, and are stated to have come from one of the most northern provinces of China.

Argus Pheasant (*Argus giganteus*), full-grown male.

Lophophorus, Temm. (*Monaulus*, Vieill.).—Bill strong, long, very much curved, wide at its base, rather thick, convex above; the upper mandible longer than the lower and overlapping it, large, and trenchant at its extremity; nostrils half closed by a membrane covered with small scattered plumes. Tarsus furnished with a long and sharp spur; hind toe elevated and not touching the ground except at its end. Tail-feathers 14, straight and rounded; fourth and fifth quills longest.

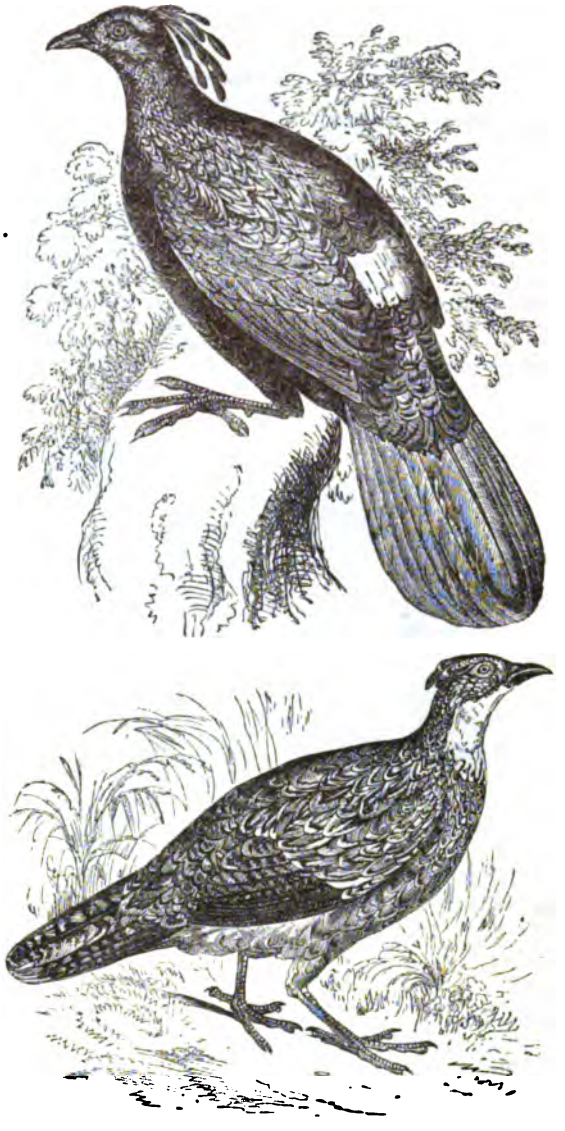
L. Impeyanus (*L. refulgens*, Temm.; Impeyan Pheasant, *Phasianus Impeyanus*, Lath.). We must refer our readers to the bird itself, or to the excellent figure in Mr. Gould's 'Century of Birds from the Himalaya Mountains,' for anything like an adequate idea of the beauty of its tints; for the greater proportion of the plumage is dazzling with changing hues of green, steel-blue, violet, and golden-bronze. The bird looks as if it were principally clothed in a scale-armour of iridescent metal; but the plumage is soft and velvety to the touch. The crest on the head consists of naked-shafted feathers, with an oval or

Head of Impeyan Pheasant (*Lophophorus Impeyanus*), male.

battledore tip of the same quality as the rest of the plumage, and of a metallic green; the centre of the back is pure white; the tail is rounded and bright chestnut. Size of a hen turkey.

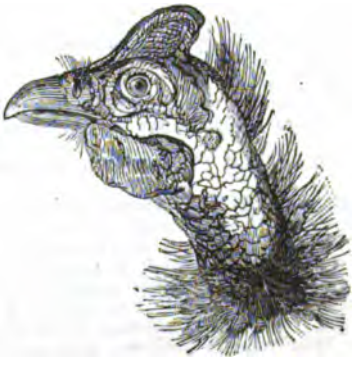
The principal food of this species consists of bulbous roots, for scooping out which its bill is well adapted. Nothing certain seems to be known of the rest of its habits.

It is a native of the mountain ranges of Nepaul and the Himalayas.



Impeyan Pheasant (*Lophophorus Impeyanus*), male and female; upper figure, male. (Gould.)

Numida (Linn.).—Bill short, strong, vaulted, stout, furnished with a warty membrane at the base; from the lower mandible hang two carunculated wattles; head naked or feathered; forehead surmounted with a bony casque or feathered crest; nostrils pierced in the cere, and divided by a cartilage. Tail short; fourth quill longest.



Head of Guinea Fowl (*Numida Meleagris*).

The birds known to the ancients under the name of *Meleagrides* and *Gallinæ Numidicæ* belonged to this genus. They are all natives of Africa, living principally on berries, small slugs, &c.

N. Meleagris (the Gallina di Numidia of the Italians; Poulle de la Guinée and Peintade Meleagride of the French; Pintado of the Spanish; Perl Huhn of the Germans; and Pearl-Hen, Guinea Hen, and Common Guinea Fowl of the English) is too well known to need description.

The bird has been spread very widely, and few poultry-yards are without it. In Jamaica, where they do much mischief to some of the crops, they have resumed their wild habits, and are shot like other game.

N. cristata is the Peintade à Crête and Peintade Huppé of the French, and Crested Pintada of Latham; it is the genus *Guttera* of Wagler. It is less than the Common Guinea Fowl. Head and neck bare, of a dull or leaden blue shading into red on the head, which is ornamented with a crest of loose hair-like feathers of a bluish-black, instead of the hard casque of the common species; this crest advances forward as far as the nostrils, but the feathers mostly turn backwards. General plumage bluish-black spotted with gray; there are from four to six spots on each feather; quills pale yellowish-brown; edges of the secondaries pure white, showing well in contrast with the rest of the dark colouring.

It is a native of Africa, in Great Namaqua Country.

Crested Pintada (*Numida cristata*).

Mr. Swainson is of opinion that the Spotted-Winged Pintada is a distinct species, which he names *N. maculipennis*.

PEA. [PISUM.]

PEACH. [AMYGDALUS.]

PEACOCK. [PAVONIDÆ.]

PEACOCK-STONE. [AMPHIDESMA.]

PEAR. [PYRUS.]

PEAR-ENCRINITE. [ENCRINITES.]

PEARL. [SHELL.]

PEARL-ASH. [POTASSIUM.]

PEARL-OYSTER. [AVICULA.]

PEARL-SPAR, a variety of Dolomite occurring in pearly rhombohedrons with curved faces.

PEARL-STONE, a form of volcanic lava, having a grayish colour and pearly lustre.

PEASTONE. [PISOLITE.]

PEAT. [BOG.]

PEBA. [ARMADILLO.]

PEBBLE, SCOTCH. [AGATE.]

PECAN-NUT. [CARYA.]

PECCARY. [SUIDÆ.]

PECOPTERIS. [COAL-PLANTS.]

PE'CORA, the name given by Linnæus to his fifth order of *Mammalia*. [MAMMALIA; MAMMALOGY.]

PECTEN. [PECTINIDÆ.]

PECTINA'RIA (Lamarck), a genus of *Amphitritidæ*, Cuvier's fourth family of his Annelides Tubicoles, the first order of his Annelides. [ANNELIDA.]

PECTINIBRANCHIA'TA, Cuvier's sixth order of *Gasteropoda*. [MALACOLOGY.]

PECTI'NIDÆ, or OSTREIDÆ, a family of Conchiferous *Mollusca*, to which the common Oyster belongs. It has the following characters:—Shell inequivalve, slightly inequilateral, free or adherent, resting on one valve; beaks central, straight; ligament internal; epidermis thin; adductor impression single, behind the centre; pallial line obscure; hinge usually edentulous. Animal marine; mantle quite open, very slightly adherent to the edge of the shell; foot small and byssiferous, or obsolete; gills crescent-shaped, two on each side; adductor muscle composed of two elements, but representing only the posterior shell-muscle of other bivalves. (Woodward.)

The principal genera referred to this order are—*Pecten*, *Ostrea*, *Lima*, *Placuna*, *Anomia*, *Placunomia*, *Hinnites*, *Spondylus*, and *Plicatula*.

Pecten (Lamarck).—Animal subrotund, not thick; lobes of the mantle very delicate, disunited throughout, thickened on the borders, and furnished with many rows of fleshy cilia, between which are regularly disposed a series of smooth oculiform tubercles; branchiæ large, decomposed into detached filaments; the small foot dilated at its extremity; mouth rather large, oval, surrounded with projecting and deeply-cut lips, and furnished on each side with a pair of triangular palps, truncated at their extremity. (Deshayes.) Shell free, regular, inequivalve, auriculated; lower margin transverse, straight; umbones contiguous; hinge toothless; cardinal pit entirely internal, trigonal, and receiving the ligament. (Lamarck.)

The Pectens are widely diffused, and species are to be found in the seas of most climates. Though there is a general similitude in the shells of all the numerous species which at once shows to what genus the animal belongs, the varieties of form and colour are infinite, and the species are in many instances very difficult to be defined, though the eye of an acute observer will at once determine differences which the pen cannot convey without some difficulty, if it succeed in making the differences understood at all. The colours of some are most vivid and beautifully variegated, whilst those of others again are sombre. The shells of some are stout and heavy, of others light, and some are nearly as transparent as glass (*P. vitreus*, Gray, and *P. vitreus*, King, for example). The depths at which they have been hitherto found range from the surface to 20 fathoms. *P. vitreus* (King), which occurred everywhere in the Strait of Magalhaens, was found attached to the leaves of *Fucus giganteus*, and formed, with other molluscs, the food of the Steamer or Race-Horse Duck (*Micropterus brachypterus* and *M. Patachonicus*). The bottoms haunted by the Pectens have been found to be sands, sandy-mud, and mud.

As an article of food, the species of this genus are generally useful. On our own southern coasts, where the sea is prodigal of its contributions to the table, Pectens are considered a delicacy, and when well treated by a good cook make a rich and sapid dish, as might be expected from the name of them when so prepared, 'Quina.' The St. James's Cockle-Shell (*P. Jacobæus*) was formerly the badge of the pilgrim who had been to the Holy Land.

Linnæus separated this extensive genus, that is, the Pectens properly so called, into three sections:—1. The Auriculated Equilateral Pectens. 2. The Pectens with one auricle ciliato-spinous within. 3. (Including *Lima*) Pectens with their valves more gibbous on one side than on the other. Of the first of these, *P. Jacobæus* and *P. Pleuronectes* are examples; of the second, *P. Pallium*, the well-known Ducal Mantle of collectors; and of the third, *P. flavicans* and *P. fasciata* (Linn.).

Lamarck divided the genus into two sections only: the first containing the species with the auricles equal or nearly equal; the second consisting of those which have the auricles unequal. The species cited as examples of the first and second divisions of Linnæus will serve as illustrations of this arrangement.

M. De Blainville separates the Pectens into four subdivisions:—1. (Les Pelerines) Those species which are very inequivalve, the left valve being very flat (*P. Jacobæus*, &c.). 2. (Les Soles) Equivalve species which do not gape (*P. Pleuronectes*). 3. Species whose two valves are nearly equally concave, but the right rather the least, and having its inferior auricle less wide than that of the left, so as to produce a sort of notch, for the passage of the byssus, as he thinks (*P. gibbus* and *P. glaber*). 4. Species with striæ parallel to their border (*P. orbicularis*, fossil).

Mr. G. B. Sowerby makes the divisions five:—1. Both valves convex, equal or nearly in size (*P. turgidus*). 2. One valve flat, the other deep or convex (*P. Jacobæus*). 3. Both valves rather convex, not meeting all round (*P. Pleuronectes*). 4. Both valves convex, but unequal in size (*P. bifrons* and *P. aurantiacus*). 5. Irregular, apparently adherent by the outside, but only taking the form of whatever it is attached to in consequence of being close pressed to it (*P. Pusio, Hinnites*).

The same author states his belief that all the Pectens are attached by a byssus, although it is seldom observed, even in the living specimens.

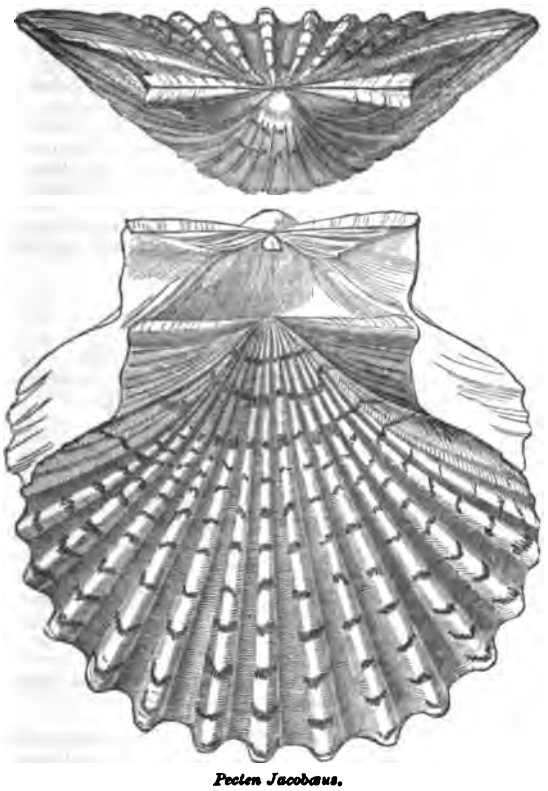
The following sub-genera have been formed from this genus:—*Neithea* (Drouet), *Pallium* (Schum.), *Hinnites* (Defr.), and *Hemicetus* (Adams). Woodward gives the number of recent species of *Pecten* as 120, and the fossil species as 450.

P. Jacobæus. Shell inequivalve, rather flattened above, with from 14 to 16 angulated rays; those of the lower valve longitudinally sulcated. Often agreeably variegated.

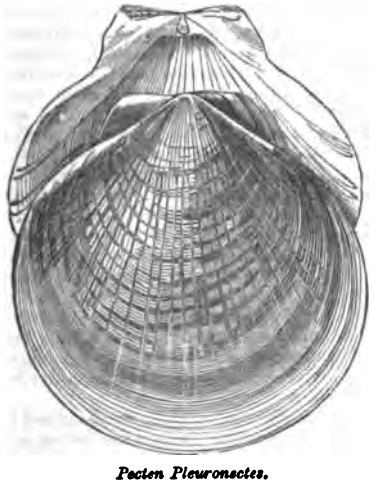
It is a native of the seas of Europe, but not of the British Islands. It is fossil in Italy.

P. Pleuronectes. Shell sub-equivalve, rather thin, smooth externally, somewhat convex on both sides. This species has the upper valve always coloured, generally reddish or rich reddish-brown, and the lower one white, whence its name. In the inside of the valves are projecting radiated somewhat distant ribs.

It is found in the East Indian seas, and fossil in France, at St. Paul-Trois-Châteaux, in the department of Drôme.



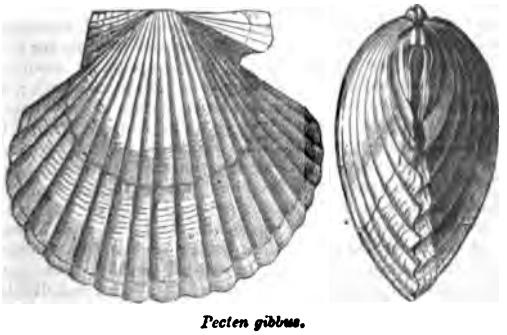
Pecten Jacobæus.



Pecten Pleuronectes.

P. gibbus. Shell sub-equivalve, ventricose, turgid, red, with from 20 to 22 convex rays, which are somewhat rugose at their sides and interstices.

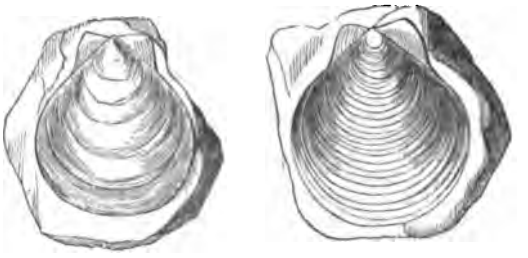
It is found in the Atlantic and American oceans.



Pecten gibbus.

P. orbicularis. Shell suborbicular, depressed, rather convex, with transverse concentric striæ on one valve, the other valve smooth; no

rays. It has been found fossil in England—Wiltshire, Devizes; Sussex, chalk formation; France—Coulaines, near Mans. It approaches *P. Pleuronectes.*



Pecten orbicularis.

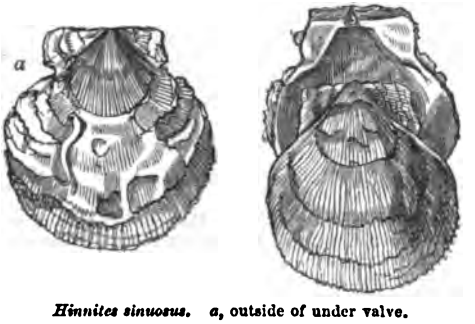
The following species of *Pecten* are British:—*P. varius, P. niveus, P. Pusio, P. striatus, P. tigrinus, P. Danicus, P. similis, P. maximus, P operecularis.*

The sub-genus *Hinnites* has the shell oval, irregular, adhering by the right valve, inequivalve, subequilateral, perfectly closed; its upper part terminated on each side by auricles similar to those of Pectens; cardinal border straight, toothless, prolonged with age into a small heel (talon); ligament thick, contained in a narrow and very deep gutter (gouttière).

A small number of species only belonging to the genus is as yet known, and a single living species (*H. sinuosus*, Desh.; *Pecten sinuosus*, Lam.; *P. Pusio*, Pennant, Sow.; *Ostrea sinuosa*, Gmel., Maton, and Rackett) has been recorded.

The fossil species, four or five in number, come from the tertiary beds of France and Italy.

H. sinuosus, Pecten Pusio of authors, has the shell ovate, unequally sinuous, variegated with brownish orange and white, and marked with numerous very narrow, striæform, and scabrous rays.



Hinnites sinuosus. *a*, outside of under valve.

Lima (Brug.).—Animal oval, having the lobes of the mantle separated nearly throughout their extent, larger than the valves of the shell, and turned inwards (se renversant en dedans); this part of the border is wide, and furnished throughout its extent with numerous tentacular, elongated, and annulated cirrhi. Branchiæ rather large, equal, and separated (écartées); foot cylindrical, vermiform, rather club-shaped, and terminating in a small sucker (ventouse), by means of which the animal can fix itself to submarine bodies; no byssus; buccal aperture oval, furnished with large foliaceous lips, terminated on each side by triangular and obliquely-truncated labial palps. (Deshayes.)

Shell longitudinal, subequivalve, auriculated, rather gaping on one side of the valves; umbones distant (écartées), their internal facets inclined inwards; hinge toothless; cardinal pit partly external, receiving the ligament.

M. Deshayes, in his edition of Lamarck, states his opinion that *Lima* is a genus which well deserved to be separated from its congeners in the family of *Pectinidæ*. Not only, says M. Deshayes, has it no byssus, but its mantle, like the shell, gapes much; and the large re-entering edge of the former is furnished with a great number of vermiform flexible tentacula, which seem formed, like the antennæ of insects, of gradually decreasing articulations. Between these tentacles there are no tubercles with smooth surfaces similar to those of the Pectens, the *Spondyli*, and the *Peda*. The foot has a particular form, recalling to the observer that of *Lucina* or *Loripes;* it is elongated, narrow, cylindrical, and rather thickened at its free extremity, where it terminates in a sort of sucker, which, according to the observations of M. Quoy, serves to fix the animal upon solid bodies even of the most smooth surface. The mouth is placed between two lips comparable to those of *Pinna;* they are foliaceous, descend upon the lateral parts of the body, and terminate on each side in a pair of labial palps, which are truncated and triangular. The branchiæ are rather large and equal. Those on one side are separated from those on the other by a rather wide space, in which may be easily perceived the adductor muscle, on the posterior face of which the anus terminates. This muscle seems more extensible

than in the greater part of the molluscs of the same class. When it is not contracted the valves are widely opened, and the animal has the power of impressing on it frequent and sudden contractions, the rapidity of which is facilitated by the extreme elasticity of the ligament of the valves. By means of these reiterated contractions the animal can flutter in the water, to use the happy expression of M. Quoy, and one must run after it to catch it among the corals or in the shallows where it dwells. M. Deshayes concludes that, from this remarkable union of characters, it might be possible for zoologists to decide upon forming of this genus a small family distinct from the Pectens, but placed in their neighbourhood.

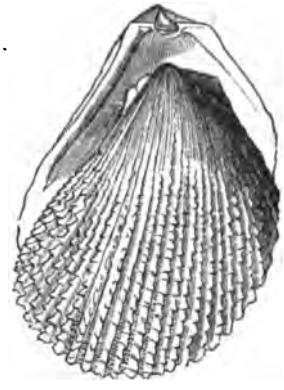
The power of fluttering through the water is possessed by the Pectens. [CONCHIFERA.]

The species of *Lima* are widely distributed, and is generally found in the seas of warm and temperate climates, where it has been taken at depths ranging from the surface to thirty fathoms.

Mr. Garner remarks that in the heart of *Lima* there are two ventricles, the rectum passing between them.

Limatula (S. Wood) and *Limæa* (Bronn) are sub-genera. Woodward computes the recent species at 20, and the fossil at 200.

L. squamosa. Shell oval, depressed, clipped as it were anteriorly, white; ribs squamous, rough as a file; hinge oblique, margin crenated. It is a native of the seas of America. There is a variety which has the scales less numerous.

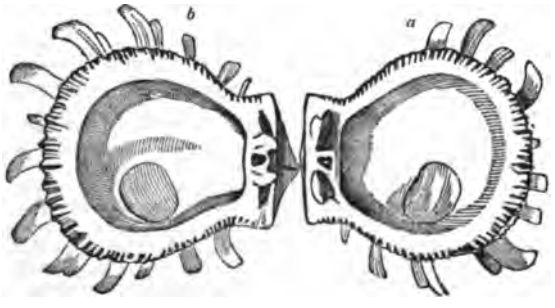


Lima squamosa.

The British species of *Lima* are—*L. subauriculata*, *L. Loscombii*, and *L. hians.*

Spondylus.—Animal oval, oblong; the borders of the mantle disunited, thick, and furnished with many rows of tentacular cirrhi, many of which are truncated, and terminated by a smooth and convex surface. Mouth oval, furnished with great cut (decoupées) lips, and on each side with a pair of oblong and pointed labial palps. Branchiæ in form of a crescent, and formed of detached filaments. Foot rudimentary, on the disc of which a club-shaped pedicle raises itself. Anus floating behind the adductor muscle of the valves. (Deshayes.)

Shell inequivalve, adherent, auriculated, beset with spines or rough; the umbones unequal; the lower valve offering an external cardinal facet which is flattened and divided by a furrow, and which increases with age. Hinge with two strong teeth in each valve, and an intermediate fosset for the ligament, communicating by its base with the external furrow. Ligament internal, the ancient remains of which show themselves externally in the furrow. (Lamarck.)



Spondylus ducalis; internal view of valves, showing hinge, ligament, muscular impression, &c. *a*, upper valve; *b*, lower valve.

The spines with which the *Spondyli* are armed, in some instances very long, must have struck everybody, and also that they bristle out on every side from the upper valve. The lower valve is attached, and adheres to submerged bodies by means of foliations. If the whole lower surface adheres, as it often does, not a spine is given out from the lower valve; but where the adhesion takes effect towards the anterior part of the lower valve only, as is very frequently the case, especially when the shell is affixed among the branches of corals, a favourite locality with some species, the foliations are confined merely to that part where adhesion is required, and the rest, or free part of the valve, is as profuse of spines as the upper valve itself. There are two points to be gained, support or adhesion, and defence; the first is of primary importance, but as soon as that is safe, all the resources of the animal seem to be turned towards its defensive and offensive armour. Those fishes which browse among the corals are thus deterred from injuring the living fixture which has there taken up its abode. A very fine series of specimens was collected with a view to this habit, and they showed not only the power which the animal had of secreting the proper process of shell according to the circumstances required, but of modifying the secretion according to the exigencies of the occasion.

Spondylus Americanus, with the valves closed; the umbones towards the spectator.

But there is another, and more interesting phenomenon, well displayed in one of the species of this genus. Professor Owen, having been led to reflect, while considering the uses of the camerated part of the shell of *Nautilus*, upon the degree or extent of that structure as possibly dependent upon the mode of growth of the animal and its shell, and how far it was a necessary physical consequence of the increase and change of position of the animal, independently of any special purpose served by the forsaken parts or chambers of the shell, had paid attention to all the cases that had come under his observation of the formation of chambers in shells, by the secretion, on the part of the animal, of a nacreous layer, forming a new basis of support to the soft parts, and cutting off the deserted portion of the shell from the chamber of occupation. In a paper on the 'Structure of the Water-Clam' (*Spondylus varius*, Brod.), read before a meeting of the Zoological Society of London, he observes that it is well known that the process above adverted to is not the only mode adopted to suit the shell to the changing form and bulk, or other exigencies of its occupant. Taking the genus *Magilus*, for one example, the Professor remarks that the part of the shell from which the body gradually recedes is filled up by the continuous compact accretion of calcareous matter, and a solid massive elongated shell is thus produced, which would be a great incumberance to a locomotive mollusc, but is of no inconvenience to a univalve destined by nature to live buried in a mass of lithophytous coral.

Other instances were observed in *Helix decollata* and in the chambers formed in *Septaria.* Among the bivalves the *Ostreæ* not unfrequently present shallow and irregular chambers in the substance of the shell, and the *Etheriæ* have vesicular cavities interposed between the testaceous laminæ; but the most constant and remarkable example of the camerated structure of the shell is presented by the large *Spondylus*, or Water-Clam, above named, so called from the fluid which (until lost by slow evaporation) occupies the chambers, and which is visible in the last-formed chamber through the thin semi-transparent exposed septum.

In order to examine this camerated structure, and more especially to see how it was modified by the presence and progressive change of place of the adductor muscle, he had a fine specimen sawn through vertically and lengthwise; it measured 8 inches in length; the substance of the concave valve, which was 2½ inches in thickness at the thickest part, included 14 chambers separated from each other by very regularly formed and stout partitions, composed, as in other chambered shells, of the nacreous portion or constituent of the shell. The septa were slightly undulating in their course, but presented a general concavity towards the outlet of the shell. Not any of these partitions were however continued freely across the shell, but each became continuous at the muscular impression, which is near the middle of the shell, with the contiguous septa. In general also the septa commenced singly from the cardinal or upper wall of the valve, and divided into two when about one-fourth of the way towards the opposite or lower wall, the thickness of the undivided part of the septum being equal to, or greater than, that of the two divisions of layers into which it splits.

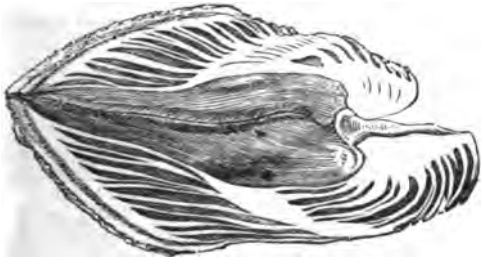
"The secreting power of the lower lobe of the mantle in the *Spondylus*," says Professor Owen in continuation, "is greater than in the upper; and the layers of nacre which are successively deposited on the cardinal margin push forward in a corresponding degree the upper valve, leaving a heel or umbo behind the hinge of the lower valve, which, from the inactivity of the secreting surface of the upper lobe of the mantle, is not opposed by a corresponding umbo in the upper valve.

"The laminæ, which are deposited in a continuous series of superimposed layers at the hinge of the lower valve, are not continued in a like state of superposition throughout; they soon separate from each other, and do not again unite, except at the space corresponding to the adductor muscle, and at the circumference of the valve.

"The interspaces of these successive layers of the growing *Spondylus* cannot, from the absence of a medium of intercommunication, serve any purpose hydrostatically with reference to locomotion; it is a singular fact indeed that the *Spondylus*, in which the chambered structure is constant, and the *Ostrea* and other bivalves, in which it is occasional, are cemented to extraneous bodies by the outer surface of the shell, generally by the concave valve; so that the septa must be regarded as mere dermal exuviæ still left adhering to the animal, to which, as a motionless bivalve, they are no incumbrance. It is highly probable that all the chambers are originally filled with fluid, as more or less is found in the outer ones of the specimens brought to this country.

"In the Testaceous Cephalopods a new structure is added, namely, the siphon, whereby the exuvial layers of the old shell and the deserted chambers are converted into a hydrostatic instrument, subservient to the locomotion of the animal. The operation of the siphon and chambers has been ably explained by Dr. Buckland in the *Nautilus*, where the calcareous inflexible tube protecting the membranous siphon is not continuous. The working of the siphon is however less intelligible in those species in which the outer calcareous tube is continued from chamber to chamber, as in the *Spirulæ*, *Orthoceratites*, &c.; and it is with respect to camerated shells of this kind that I would ask how far the reasoning suggested by the chambers in the Water-Spondylus may be applicable in their case, and whether a final intention can be clearly traced beyond the diminution of specific gravity occasioned by a large proportion of the shell being converted into receptacles of gas; if indeed we have sufficient evidence to assume that they do not contain a denser fluid, like the Spondylus."

The cut represents a section of a very old individual of this species, in which the upper valve was very convex, and furnished with a great number of septa.



Section of Water-Spondylus cut longitudinally through both valves, which are represented as closed.

The species of *Spondylus* have been found attached to rocks, corals, other shells, &c., at depths varying from the surface to 100 fathoms, in the seas of warm and temperate climates, as the West Indies, the Canaries, the Mediterranean, India, Torres Straits, the Pacific, and West America. The finest and most beautiful species are natives of tropical and intertropical localities.

The number of recent species is about 30, and fossil 45. The latter are found in the Inferior Oolite and Neocomian Beds.

Pedum, Lamarck, (sub-genus).—Animal oval, oblong, flattened, having the lobes of the mantle open throughout their circumference, thickened on their edges, and furnished on this part with many rows of tentacular cirrhi, and, at regular distances, tubercles with smooth surfaces. A pair of large branchiæ descending on each side to the edge of the lower border of the mantle; abdominal mass small, having anteriorly and high up a small vermiform foot, and at its base a silky byssus of some size; mouth oval, having on each side a pair of labial triangular palps. (Deshayes.)

Shell inequivalve, subauriculate, lower valve gaping; umbones unequal and distant. Hinge toothless; ligament partly external, inserted in an elongated canaliform pit, which is hollowed out in the internal wall of the umbones. Lower valve notched near its posterior base. (Lamarck.)

P. Spondyloideum is the only species. The shell is ovato-cuneiform, planulate; whitish tinged with red or purplish, especially near the umbones; the upper valve flat and striated longitudinally; the lower valve largest, with the lateral edges turned up and raised above those of the upper valve.

Shell of *Pedum Spondyloideum*.

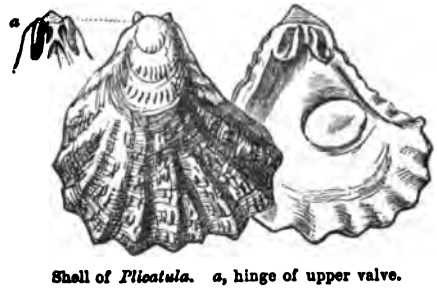
There is a smaller variety, much more round, and generally more delicate.

It is a native of the East Indian Seas (Isle of France, &c.), where it is found half-imbedded in coral-reefs.

Plicatula.—Shell inequivalve, inauriculate, narrowed towards its base; the upper border rounded, subplicated; with unequal umbones, and without external facets. Hinge with two strong teeth in each valve. A fosset between the cardinal teeth, receiving the ligament, which is entirely internal. (Lamarck.)

The species inhabit the seas of warm climates, where they are found adhering to stones, shells, and other submarine bodies, at depths varying from four to eleven fathoms.

Woodward makes the number of recent species six, and fossil forty.



Shell of *Plicatula*. *a*, hinge of upper valve.

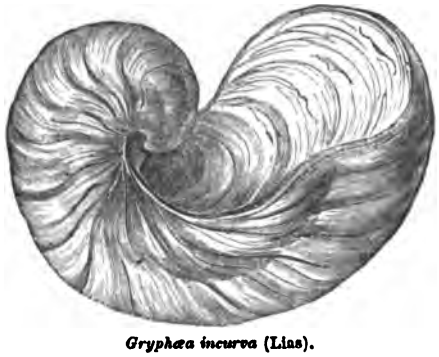
Ostrea (*Gryphæa* (Lam.), fossil principally; *Exogyra* (Say), fossil only). The two latter genera are so generally established in fossil catalogues, that it may be convenient to retain their names; but we agree with Mr. G. B. Sowerby and M. Deshayes, that, physiologically considered, they ought to be abandoned. Mr. Sowerby, in his 'Genera,' remarks that the particular points upon which Lamarck depends for his distinction between the Oysters and *Gryphææ* are, 1st, the apparent regularity of the latter; 2nd, their being scarcely if at all attached; and 3rd, the generally large, involute, spiral umbo of the lower valve. To the first Mr. Sowerby answers, that though the *Gryphæa* are in general apparently more regular than the *Ostreæ*, they cannot be considered as regular shells, and that they are moreover very variable; secondly, the *Gryphææ*, as well as all other *Ostreæ*, are attached by the umbo of the larger and concave valve, and this particularly in the young state (in which state in fact it is impossible to distinguish between one and the other); moreover both become free as they advance in size; and if the *Gryphææ* are then apparently more regular, it is because in their young state they have lived in situations where they could only become attached to small regular objects, while the *Ostreæ*, having lived in more rugged and irregular situations, and necessarily remaining attached for a longer time, have partaken more of the irregularity of their native situation. "Indeed," adds Mr. Sowerby, "there is sufficient evidence that an oyster, when by any chance it becomes attached to a small smooth object, where it is comparatively free, becomes also regular in the same degree: thirdly, we cannot approve of the term spiral as at any time applicable to the umbo of the lower valve of the *Gryphææ*; when young, it is not involute; and though Lamarck mentions the size of this as one important distinguishing mark of his genus, he gives the characters of several species in which this part is small. Another circumstance in which the *Gryphæa* is thought to differ from *Ostrea* has been dwelt upon by some, an obscure lobe or sulcus observable on the right side, particularly

of the lower valve; but this is far from being distinct in some species."

But if the generic claims of *Gryphæa* be untenable, those of *Exogyra*, established by Say for the reception of the *Gryphææ*, whose umbo, instead of rising above the valves, take a lateral direction, have still less foundation. There is not, says Deshayes in conclusion, a single character which is not to be found in the oysters, and sometimes in the varieties of the same species.

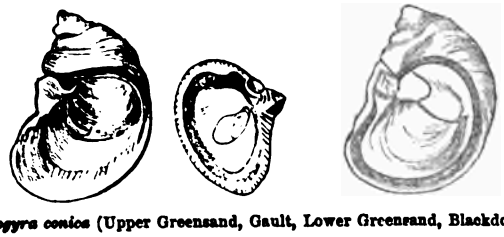
The species of *Gryphæa* are found in almost all the strata down to the lias inclusive, and consist of about thirty-five species.

G. angulata is recent.



Gryphæa incurva (Lias).

Exogyra is included in the species of *Gryphæa* noticed in the last edition of Lamarck. Von Buch has recently published a fine species under the name of *E. polygona*, from Montan (South America), where it was found in company with Pectens by M. Alexandre de Humboldt.



Exogyra conica (Upper Greensand, Gault, Lower Greensand, Blackdown).

The generic characters of *Ostrea* are as follows:—Animal oval, oblong, flattened, often irregular; lobes of the mantle thick and fringed on the borders, separated throughout their extent; no foot; mouth moderately furnished with two pair of elongated lanceolate palps; branchiæ large, curved, nearly equal. The non-symmetrical heart not having its basis upon the intestine, which last terminates behind the adductor muscle by an anus which floats between the lobes of the mantle. (Deshayes.)

Shell adherent, inequivalve, irregular; umbones distant, and becoming very irregular as the animal advances in age; upper valve smallest, gradually displacing itself, and advancing forwards as the animal grows older. Hinge toothless; ligament demi-internal, inserted in the cardinal pit of the valves; the pit of the lower valve increasing with the age of the animal, as well as the umbo, and acquiring sometimes a great length.

The species of this genus are distributed very widely, and principally in the seas of temperate and warm climates: no species appear to have been met with in the Polar Expeditions very far north. Oysters have been taken on gravel and sand, in estuaries, and on the sea-coast, sometimes attached to rocks, trees, &c., at depths varying from the surface to 17 fathoms. In the British Museum there is a good-sized crab, on the back and claws of which are many oysters. [CANCER.]

The True Oysters have been divided into two groups, which may be satisfactorily used by zoologists and geologists as subdivisions of this numerous genus.

A. True Oysters with simple or undulated, but not plaited valves.

This considerable group, which consists of between 30 and 40 recorded species (recent), may be illustrated by the well-known *Ostrea edulis*, or Common Edible Oyster of the European seas.

The Edible Oyster is the *Ostrea* and *Ostreum* of the Romans; Ostrica of the Italians; Ostra of the Spaniards; Auster of the Germans; and Huitre of the French.

"The *Ostrea edulis*," says Professor E. Forbes, in the 'History of British Mollusca,' "may be said to have its capital in Britain, for though found elsewhere on the coasts of Europe, both northward and southward, in no part of them does it attain such perfection as in our seas, through which it is generally distributed, sparingly in some places, abundantly and in gregarious assemblages in others, chiefly inhabiting the laminarian and coralline zones. The ancient Romans valued our native oysters even as we do now, and must have held them in higher estimation than those of Italian shores, or they would not have brought them so far for their luxurious feasts. Juvenal records the exquisite taste of the epicure:—

"'Who,
At the first bite, each oyster's birthplace knew;
Whether a Lucrine or Circæan he'd bitten,
Or one from Rutupinian deeps in Britain.'

"'Circæis nata forent, an
Lucrinum ad saxum, Rutupinove edita fundo
Ostrea, callebat primo deprendere morsu.'"

(Juvenal, 'Sat.' I., iv. 140.)

Property necessarily exposed, as these valuable oyster-beds must be, required the protection of the legislature. (Stat. 31 George III., c. 51; 48 George III., c. 144; and 7 and 8 George IV., c. 29). By the last-named statute (which repeals 31 George III., c. 51), sec. 36, stealing of oysters or oyster-brood from any oyster-bed, laying, or fishery, is larceny, and the offender upon conviction shall be punished accordingly. Moreover, if any person shall unlawfully and wilfully use any dredge, net, &c. for the purpose of taking oysters or oyster-brood, within the limits of any oyster-bed or fishery, every such person shall be deemed guilty of a misdemeanour, and upon being convicted thereof, shall be punished by fine or imprisonment, or both, such fine not to exceed 20*l.*, and such imprisonment not to exceed three calendar months. The statute contains a provision that the catching floating fish with any net, instrument, or engine adapted for catching such fish, within the limits of any oyster-fishery, shall not bring the fisher within the penalties of the Act. [OYSTER, in ARTS AND SC. DIV.]

The bill for the protection of the oyster-fisheries in Scotland provides that any person in Scotland knowingly stealing oysters from a bed, laying, or fishery, which is sufficiently marked as the property of other persons, shall be deemed guilty of theft, and punished accordingly; and that any person using any net, dredge, or other instrument, within the limits of such oyster-fishery, for the purpose of taking oysters, although none be actually taken, shall be deemed guilty of an attempt to commit theft, and be liable to fine or imprisonment, the fine not to exceed 20*l.*, and the imprisonment not three months, with a clause that nothing in the act shall prevent persons from catching floating-fish in an oyster-fishery with instruments adapted for taking floating-fish only.

B. True Oysters, with the borders of their valves distinctly plaited.

Of this group, consisting of more than 30 recorded species (recent), *O. Crista Galli*, the Cockscomb Oyster, will serve as an example. It has a shell varying in form according to the bodies to which it adheres, but generally somewhat rounded, very much plaited, the plaits

Cockscomb Oyster (*Ostrea Crista Galli*).

longitudinal and angulated; internal border rough; externally violet, purplish, or reddish-white. The shell externally has subgranulous striæ, and subtubular scales. It is found in the East Indian Seas.

The number of recent species of *Ostrea* is 60, and of fossil 200. (Woodward.)

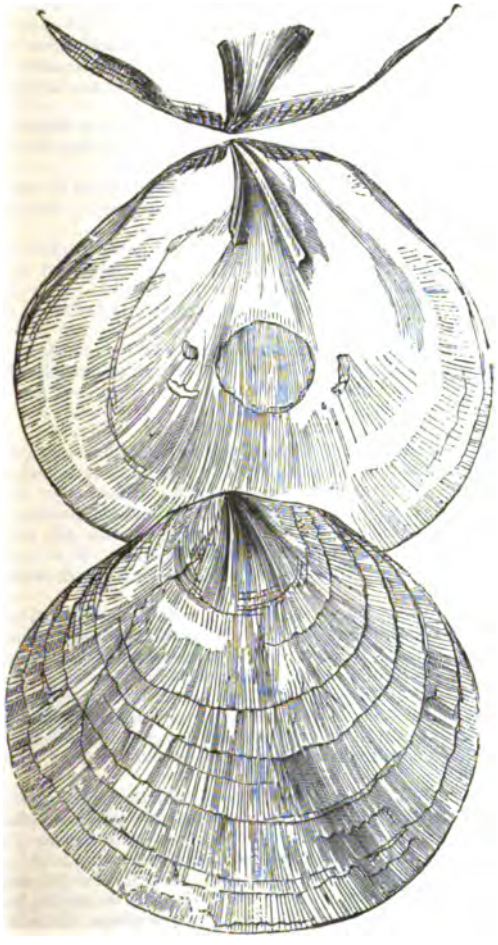
Placuna (Brug.).—Animal very much compressed. Shell free, irregular, very much flattened; valves delicate and almost translucid, quite translucid in some species, nearly equal, and subequilateral; hinge internal, offering on one valve two longitudinal, trenchant, rib-like elevations, converging at the summit, and on the other two furrows, corresponding to those ribs, and giving attachment to the ligament; muscular impression subcentral and rather small. (Rang.)

The species now known are from the East Indian and Red Seas, and have been taken on sandy bottoms.

M. Deshayes remarks that the animal is not known, but that he is convinced that it has a great analogy to that of *Anomia*.

The number of species recorded in the list of M. Deshayes is three living and one fossil (tertiary). Of the living species, *P. papyracea* is noted as both living and fossil (tertiary). Four species are enumerated in the last edition of Lamarck as they were in the first; but the fourth, *P. pectinoides* (fossil), is considered to have all the characters of *Plicatula*, and is therefore removed by M. Deshayes to that genus. Mr. G. B. Sowerby had previously given a similar opinion. The species best known are, *P. Placenta*, vulgarly known as the Chinese Window-Oyster, the valves of which are sufficiently delicate to transmit light; and *P. Sella*, known to collectors as the Saddle-Oyster (from Tranquebar, &c.).

P. Placenta has the shell suborbicular, flat, pellucid, white, with longitudinal subdecussate striæ. It is found in the East Indian Seas.



Placuna Placenta.

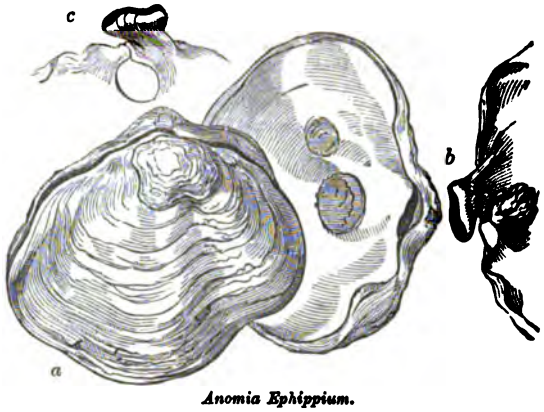
Anomia (Brug.).—Animal very much compressed, having the borders of the mantle delicate, and furnished externally with a row of tentacular filaments. Foot rudimentary; adductor muscle divided into three branches, the largest of which passes by a notch in the lower valve in order to attach itself to an opercular stony or corneous piece fixed to marine bodies. Shell adherent by its opercular piece, inequivalve, inequilateral, irregular, delicate, and often translucid; the fixed valve most flattened, having a round or oblong notch near the umbo for the reception of the opercular piece; the other larger and more concave; both joined by a short and thick ligament; muscular impression separated into three portions. (Rang.)

The recorded species are generally quoted as coming from the European seas and the Atlantic Ocean. The depths at which they have been taken are stated to vary from the surface to 100 fathoms, adhering to oysters, and other shells, rocks, &c.

The species are not very numerous; and perhaps more are recorded than actually exist; for the shell will take upon itself the regularities or irregularities of the body to which it is attached. Thus, on a Pecten, an individual will become striated like that Pecten through both valves, when another of the same species is smooth if adherent to a comparatively smooth body. M. Rang observed this frequently on the shores of the Mediterranean; and both Mr. G. B. Sowerby and M. Deshayes make the same observation.

There are 20 recent and 30 fossil species. The fossils are found in the Crag and London Clay, in the marine formations above the Chalk in France, and as low down as the Oolite.

A. Ephippium. Shell suborbiculate, rugoso-plicate, waved, planulate, with an oval foramen, whitish or yellowish, often reddish-yellow, below. One of the largest species. It is found in the British Channel, the Mediterranean Sea, and Atlantic Ocean.



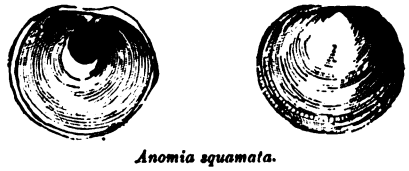
Anomia Ephippium.

a, valves closed; *b*, open to show the hinge; *c*, hinge of attached valve without the bony appendage.

Bony appendage of *Anomia Ephippium* adhering to the rock.

a, the bony part that goes through the opening of the shell; *b*, the surface which is attached to external objects.

M. De Blainville records a species, *Anomia squamata*, which has not this bony appendage, and which he says is affixed by the valve itself. This so-called species, however, which should be *Squamula*, is in Mr. G. B. Sowerby's opinion nothing more than *A. Ephippium* in a very young state before the appendage is ossified.



Anomia squamata.

Placunanomia of Broderip has the following generic character:—Animal probably intermediate between that of *Placuna* and *Anomia*. Shell adherent, subequivalve, irregular, flattened, plaited towards the margin, vitreous internally. Hinge internal, with two elongated, thick, subcurved, divaricated teeth converging at the base in the lower valve, and two ligamentiferous furrows opposite in the upper valve. Lower valve superficially fissured externally towards the hinge, the subosseous organ of adhesion inserted between the laminæ of the shell, and filling the fissure externally. Muscular impression in each valve subcentral. In the upper valve the impression of the organ of adhesion is superadded.

This sub-genus partakes of the characters of the genera *Ostrea*, *Plicatula*, *Placuna*, and *Anomia*. It may be regarded as the connecting link between the two latter. With an arrangement of the hinge approaching very nearly to that of *Placuna*, it has the distinguishing organisation of *Anomia*, while the external appearance of the shell, especially if viewed in situ, bears the strongest resemblance to *Plicatula*, or some of the plicated Oysters. The organ of adhesion, which in its bony character (for it is more bony than shelly) resembles that of *Anomia*, does not perforate the lower valve directly, but is inserted between the laminæ of the internal surface of the lower valve above the muscular impression and below the hinge, and passes

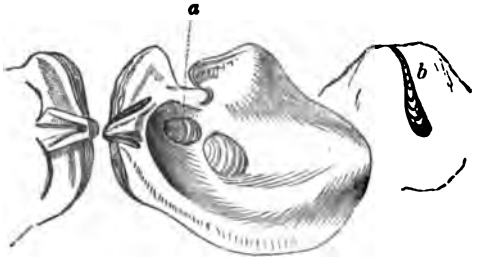
out into an external, irregular somewhat longitudinal superficial fissure, or cicatrix, which is narrowest at the hinge margin, and which it entirely fills to a level with the surrounding surface of the shell. (Broderip, 'Zool. Proc.,' February 1832.)

The species of this genus are widely diffused, and inhabit the seas of warm climates in both hemispheres. Mr. Broderip has described four ('Zool. Proc.' and Müller's 'Synopsis') brought to this country by Mr. Cuming from the West Indies, Central America, and other western localities. They were dredged from sandy mud and muddy bottoms, adhering to bivalve shells, dead and living, and dead coral, at depths of 6, 11, and 17 fathoms; of these *Placuna echinata* wears something of the appearance of the short-spined *Spondyli*. Besides the species above alluded to, Mr. Broderip states that Mr. Sowerby furnished him with an odd valve of a large species from Luçonia, which was beautifully iridescent internally; but as it was believed that this was identical with the fine shell sold by him to the British Museum, Mr. Broderip left the description of it to the officers of that establishment. Mr. Sowerby had some other odd valves, which Mr. Broderip thought might prove new, and the latter possessed two or three specimens adhering to *Spondyli*, from an unknown locality; but they appeared to be young.

M. Deshayes remarks that this genus establishes the passage between *Placuna* and *Anomia*, and that it shows that the V-shaped tooth of *Placuna* is only an extreme modification of the large callosity of the *Anomiæ;* he adds that a fossil shell found in Egypt, and which has been taken for a *Placuna*, is a new step, as regards the hinge, between the *Anomiæ* and *Placunæ*.

P. Cumingii (Brod.) has the shell subround, obscurely silvered, white, flattened; margin plaited, the plaits very large; length 2½ inches, breadth 7-10ths of an inch; height 2¾ inches.

It inhabits the shores of Central America (Gulf of Dulce, Province of Costa Rica); dredged from a muddy bottom, at the depth of 11 fathoms, attached to dead bivalve shells and dead coral.



Placunanomia Cumingii.

a, internal appearance of the organ of adhesion; *b*, the same seen externally.

PECTUNCULUS. [POLYODONTA.]

PEDALIACEÆ, a natural order of Monopetalous Exogenous Plants, very nearly related to *Verbenaceæ*, having like it irregular and usually

Pedaliaceæ.

A shoot of *Josephinia imperatricis* in flower. 1, the corolla laid open; 2, the pistil; 3, the ripe fruit; 4, a transverse section of the latter.

didynamous flowers and a few-seeded 2- or 4-celled fruit; but differing in having the radicle directed towards the base instead of the apex of the fruit. From *Bignoniaceæ*, with which they are more generally compared, their wingless seeds offer the principal distinction. They are all exotic tropical herbaceous plants, with opposite leaves and axillary flowers, and are of little known use, with the exception of the genus *Sesamum*, whose seeds afford a bland oil not inferior, when fresh, to that of the olive. [SESAMUM.]

Uncaria procumbens, the Grapple Plant of the Cape of Good Hope, has the fruit covered with curved spines, which lay hold of the clothes of travellers. The horns of *Martynia proboscidea* do the same, and are called in Italy the Testa di Quaglia (Quail's Head). The order contains 14 genera and about 25 species.

PEDETES. [MURIDÆ.]

PEDIASTRUM. [DESMIDIEÆ.]

PEDICEL. [PEDUNCLE.]

PEDICELLARIA, the name given by Müller to little pincer-shaped bodies found on the surface of many species of star-fishes and sea-urchins. When seen on the surface of the dried specimens they appear like little cleft spines. In *Uraster rubens*, according to Dr. Sharpey, they cover the surface generally, and are more numerous round the spines. Each one of these little bodies consists of a soft stem, which bears on its summit a little forceps of calcareous matter. If anything is introduced between the blades of these forceps when the animal is alive, it is instantly grasped with considerable force. Those on the body and upper spines differ in shape from those on the spines immediately bordering the avenues. When the star-fish is living the blades of the forceps are in continual activity, but when cut off they seem to lose that power. These bodies have been observed by Sars in *Echinus sphæra*, and he describes three species—*P. tridens*, *P. triphylla*, and *P. globifera*.

The question of the nature of these bodies has been often agitated. Whilst Müller and others have considered them to be parasitic animals, Oken, Sharpey, and Sars regard them as organs of the animal. Sars assigns the following reasons for his belief:—

1. The *Pedicellariæ* are found in the same species of *Echinodermata* under all circumstances, which would not be the case if they were parasitical animals.

2. The structure of the calcareous forceps and stems to which they are attached, bear structurally a greater resemblance to the spines of the *Echinodermata* than to other structures.

3. The *Pedicellariæ* have a vital connection with the skin and shell of the *Echinus*. The stem of the *Pedicellaria* is attached to a knob of the shell of the *Echinus*, on which it moves.

4. Sars states that when a single *Pedicellaria* is irritated, the rest are inclined towards it.

Although Professor E. Forbes states that he was not able to confirm Sars's observation on the two last points, he was nevertheless inclined to adopt the opinion that they were peculiar organs of the *Echinodermata*, rather than parasitic animals.

(E. Forbes, *British Star-Fishes.*)

PEDICULARIS (from the Latin word *Pediculus*, a louse, from its supposed quality of making sheep that feed upon it lousy), a genus of Plants belonging to the natural order *Scrophulariaceæ*. It has an inflated 5-toothed calyx, a ringent corolla, with the upper lip laterally compressed, the lower plane, 3-lobed; the capsules are acute and compressed; the seeds numerous and angular. The species are usually simple herbs. The flowers sessile, disposed in dense terminal interrupted spikes.

P. palustris, Marsh Louse-Wort, has a solitary erect stem, branched throughout, pinnatifid leaves, with oblong blunt-lobed segments; an ovate pubescent 2-lobed calyx, the lobes incise, dentate, crisped. The upper lip of the corolla has a short truncate beak, with a triangular tooth on each side. The flower is large and crimson, varying to white. It is found in marshes and wet meadows, particularly in the north of England, and is said to be injurious and disagreeable to cattle. This is the *Pedicularis Herba* of Columella, vi. 30, and of Scribonius Largus.

P. sylvatica, Wood Louse-Wort, has a stem branched at the base, erect, the branches long, spreading, and prostrate; the leaves pinnatifid, leaflets ovate and deeply toothed. The upper lip of the corolla as in the last species, the flower large and rose-coloured. It is found on wet, heathy, and rather hilly grounds in Siberia, Europe, and Great Britain. The expressed juice of the herb, or a decoction, has been used with advantage as an injection in serous ulcers. It is injurious to the sheep that feed on it. There are 75 other species of *Pedicularis* enumerated, none of which are British, or applicable to any useful purpose. They are found chiefly in Europe and Northern Asia.

(Babington, *Manual of British Botany.*)

PEDI'CULUS (Linnæus), a genus of Insects belonging to the order *Aptera*. These insects, commonly called Lice, form the order *Anoplura* of Dr. Leach, and *Parasita* of Latreille. [ANOPLURA.] Latreille thus characterises this order of insects:—Their body is flattened, nearly diaphanous, and divided into 11 or 12 distinct segments, of which three belong to the trunk (or thorax), each bearing one pair of legs. The first of these segments frequently forms a sort of thorax (or rather prothorax). The stigmata are very distinct. The antennæ are short, equal, composed of five joints, and frequently inserted in a

notch. There are one or two small ocelli on each side of the head. The legs are short, and terminated by stout claws, or two opposing hooks, which enable these animals to cling with great facility to the hairs of quadrupeds or the feathers of birds, whose blood they suck, and on whose body they propagate and pass their lives. They attach their ova to these cutaneous appendages, and multiply excessively, one generation succeeding another with great rapidity. Particular and unknown causes facilitate their increase to an astonishing degree, the *P. humanus*, under such circumstances, producing in man what is termed the 'morbus pediculosus.' Their movements are slow.

Three species of Lice are said to infest the human subject—the *P. humanus*, which inhabits the bodies and garments, and is known by the name of the Body-Louse; the *P. cervicalis*, or *P. humanus capitis* of De Geer, which inhabits the head of man, and particularly children; and lastly, the *P. pubis* of Linnæus, which constitutes Leach's genus *Phthirus*. This species inhabits the eyebrows, &c., and is commonly known by the name Crab-Louse.

The following are the principal genera into which the Pediculi are divided:—

In *Pediculus* proper the mouth, which is in the form of a snout, consists of a very small tubular mammilla situated at the anterior extremity of the head; the tarsi are composed each of a joint almost equal in size to the tibia, and terminated by a strong claw, which folds over a projection, and fulfils the function of a forceps; the thorax is composed of three distinct equal segments. The *P. humanus* and *P. cervicalis* belong to this genus.

The genus *Phthirus* differs from *Pediculus* in having the body wide and rounded, the thorax very short and confounded with the body: the anterior feet are simple, and the two hinder pairs are didactyle.

The *Pediculus* of the Hog has the thorax narrow and distinct from the abdomen, which is very broad; it constitutes, according to Leach, the genus *Hæmatopinus*.

The *Nirmi* (*Nirmus* of Hermann, Leach, &c., and *Ricinus* of De Geer) have the mouth situated beneath the head, and composed of two lips and two hook-like mandibles; their tarsi are very distinct, and terminated each by two equal hooks. Latreille says that the species of this group, with one exception, that of the dog, are exclusively confined to birds.

PEDILANTHUS, a genus of Plants belonging to the natural order *Euphorbiaceæ*. It has a common slipper-shaped involucre. The male flowers several in the circumference. Pedicels bracteolate, each articulated with a naked anther. Female flowers one in the centre. Calyx wanting; style 1; stigmas 3; capsules 3-cocccus.

P. tithymaloides, Jew-Bush, is found in various parts of the West Indies in stony bushy places, near the coast. It is a shrub throwing out runners, erect, about six feet high, abounding in white bitter milk. The stems are numerous, weak, soft, as thick as the finger; when old cinereous, when young green. The leaves are ovate, obtuse, or acute; coriaceous, entire, alternate, stalked, distichous, when young downy on each side, and wavy at the edges, becoming at last quite smooth and flat. Peduncles 1-flowered, short, clustered about the extremities of the branches. Involucre slipper-shaped, bright-red with a green back. The practitioners of Curaçoa give a decoction of the whole plant, especially of the stem, as the ordinary beverage, and in large doses in some diseases. The root is emetic.

(Lindley, *Vegetable Kingdom*; Lindley, *Flora Medica*.)

PEDIPES (Adanson), the name for a genus of Turbinated *Mollusca* belonging to the family *Auriculacea* of M. De Blainville and *Colimacea* of Lamarck.

PEDUM. [PECTINIDÆ.]

PEDUNCLE, the stalk of the flower in Plants. The secondary stalks are called Pedicels.

PEEWIT. [CHARADRIADÆ.]

PE'GANUM, from Πήγανον, the Greek name of Rue, of which three kinds are described by Dioscorides—the Garden, the Mountain, and the Wild. The last is said to be called Moly in Cappadocia and Galatia, and by some Harmala. It is remarkable that even in the present day a plant is found in the north of India, the Punjab, and Cabul, which is called Hoormul by the natives of the above countries, and sometimes distinguished in India by the name of Lahoovee-Hoormul, indicating that it was introduced from the direction of Lahore. The Persian works on Materia Medica in use in India give Molee as its Greek name, according to Dr. Royle ('Illustr.,' p. 155). It is interesting to find that the plant to which these names are assigned by the natives of the country is the *Peganum Harmala* of botanists, a fact which shows that the investigations of the West had arrived at the same conclusion as those in the East respecting the plant alluded to by Grecian authors; and this enables us to put more faith in the results of such investigations than is sometimes done. The plant, which is called Syrian Rue in gardens, belongs to the natural family of *Rutaceæ*, and is of easy culture in any light soil. The seeds, which were formerly in use in medicine in Europe, still are so in the East, but are not possessed of any peculiar or very active properties.

PE'KEA, a genus of Plants inhabiting Guyana, and furnishing the Saouari or Sawarra Nuts of the shops, a very different fruit from that to which the name of Saouari is given in Guyana. *Pekea* comprehends two species, the *P. butyrosa* and *P. tuberculosa*: the former is unknown in this country; the latter, which yields the fruit in question, is a very large tree inhabiting the woods of Guyana, where it is called Tataboube by the Garipou Indians. It has opposite digitate leaves, whose leaflets are oval, smooth on the upper side, but white with down beneath; the terminal leaflet is said to be 8 inches long by 3¼ inches in breadth, while those at the sides are much smaller. The flowers are unknown. The fruit consists of greenish compressed drupes, which adhere around a common centre, and contain a single seed of large size, covered with a brownish rugged woody shell, and containing a kernel of a soft consistence, and of the most delicate buttery quality. It is by far the best of the South American nuts that are brought to England, and much superior to our own walnuts, almonds, and filberts; but it is scarce and dear in most seasons.

Pekea tuberculosa.

PEKTOLITE, a Mineral occurring in spheroidal masses which have a radiating fibrous structure. Its colour is grayish. Hardness 4·0 to 5·0. Lustre pearly. It is nearly opaque. Specific gravity 2·69. It is found in large masses on Monte Baldo in the Southern Tyrol, and at Monzoni in the Fassa-thal. Its analysis by Von Kobell afforded—

Silica	51·30
Lime	33·77
Soda	8·26
Potash	1·57
Alumina and Oxide of Iron	0·90
Water	3·89
	——99·69

PELAGIA. [MILLEPORIDÆ; ACALEPHÆ.]

PE'LAGUS, De Montfort, a genus of *Ammonites*.

PE'LAMYS. [HYDRIDÆ.]

PELARGO'NIUM is the name given by botanists to the gaily painted flowers which are usually called Geraniums in our greenhouses. The latter differ obviously from *Pelargonium* in having regular flowers, and in being herbaceous plants, while the genus in question consists almost entirely of shrubs with flowers as irregular as those of the Pansy. There is a large number of genuine species of this genus, chiefly inhabiting the Cape of Good Hope; and as these intermix very readily, producing in great abundance shrubs which are capable of being perpetuated by cuttings, a prodigious number of spurious species, as well as acknowledged varieties, have found their way into the writings of systematic botanists. For example, De Candolle enumerates 369 supposed species, of which at least one-half are of artificial origin. While however science has been embarrassed by this facility of cross-breeding, the gardens have been enriched by crowds of the most beautiful objects, in which the features of their savage progenitors

can no longer be recognised; and it is probable that of all the flowers which have been acted upon by the hand of man, the *Pelargonium* is that in which the result has been most striking.

By care and attention to a few simple points of practice these plants may be cultivated and multiplied by any one who has a greenhouse, and hence they have become universal favourites. These points are the following, namely:—1, water; 2, warmth; 3, a gentle bottom heat; 4, abundance of air; 5, as much light as the leaves will bear; and 6, a rich soil during the season of growth; and a cool atmosphere, less water, abundance of light, and close pruning afterwards.

PELEA. [ANTILOPEÆ]

PELECA'NIDÆ, a family of *Natatores*, or Swimming Birds.

The genus *Pelecanus* of Linnæus, placed in the 'Systema Naturæ' between *Diomedea* and *Plotus*, contains the True Pelicans (*Pelecanus Onocrotalus*), the Frigate Bird or Man-of-War Bird (*Tachypetes*), under the designation of *P. aquilus*, the Cormorants (*P. Carbo* and *P. Graculus*), and the Solan Goose and Boobies.

The Totipalmes of Cuvier (comprising those Palmipedes which have the hind toe united with the others in a single membrane, perch on trees, are good fliers, and have short legs), consist of the Pelicans (*Pelecanus*, Linn.), comprehending all those which have the base of the bill denuded of feathers. Their nostrils are slits, the aperture of which is scarcely perceptible. The skin of the throat is more or less extensible, and their tongue very small. Their delicate gizzard, if gizzard it may be called, forms one large sac with their other stomachs. Their cæca are only moderate or small. The following are the genera comprehended under the Pelicans:—The Pelicans properly so called (*Onocrotalus* of Brisson, *Pelecanus* of Illiger); the Cormorants (*Phalacrocorax* of Brisson, *Carbo* of Meyer, *Halieus* of Illiger); the Frigates (*Pelecanus Aquilus*, Linn., *Tachypetes*, Vieill.); the Boobies (*Sula* of Brisson, *Dysporus* of Illiger). The Pelicans are succeeded by the Anhingas (*Plotus*, Linn.), and the Tropic Bird (*Phaeton*, Linn.).

Mr. G. R. Gray, of the British Museum, in his 'List of the Genera of Birds, with an Indication of the Typical Species of each Genus' (London, 1840), makes the *Pelecanidæ* the sixth and last family of the Palmipedes, and separates it into the sub-families *Plotinæ*, *Phaetoninæ*, and *Pelecaninæ*. The last sub-family consists of the genera *Sula*, *Onocrotalus*, *Pelecanus*, *Phalacrocorax*, and *Fregata*.

Pelecanus (Linn.).—Bill long, straight, wide, very much depressed; upper mandible flattened, terminated by a very strong hook or nail, which is compressed and very much bent; lower mandible formed by two osseous branches, which are depressed, flexible, and united at the point, and from which a naked skin in the form of a bag is suspended.

Head of Pelican.

Foot of Pelican.

Face and throat naked. Nostrils basal, in the shape of longitudinal slits. Feet strong and short; three anterior toes; the hind toe is articulated anteriorly, but on the same plane with the others, and all are united by a membrane; middle claw without dentilations. Wings moderate; first quill shorter than the second, which is the longest; greater wing-coverts and secondaries nearest to the body as long as the quills. (Temm.)

The true Pelicans are large and heavy birds, with a great extent of wing, and are excellent swimmers. The expansive pouch, whose elasticity is well known to all who have witnessed the shapes into which it is stretched and formed by the itinerant showman, will hold a considerable number of fish, and thus enables the bird to dispose of the superfluous quantity which may be taken during fishing expeditions, either for its own consumption or for the nourishment of its young. In feeding the nestlings—and the male is said to supply the wants of the female when sitting in the same manner—the under mandible is pressed against the neck and breast, to assist the bird in disgorging the contents of the capacious pouch; and during this action the red nail of the upper mandible would appear to come in contact with the breast, thus laying the foundation, in all probability, for the fable that the Pelican nourishes her young with her blood, and for the attitude in which the imagination of painters has placed the bird in books of emblems, &c., with the blood spirting from the wounds made by the terminating nail of the upper mandible into the gaping mouths of her offspring.

The neighbourhood of rivers, lakes, and the sea-coasts, are the haunts of the Pelicans, and they are rarely seen farther than twenty leagues from the land. They appear to be to a certain extent gregarious. Le Vaillant, upon visiting Dassen-Eyland, where was the tomb of a Danish captain, at the entrance of Saldanha Bay, beheld, as he says, after wading through the surf and clambering up the rocks, such a spectacle as never perhaps appeared to the eye of mortal. "All of a sudden there arose from the whole surface of the island an impenetrable cloud, which formed, at the distance of forty feet above our heads, an immense canopy, or rather a sky, composed of birds of every species, and of all colours—cormorants, sea-gulls, sea-swallows, pelicans, and I believe the whole winged tribe of this part of Africa, were here assembled. All their voices, mixed together and modified according to their different kinds, formed such a horrid music that I was every moment obliged to cover my head to give a little relief to my ears. The alarm which we spread was so much the more general among these innumerable legions of birds, as we principally disturbed the females which were then sitting. They had nests, eggs, and young to defend. They were like furious harpies let loose against us, and their cries rendered us almost deaf. They often flew so near us that they flapped their wings in our faces, and though we fired our pieces repeatedly we were not able to frighten them; it seemed almost impossible to disperse this cloud. We could not move one step without crushing either their eggs or their young ones; the earth was entirely strewed with them." The same traveller found on the Klein-Brak River, whilst waiting for the ebb tide, thousands of pelicans and flamingoes, the deep rose-colour of the one strongly contrasting with the white of the other.

The species of *Pelecanus* are widely spread (Europe, Asia, Africa, and America), though not numerous: two are European, *P. Onocrotalus*, and *P. crispus*. We select the former as an example.

P. Onocrotalus, the Common European Pelican. The plumage generally of a fine white tinted with light rose- or salmon-colour, which is brightest in the breeding season, except the primaries and spurious wing, which are black, and the depending occipital crest and a few pendulous feathers on the lower part of the neck, which are light-yellow; naked space round the eyes and at the base of the bill, where the frontal feathers form a point, flesh-colour; the upper mandible bluish, with a crimson line running along the top, reddish at the base, yellowish at the tip, and the terminal nail red; guttural pouch yellow; irides bright reddish-brown or hazel; feet livid; tail short. Length from five to six feet; expanse of wings twelve or thirteen feet. Sexes similar.

The young of the year and those of a year old are whitish-ash throughout; belly whitish; wings and back very deep ash; all the feathers bordered with brighter ash; quills blackish-ash; bill and naked parts livid; iris brown. The first white feathers appear on the neck and belly. (Temm.)

Fish is the food of the Pelican, which it captures with great adroitness, generally in shallow inlets. It is no diver, but it will occasionally dash from a great height on the wing upon a fish with such velocity that it becomes submerged, though its buoyancy brings it instantly to the surface again. Although it perches on trees, it seems to prefer rocky shores. The nest, generally formed of coarse reedy grass, with a lining of grass of a softer quality, is large (about a foot and a half in diameter), and made upon the ground. Two, three, four, and sometimes five pure white eggs, but mostly two, of nearly the same size at both ends, are laid in it.

Sonnerat found five under a female of this genus. She would not rise to let him pass, but kept her seat. She struck at him with her bill, and screamed when he attempted to drive her from her eggs. Labat fastened two young pelicans to a stake. The mother daily brought them food, and remained with her young ones constantly until the evening, when she flew up to roost in a tree immediately above them. The trio became very familiar, suffering Labat to touch them; and the young ones gratefully accepted the little fish which he offered to them, and which they first put into their pouches. These Pelicans were, in all probability, not of the species under consideration.

This bird is found in the Oriental countries of Europe; common on the rivers and lakes of Hungary and Russia; tolerably abundant

on the Danube; rare and accidental on the sea-coast. An adult specimen, sent to M. Temminck, who gives the above habitats, from Egypt, and another from the Cape of Good Hope, differed in nothing from those of Europe, except in their greater dimensions. That the species exists in Asia there is no doubt. Belon, who refers to Leviticus (xi. 18), where the bird is noted as unclean, says that it is frequent on the lakes of Egypt and Judæa. When he was passing the plain of Roma, which is only half a day's journey from Jerusalem, he saw them flying in pairs like swans above his head, rather low; and adds that they are seen flying in a large flock like those birds. Hasselquist saw it at Damietta in Egypt. He also adds that it comes to Egypt in the middle of September, in his chapter on the arrival there of migrating birds. "In flying," says Hasselquist, "they form an acute angle, like the common wild geese when they migrate. In the summer they inhabit the Black Sea and coasts of Greece; and in their migration remain for a few days near Smyrna and other parts of the coasts of Natolia, but never stray far from the continent: they fly very high. Some of them remain at Damietta, and in the islands of the delta in the Mediterranean, but the greater part go to Egypt." They appear in some of the Egyptian drawings. (Rossellini.)

Common European Pelican (*Pelecanus Onocrotalus*).

Dr. Von Siebold and M. Bürger saw it in Japan, and their observation is confirmed by M. Temminck. Mr. Gould states that though the tropical climates of Africa and India constitute its natural habitat, nevertheless the eastern rivers of Europe, such as the Danube and Volga, the extensive lakes of Hungary and Russia, and the shores of the Mediterranean, are places where it dwells in abundance. The same author says that it is a species strictly confined to the Old World, over a great part of which it is distributed. Prince Bonaparte quotes it as being rare and adventitious at Philadelphia and Rome. Sir John Richardson quotes it, or rather a variety of it, killed on the Mississippi, 56° N. lat.

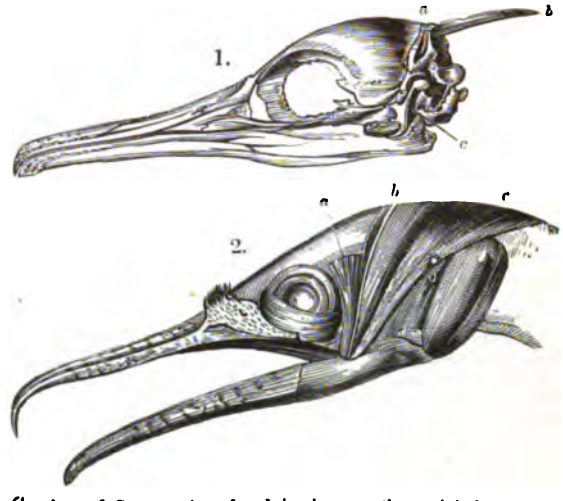
In the 'Proceedings of the Zoological Society' for 1835, is an account of the dissection of a Pelican by Professor Owen, and the dissection of a male of the same species, by Mr. Marten, is given in the same volume.

Phalacrocorax (Brisson).—Bill moderate or long, straight, compressed; upper mandible very much curved towards the point, and hooked; lower mandible compressed; base inserted in a small membrane, which extends under the throat. Sides of the face and throat naked. Nostrils basal, linear, hidden. Feet strong, short; three toes before, the hind-toe articulated interiorly, all united by a membrane; nail of the middle toe serrated. Wings moderate, the first quill longer than the second, which is longest.

This is the genus *Halieus* of Illiger, *Carbo* of Meyer, and *Hydrocorax* of Vieillot.

Mr. Yarrell, who observes ('Zool. Journ.,' vol. iv.) that most of those authors who have written on the comparative anatomy of birds agree in describing an additional bone as peculiar to the back part of the head of the Cormorant, or Corvorant, as he writes it (*Pelecanus Carbo*), adds that the muscles attached to this bone, and the services they are destined to render the animal, have been either overlooked or misconceived. He describes the additional bone as about one inch in length, triangular in shape, somewhat grooved on its surfaces, and from its articulation with the occiput, tapering gradually to a point. The mode by which this bone is articulated to the occiput is considered by Mr. Yarrell to be similar to that observed in the ribs of serpents, in which the condyle is situated upon each vertebra, and the cavity is at the end of the rib: so in the Cormorant, the condyle is upon the occipital bone, the cavity at the triangular end of the xiphoid bone; the joint is therefore hemispherical, admitting great extent of motion. Mr. Yarrell then notices the great length of the os quadratum (*c*) from above downwards, in this and other birds which feed on fishes. The articulation of this bone, he observes, both with the cranium itself, as well as with the lower mandible, admits great latitude of motion. It moves with facility backwards, forwards, outwards, and inwards, by the action of the numerous muscles attached to it, thus increasing the capacity of the pharynx for the more easy passage of any unusually large fish. The rami of the lower mandibles are comparatively slender, weak, and elastic, and hence the value of the additional pair of muscles described by Mr. Yarrell, muscles which are not, he states, possessed by any of the species of *Colymbus*, *Alca*, *Uria*, and *Larus*, all of which have the rami of the lower mandibles much deeper and thicker in proportion.

The xiphoid or sword-shaped bone is described by Mr. Yarrell as having three surfaces, each slightly concave, forming together an isosceles triangle, the base of which is downwards.



1, Cranium of Cormorant, reduced in size. *a*, the occipital crest; *b*, the xiphoid bone; *c*, the os quadratum.

2, Cranium of Cormorant, with the muscles moving the lower mandible. *a* and *b*, muscles answering to the masseter and temporal; *c*, the muscle arising from the xiphoid bone.

The xiphoid bone exists in the other European species of *Phalacrocorax*, and probably in the whole of that genus; but it is absent in the true Pelicans, and, we believe, in the Frigate Bird and *Plotus*. The recorded species are not numerous; five are noted as European.

P. Carbo, the Common Cormorant. (Old.) Under the throat a large white or whitish collar, the upper extremities of which reach to just below the eyes. Summit of the head, neck, breast, all the lower parts and the rump, lustrous greenish-black; on the neck small whitish traits, which are nearly imperceptible; feathers of the upper part of the back and wings ashy-brown, or bronzed in the middle, bordered by a large band of glossy greenish-black; quills and tail-feathers black; bill blackish-ash; naked region of the eyes greenish-yellow; small guttural pouch yellowish; iris green; feet black. Length 27 to 29 inches (both sexes—winter plumage. Temm.).

M. Temminck remarks that individuals in this state of plumage have been most frequently described as females of this species.

Spring or Nuptial Plumage.—On the occiput and a part of the nape are long feathers, which form a crest of deep lustrous green; the large collar on the throat is pure white; on the summit of the head, on a great part of the neck, and on the thighs, appear very long, loose, and silky feathers of a pure white. These plumes are more or less long, according to the age of the individual. Rest of the plumage as in winter. (Temm.)

Young of the Year.—Summit of the head, nape, and back, deep brown, with slight green reflections; the large collar whitish-gray; front of the neck and all the lower parts gray-brown, varied with whitish, particularly on the breast and the middle of the belly, where these spots are numerous; feathers of the upper part of the back, scapulars, and coverts of the wings, gray-ash in the middle, bordered by a band of deep brown; bill bright brown; iris brown. It is not till the age of one year that the young assume the perfect winter livery.

The Cormorants on the south coasts of England are very large. Pennant relates that he weighed a bird of this species that exceeded seven pounds; the length was 3 feet 4 inches: the extent 4 feet 2 inches.

There is little or no doubt that this is the Κόραξ of Aristotle ('Hist. Anim.,' viii. 3), whose description of the bird and of its habits agrees well with that now before us. It is the Corvo Marino, Corvo Aquatico, Marangone, Merangone, and Mergone, of the Italians; Cormoran (Belon) and Cormoran of the French; Scharbe and See-Rabe

of the Germans; Skarv and Strand-Ravn of the Norwegians; Aalekrage of the Danes: Skarfur of the Icelanders; Mûlfran and Môrfran of the Welsh; Corvorant and Cormorant of the English. It is the *Corvus Aquaticus* of Gesner, Ray, and others; *Pelecanus Carbo* of Linnæus; *Phalacrocorax Carbo* of Cuvier and others; and *Carbo Cormoranus* of Meyer and others.

Common Cormorant (*Phalacrocorax Carbo*). Adult male, in spring plumage. (Gould.)

It has been a question how the English name of the bird should be spelled, some preferring the form Corvorant, which is the form used by Montagu, Latham, Pennant, and Dr. Caius, the last of whom derives the word from 'corvus vorans.' Cormorant is considered a corruption by those who elect this derivation. Milton, Ray, and Willughby wrote Cormorant, which is the form now generally used by British ornithologists.

The geographical distribution of this bird is very extensive. It is an inhabitant of the New as well as the Old Continent. In the latter it is widely diffused. It is spread over a considerable portion of Europe, especially the north. It is a common bird in England.

The Cormorant swims very low in the water; even in the sea the body is deeply immersed, little more than the neck and head being visible above the surface. It is a most expert diver, pursuing the fish which form its food with great activity under water. It is said to be very fond of eels. It flies with the neck outstretched, and may be often seen drying its drenched plumage on the shore or on insulated rocks. It perches on trees, where it is occasionally known to build its nest, but it mostly selects rocky shores and islands, selecting, according to Selby, the summits, and not (like the Green Cormorant) the clefts or ledges. Upon the Fern Islands its nest is composed entirely of a mass of sea-weed, frequently heaped up to the height of two feet, in which are deposited from three to five eggs of a pale bluish-white, with a rough surface. "The young," says Mr. Selby, "when first hatched, are quite naked and very ugly, the skin being of a purplish-black; this in six or seven days becomes clothed with a thick black down, but the feathered plumage is not perfected in less than five or six weeks. . . . . I have repeatedly found that, upon being thrown into the sea, even when scarcely half fledged, they immediately plunge beneath the surface, and endeavour to escape by diving. This they will do to a great distance, using their imperfect wings, and pursuing their submarine flight in the same manner and almost with as much effect as their parents."

The old French quatrain in the 'Portraits d'Oyseaux' gives no bad account of the habits of this bird:—

> "Le Cormorant est oyseau bien cognu,
> Hantant les eaux tant douces que salées,
> C'est luy par qui rivières sont pillées,
> Et des estangs l'annuel revenu."

Its voracity is indeed great, and the way in which it will dispose of a large fish, a plaice for instance, aided in a great measure by the powers of compression and dilatation conferred on it by the apparatus noticed above, is surprising. The species is easily domesticated. Montagu, who kept one, gives a favourable account of its disposition, and indeed their docility is shown by the use made of them formerly in fishing. Pennant cites Whitelock, who says that he had a cast of them manned like hawks, and which would come to hand.

Sir George Staunton ('Embassy to China') states that the embassy, in its journey to Han-choo-foo, "had not proceeded far on the southern branch of the canal, when they arrived in the vicinity of the place where the Leu-tze, or famed Fishing-Bird of China (*Phalacrocorax Sinensis*) is bred, and instructed in the art and practice of supplying his owner with fish in great abundance. It is a species of the Pelican, resembling the Common Cormorant, but which, on a specimen being submitted to Dr. Shaw, he has distinguished in the following terms:—'Brown Pelican or Corvorant with white throat, the body whitish beneath and spotted with brown; the tail rounded; the irides blue; the bill yellow.'" The bird, an undoubted Cormorant, is figured in the 'Atlas,' pl. 37, and a vignette at the end of the chapter shows two Chinese fishermen carrying their light boat, around the gunnel of which their cormorants are perched, by a pole, resting on their shoulders between them. Sir George further says, "On a large lake close to this part of the canal, and to the eastward of it, are thousands of small boats and rafts, built entirely for this species of fishery. On each boat or raft are ten or a dozen birds, which at a signal from the owner plunge into the water; and it is astonishing to see the enormous size of fish with which they return grasped between their bills. They appeared to be so well trained that it did not require either ring or cord about their throats to prevent them from swallowing any portion of their prey, except what the master was pleased to return to them for encouragement and food. The boat used by these fishermen is of a remarkably light make, and is often carried to the lake, together with the fishing-birds, by the men who are there to be supported by it."

Belon gives an amusing account, in his quaint French, of the chase of this bird during calms, especially in the neighbourhood of Venice, the hunt being carried on in very light boats ("deux ou trois douzaines de compagnie"), each of which, says he, being rowed by five or six men, darts along the sea like the bolt from an 'arbalaste,' till the poor cormorant, who is shot at with bows as soon as he puts his head above water and cannot take flight, after diving to suffocation, is taken, quite tired out by his pursuers.

P. cristatus (Cormoran Largup of Temminck; Crested Corvorant of Pennant; Shag or Green Cormorant of Gould). In the old bird in its winter dress the whole plumage is of the most beautiful resplendent and lustrous green; upper part of the back, scapulars, and wing- and tail-coverts of a fine bronze; each feather framed as it were by a narrow band of beautiful velvety-black; extremity of the wings not reaching beyond the origin of the tail, which is short, rounded, and of a dead black; base of the bill and very small guttural pouch fine yellow; bill brown; feet black; iris green. Length 2 feet 1 or 2 inches.

At the commencement of the spring there rises on the middle of the head, between the eyes, a fine tuft of wide and outspread feathers, about an inch and a half high, capable of erection, and which in that state present a toupet, or large plume; on the occiput also are ten or twelve rather long and subulate feathers. There are never any white feathers on the neck nor on the thighs, as in the Great Cormorant (last-mentioned species).

Crested Cormorant (*Phalacrocorax cristatus*). Adult, in summer plumage. (Gould.)

The Young of the Year are distinguished from the young of all the other species by their long and slender bill, their short tail, and the wide lustrous borders which surround all the feathers of the mantle. The colour of the upper parts is brown lightly shot with greenish; that of the lower parts is ashy-brown more or less whitish.

The bill of this species is very slender, 2 inches 4 lines long, and longer than the head. Tail very short, composed of twelve feathers. (Temm.)

It is probable that *P. Desmarestii* is identical with *P. cristatus*.

The habits of *P. cristatus* are very similar to those of *P. Carbo*. The nest is placed in clefts and on ledges of cliffs. Mr. Selby found that it was composed of a mass of sea-weed, chiefly *Fucus vesiculosus*, and that the eggs, four or five in number, were smaller than those of *P. Carbo*, but similar to them in outward appearance.

This bird is found in the whole of the north of Europe; it is very common in Iceland, the Orkneys, Feroe Islands, Norway, and Sweden, in the vicinity of great lakes. To these localities must be added the

Mediterranean, if M. Temminck be right in considering *P. Desmarestii* and *P. cristatus* identical.

Plotus (Linn., Klein).—Bill longer than the head, quite straight, firm though slender, obliquely dentilated on the edges, which are bent inwards, and terminating in a very sharp point; face and throat naked; nostrils linear. Feet short and robust. Wings short; second, third, and fourth quills longest; tail very long, the feathers stiff and elastic.

This is the genus *Anhinga* of Brisson; *Plottus* of Scopoli; and *Ptinx* of Mœhr.

Species of *Plotus*, or Darter, as it has been called by English and American ornithologists, are found in the Old and New Continents.

These extraordinary birds are well described by Buffon when he says, "the Anhinga offers us a reptile grafted on the body of a bird." Those who have seen the long neck, and that only, issuing from the water, twisting about among the herbage and among the foliage, say that a casual observer might well take it for a snake. Vaillant states that the neck of the species seen by him in Africa was always in oscillation when the bird was perched; and that any one who saw its tortuous movements among the foliage, the body being concealed, would take it for one of the tree-serpents. The form indeed was considered by the older voyagers as a monster partaking of the nature of the snake and the duck; and Wilson states that in some ancient charts which he had seen, the creature was delineated with all the extravagance of fiction. In flight the neck is stretched out, immoveable, in a line with the body.

P. Levaillantii (*P. Africanus* of Swainson). Nuptial Plumage.—Bill yellow; feet yellow; all the upper part of the head and back of the head brick-red, bordered with a riband of black which descends to the shoulders; forehead, cheeks, and sides of the neck pure white; throat and anterior part of the neck pale ochraceous-yellow; breast and all the under parts of the body deep black with greenish reflections; the lower part of the neck above the back reddish and ocellated with white; the whole of the mantle and the small coverts brown, with the middle of each feather of a bright rusty colour; tail-feathers and quills brown, some of the latter terminated with rust-colour.

Plotus Levaillantii.

Le Vaillant, in his usual lively style, relates how he was induced to visit a rich proprietor in the fertile canton of the Twenty-Four Rivers to the north-east of Swartland, South Africa, after he had determined on not stopping, by the tempting description of two extraordinary birds which habitually haunted the vicinity of this propietor's habitation, and which, from the description, he knew must be Anhingas. They frequented a particular tree, and baffled him more than once; at length he got within shot, and killed them both, right and left. His Hottentots called them Slange-Hals-Voogel (Bird with a Serpent's Neck). He describes them as diving ("entre deux eaux") for fish: when they caught a small one it was swallowed whole; when they captured a large one it was carried to a rock or the trunk of a tree, and the bird, fixing it beneath its feet, picked it to pieces with its bill. Though the water is their favourite element, it is upon trees or rocks, he tells us, that it establishes its nest and brings up its young, taking care to place it so that they may be easily precipitated into the river as soon as they are able to swim, or whenever the safety of the little family requires it. He describes it as most difficult of approach, especially when swimming, and when nothing but the head is to be seen; the instant the flint struck the steel the bird dived, and often when it was looked for a-head it had doubled back in its diving, and then took wing far behind the sportsman. It is found in Senegal, Cape of Good Hope, and part of the coasts of Asia. (Lesson.)

P. Anhinga (*P. Americanus*, Sowerby). Male.—Bill 3¾ inches long, rather slender, very sharp pointed, and armed with numerous sharp teeth towards the tip, for the securing its prey; black above, yellow below; bare space round the eye and pouch under the chin yellow; slit of the mouth extending beyond the eyes; irides vivid red; head, neck, and all the lower parts black glossed with dark green; side of the neck, from the eye backwards for more than half its length, marked by a strip of brownish-white, consisting of long hair-like tufts of plumage extending an inch beyond the common surface, resembling the hair of callow young; a few small tufts on the crown; the whole upper parts black, marked in a very singular and beautiful manner with small oval spots and long pointed streaks of limy-white which has the gloss of silver in some lights; middle of the back, primaries,

Plotus Anhinga, male.

Plotus Anhinga, female. (Wilson).

secondaries, rump, and tail-coverts, plain glossy black; on the upper part of the back the white is in very small oval spots lengthening as they approach the scapulars and tertials, on the latter they extend the whole length of the feathers, running down the centre (these are black shafted); the wings long and pointed; lesser coverts marked on every feather with an oval or spade-shaped spot of white; greater coverts nearly all of a limy-white; tail long, rounded, and exceedingly stiff, consisting of 12 broad feathers, the exterior vanes of the four middle ones curiously crimped, the whole black and broadly tipped with dirty brownish-white; thighs black; legs scarcely an inch and a

half long; feet webbed, all the four toes united by the membrane, which is of uncommon breadth; exterior toe, the longest, 3 inches; claws horn-colour, strong and crooked, inner side of the middle one pectinated; legs and feet yellow. All the plumage very stiff and elastic; that of the neck and breast thick, soft, and shining. Length 9 feet 3 inches.

Female.—Differs in having the neck before of a roan colour or iron-gray, the breast the same, but lighter and tinged with pale chestnut; belly as in the male—where the iron-gray joins the black on the belly, there is a narrow band of chestnut; upper head and back of the neck dark sooty-brown streaked with blackish; cheeks and chin pale yellow-ochre; in every other respect the same as the male, except in having only a few slight tufts of hair along the side of the neck; tail 12 inches long to its insertion, generally spread out like a fan, and crimped, like the other, on the two outer vanes of the two middle feathers only. Length 3 feet 5 inches. (Wilson.)

"Here is in this river (St. Juan, East Florida) and in the waters all over Florida," says Bartram, speaking of this species, "a very curious and handsome bird; the people call them snake-birds; I think I have seen paintings of them on the Chinese screens and other Indian pictures; they seem to be a species of Colymbus, but far more beautiful and delicately formed than any other that I have ever seen. They delight to sit, in little peaceful communities, on the dry limbs of trees hanging over the still waters, with their wings and tails expanded, I suppose to cool and air themselves, when at the same time they behold their images in the watery mirror. At such times, when we approach them, they drop off the limbs into the water as if dead, and for a minute or two are not to be seen; when on a sudden, at a great distance, their long slender head and neck appear, like a snake rising erect out of the water; and no other part of them is to be seen when swimming, except sometimes the tip end of their tail. In the heat of the day they are seen in great numbers, sailing very high in the air over lakes and rivers. They inhabit the waters of Cape Fear River, and, southerly, East and West Florida."

Mr. Abbot, of Georgia, who agrees with Wilson in opinion that *P. Anhinga* is the female of the Black-Bellied Darter, gives its length as 36 inches, extent 46 inches.

It is found in the Carolinas, Georgia, and the Floridas; common in Brazil and Guyana.

Fregata (Ray).—Bill long, robust, trenchant, depressed at the base, widened on the sides, with a suture above, the mandibles very much hooked at the point, and the gape very wide: nostrils linear; orbits naked; throat dilatable. Wings very long and very narrow, first two quills very long. Feet short; the toes united by a membrane which is deeply notched. This is the genus *Tachypetes* of Vieillot.

The Man-of-War Birds, or Frigates, are eminently raptorial. Ray speaks of their eagle-eye, vulturine claws, and kite-like glidings. Their immense extent of wing and dashing habits have obtained for them the name of the swiftest sailing ships of war that sweep the seas.

F. Aquilus. Tail forked, body black, bill red, orbits black. The male is entirely black: abdomen of the female white. Some accounts state the extent of the wings to be fourteen feet, an almost incredible expanse.

Frigate or Man-of-War Bird (*Fregata Aquilus*); the gular pouch not dilated.

Sloane, who saw them at Jamaica, describes them under the name of Men-of-War Birds, as appearing in the bay near Port Royal. "They fly," says he, "like kites, look black, are very large winged in proportion to their body; they fight with sea-gulls (which are to be found here, and are like ours) for their prey." It is however but an unequal fight, for the poor gull has not much chance when opposed to the swoop of the Frigate. [Booby.]

The nest is said to be built on rocks in small desert islands, on lofty cliffs, or in high trees in retired situations near the sea. The eggs are stated to be one or two in number, and to be of carnation tinge and dotted with crimson. The newly hatched young are said to be covered with a gray down.

This bird is very common on the intertropical American coasts, and in the Atlantic and Pacific oceans, but always within reach of land.

PELECANOIDES. [Procellaridæ.]

PELECANUS. [Pelecanidæ.]

PELICAN. [Pelecanidæ.]

PELLORNEUM. [Merulidæ.]

PELOCONITE, a Mineral which occurs amorphous. Fracture conchoidal. Hardness 3. Brittle. Colour bluish-black. Streak liver-brown. Lustre vitreous, dull. Opaque. Specific gravity 2·567. Soluble in hydrochloric acid; the solution contains phosphoric acid, iron, manganese, and copper. It is found in Chili.

PELO'RIS, synonymous with *Ostrea*. [Pectinidæ.]

PELORONTA. [Neritidæ.]

PELTOCARIS. [*See* Supplement.]

PELVIS. [Man; Skeleton.]

PENÆACEÆ, *Sarcocollads*, a small natural order of Perigynous Exogenous Plants. These plants are shrubs with opposite imbricated exstipulated leaves. The flowers are apetalous, the ovary composed of four carpels, the calyx tubular. Lindley places this order in his Rhamnal alliance, and points out its relations with *Proteaceæ* and *Bruniaceæ*. The species are mostly natives of the Cape of Good Hope. A viscid sweetish nauseous gum-resin, called Sarcocol, is produced by various species. This substance contains a peculiar principle called Sarcocollin, which is converted into oxalic acid by the addition of nitric acid. Although Dr. Lindley has named these plants Sarcocollads, he is inclined to doubt, with Endlicher, if this order really produces Sarcocol at all; and suggests that it is produced, as Sagapenum and Galbanum, by a species of the order *Umbelliferæ*. The genera are *Penæa*, *Sarcocolla*, and *Geisoloma*. There are 21 species. (Lindley, *Vegetable Kingdom*.)

PENÆUS. [Palemonidæ.]

PENELOPE. [Cracidæ.]

PENE'ROPLIS (De Montfort). [Foraminifera.]

PENGUINS (Manchots of the French), a group of Natatorial Birds, in which the wing, powerless as an organ of flight, is reduced to a mere rudiment as far as feathers are concerned; but it well assists the bird as a species of fin in its rapid divings and evolutions under water, and even as a kind of anterior extremity when progressing on the land. They seem to be among the *Natatores* what the *Struthionidæ* are among the strictly terrestrial birds.

The Penguins occupy in the southern hemisphere the place filled by the Auks in the northern portion of the globe.

The habits of these birds are highly interesting, and have been described by many travellers. Le Vaillant found in Dassen Island that the smaller crevices of the rocks served as places of retreat for Penguins (*Spheniscus*, probably), which swarmed there above every other kind. "This bird," he says, "which is about two feet in length, does not carry its body in the same manner as others: it stands perpendicularly on its two feet, which gives it an air of gravity, so much the more ridiculous, as its wings, which have no feathers, hang carelessly down on each side: it never uses them but in swimming. As we advanced towards the middle of the island, we met innumerable troops of them. Standing firm and erect on their legs, these animals never deranged themselves in the least to let us pass."

Sir John Narborough says of the Patagonian Penguins, that their erect attitude and bluish-black backs contrasted with their white bellies might cause them to be taken at a distance for young children with white bibs. The towns, camps, and rookeries, as they have been called, of these birds, have proved an ample theme for most of the southern voyagers. Those at the Falkland Islands have attracted particular attention. Some of these assemblies are described as giving a dreary, not to say awful impression of the desolation of the place and the utter absence of the human race. In some of the towns, it is stated, there was a general stillness, and when the intruders walked among the feathered population, to provide themselves with eggs, they were regarded with side-long glances, but they seemed to carry no terror with them. In many places the shores are covered with these birds, and 300 have been taken within an hour; for they generally make no effort to escape, but stand quietly by whilst their companions are knocked down with sticks till it comes to their turn. Cook, speaking of two islands in the high latitudes of the south, describes the cold as intense; the islands were covered with hoar-frost and snow, neither trees nor shrubs appeared, and he saw no living creature except the Shags and Penguins, the last being so numerous that they seemed to encrust the rock.

Some describe the rookeries as designed with the utmost order and regularity, though they are the resort of several different species. A regular camp, often covering three or four acres, is laid out and levelled, and the ground disposed in squares for the nests, as accurately as if a surveyor had been employed. Their marchings and counter-marchings are said to remind the observer of the manœuvres of soldiers on parade. In the midst of this apparent order there appears to be, according to the same accounts, not very good government, for the stronger species steal the eggs of the weaker, if they are left unguarded, and the King Penguin (*Aptenodytes Patachonica*) is the greatest thief

of all. Three species are stated to be found in the Falkland Islands. Two of these, the King and the Macaroni (*Aptenodytes chrysocome*) deposit their eggs in these rookeries. The Jackass (*Aptenodytes demersa*), which is the third, obtaining its English name from the horrible brayings which it sets up at night, makes its nest in burrows on downs or sandy plains, and does not seem to take invasion so quietly as the other species.

But the dimensions of the rookeries above noticed sink into insignificance when compared with a settlement of the King Penguins (*Aptenodytes Patachonica*) recorded by Mr. G. Bennett, who saw at the north end of Macquarrie Island, in the South Pacific Ocean, a colony of those birds which covered an extent of thirty or forty acres. He describes the number of Penguins collected together in this spot as immense; but observes that it would be almost impossible to guess at it with any near approach to truth, as, during the whole of the day and night, 30,000 or 40,000 are continually landing, and an equal number going to sea. "They are arranged, when on shore, in as compact a manner and in as regular ranks as a regiment of soldiers; and are classed with the greatest order, the young birds being in one situation, the moulting birds in another, the sitting hens in a third, the clean birds in a fourth, &c.; and so strictly do birds in similar condition congregate, that should a bird that is moulting intrude itself among those which are clean, it is immediately ejected from them. The females hatch the eggs by keeping them close between their thighs; and if approached during the time of incubation, move away, carrying their eggs with them. At this time the male bird goes to sea and collects food for the female, which becomes very fat. After the young is hatched, both parents go to sea, and bring home food for it; it soon becomes so fat as scarcely to be able to walk, the old birds getting very thin. They sit quite upright in their roosting-places, and walk in the erect position until they arrive at the beach, when they throw themselves on their breasts, in order to encounter the very heavy sea met with at their landing-place."

Mr. Bennett mentioned several instances of the appearance of Penguins at a considerable distance from any known land. They generally however indicate its neighbourhood. ('Zool. Proc.,' 1840.)

Captain Fitz-Roy gives the following interesting account of the mode in which Penguins feed their young. The species on which he made his observations at Noir Island was probably the Jackass Penguin:—

"Multitudes of Penguins were swarming together in some parts of the island, among the bushes and 'tussac' (thick rushy grass) near the shore, having gone there for the purpose of moulting and rearing their young. They were very valiant in self-defence, and ran open-mouthed, by dozens, at any one who invaded their territory, little knowing how soon a stick would scatter them on the ground. The young were good eating, but the others proved to be black and tough when cooked. The manner in which they feed their young is curious and rather amusing. The old bird gets on a little eminence and makes a great noise (between quacking and braying), holding its head up in the air, as if it were haranguing the penguinnery, while the young one stands close to it, but a little lower. The old bird, having continued its clatter for about a minute, puts its head down and opens its mouth widely, into which the young one thrusts its head, and then appears to suck from the throat of its mother for a minute or two, after which the clatter is repeated, and the young one is again fed; this continues for about ten minutes. I observed some which were moulting make the same noise, and then apparently swallow what they thus supplied themselves with; so in this way, I suppose, they are furnished with subsistence during the time they cannot seek it in the water." ('Voyages of the Adventure and Beagle,' King.)

Mr. Darwin pleasantly relates his encounter with one of these birds on the Falkland Islands. "One day," says our voyager, "having placed myself between a Penguin (*Aptenodytes demersa*) and the water, I was much amused by watching its habits. It was a brave bird; and, till reaching the sea, it regularly fought and drove me backwards. Nothing less than heavy blows would have stopped him; every inch gained he firmly kept, standing close before me, erect and determined. When thus opposed, he continually rolled his head from side to side, in a very odd manner, as if the power of vision only lay in the anterior and basal part of each eye. This bird is commonly called the Jackass Penguin, from its habit, while on shore, of throwing its head backwards, and making a loud strange noise, very like the braying of that animal; but while at sea and undisturbed, its note is very deep and solemn, and is often heard in the night-time. In diving its little plumeless wings are used as fins; but on the land as front legs. When crawling (it may be said on four legs) through the tussocks, or on the side of a grassy cliff, it moved so very quickly that it might readily have been mistaken for a quadruped. When at sea, and fishing, it comes to the surface, for the purpose of breathing, with such a spring, and dives again so instantaneously, that I defy any one at first sight to be sure that it is not a fish leaping for sport." ('Voyages of the Adventure and Beagle;' Darwin, 'Researches in Geology and Natural History.')

Bougainville endeavoured to bring home a penguin alive. It became so far tame that it followed the person who fed it; it ate bread, flesh, or fish; but its fare appears to have been insufficient or inappropriate, for it fell away and died.

An elaborate dissection of an adult male Patagonian Penguin (*Aptenodytes Patachonica*, Forster), the total length of which, measured over the back, was 3 feet 2 inches 6 lines, is given by Mr. Reid in the 'Zoological Proceedings' for 1835. The specimen was captured at East Falkland Island, in 51° 32′ S. lat.

Mr. Reid describes the bones as very hard, compact, and heavy, having no apertures for the admission of air; but they contain, especially the bones of the extremities, a thin oily marrow.

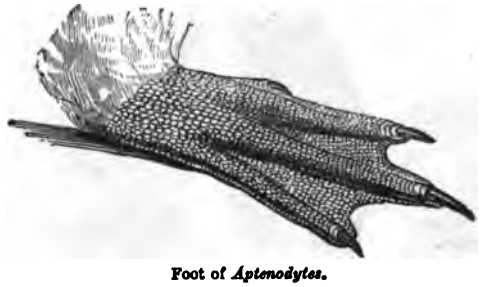
The muscles were of a dark red colour, very tough, and having a great deal of cellular membrane amongst them. The fascise were very thick and strong. In no instance did Mr. Reid observe any tendency to ossification in the tendons. In the tendons of the perforatus of the first and second toes there was a sesamoid bone, scarcely equalling in size a mustard-seed.

The sensations of these curious birds do not seem to be very acute. Sparrman relates that he stumbled over a sleeping one and kicked it some yards without disturbing its rest; and Forster states that he left a number of them apparently lifeless, while he went in pursuit of others; but they afterwards got up and marched off with their usual gravity.

In the arrangement of these birds Mr. Vigors places them with the *Alcadæ*, which also include *Uria*. [Guillemots; Auk.] Mr. Vigors observes that the groups composing the *Alcadæ* are characterised by having no hind toe, and passes from them to the *Pelecanidæ* by means of *Aptenodytes*. [Pelecanidæ.]

Head of *Aptenodytes*.

Mr. Swainson observes that the hind toe in the Penguins and Cormorants is placed almost as forward as in the swifts. In the Penguin the tarsus is so short as almost to be confounded with the sole of the foot; and it is probably rested upon the ground for its whole length when the bird walks, just as in the bear and other plantigrade quadrupeds; it is also, he adds, remarkably broad; the hind toe is placed in front, and on the inner margin; but it is so unusually small that, but for its short but well-defined claw, it would not be perceived. This claw is without any vestige of a web, or of a lobe, and is quite disconnected from the others; of the three anterior toes the middle is the longest, the outer rather less, and the inner the shortest. The whole foot is remarkably flattened, as if to enable the bird to cover a greater breadth of ground. ('Classification of Birds,' vol. i.)



Foot of *Aptenodytes*.

The *Alcadæ* of Mr. Swainson consist of the genera *Uria*, *Alca*, *Mormon*, *Chimerina* (Esch.), *Phaleris*, and *Aptenodytes*. The family is placed between the *Colymbidæ* and the *Pelecanidæ*.

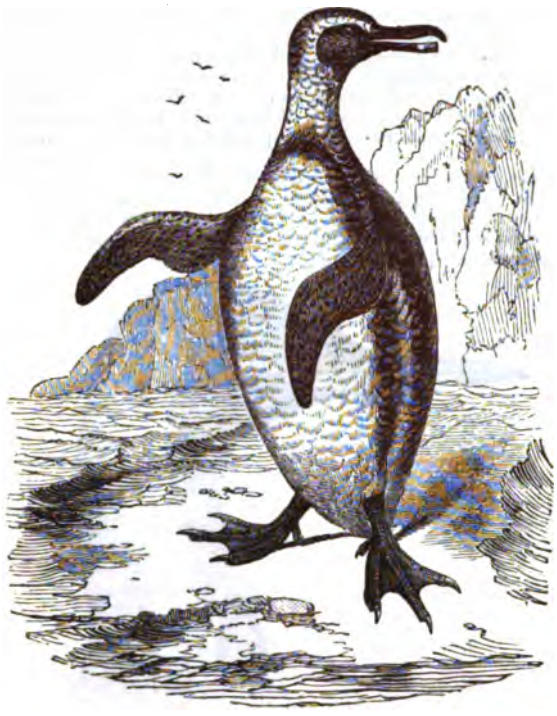
According to Mr. G. R. Gray, the genera of the *Alcadæ* are subdivided into the sub-families *Alcanæ*, *Phalerinæ*, *Spheniscinæ*, and *Urianæ*.

The *Spheniscinæ* comprehend the genera *Spheniscus*, Brisson; *Eudyptes*, Vieillot; *Pygoscelis*, Wagler; and *Aptenodytes*, Forster. ('List of the Genera of Birds,' 1840.) Specimens of each of these genera are to be seen in the British Museum.

Spheniscus (Brisson).—Bill compressed, straight, irregularly furrowed at the base; end of the upper mandible hooked, that of the lower mandible truncated; nostrils median and exposed. Wings not adapted for flight.

S. demersus (*Aptenodytes demersa*, Gmelin). Bill and feet black; the former with a yellowish transverse band near the apex; eyebrows and pectoral band white; body above black or black-speckled; white beneath.

This bird is found in the South Seas—Atlantic and Antarctic; and in great abundance at the Falkland Islands and Cape of Good Hope.



Spheniscus demersus.

Eudyptes, Vieillot (*Catarrhactes*, Brisson).—Bill straight at the base, compressed, furrowed obliquely, pointed, rounded above, upper mandible hooked, lower mandible rounded or truncated at the point; a furrow originates from the nostril, and terminates at the lower third of the border. Wings reduced to rudiments, not adapted for flight.

Crested Penguin (*Eudyptes chrysocome*).

E. chrysocome (*Aptenodytes chrysocome*, Gmelin), the Crested Penguin of Latham, Manchot Sauteur of Bougainville and Buffon. Bill reddish-brown; frontal crest, consisting of very narrow loose feathers, black and erectile; auricular band deflected, sulphureous. Body, above bluish-black, below velvety-white; wings black above, white below; feet yellowish.

M. Lesson has given a good account of its habits, as well as of those of other allied species, in the 'Zoologie de la Coquille.' He states that it lives in all the seas of the southern hemisphere, far from the land; for he killed individuals in 48° 8′ 38″ S. lat., 56° 56′ 49″ W. long., voyaging in couples, doubtless male and female.

Aptenodytes (Forster).—Bill longer than the head, slender, straight, bent at the point; both mandibles equally pointed, rather obtuse; the upper mandible furrowed throughout its length; the lower mandible largest at the base, and covered with a naked smooth skin; nostrils linear, hidden by the frontal feathers. Feet short and stout; toes directed forwards; great toe very short. Wings featherless, reduced to rudiments or winglets covered with hair-like feathers.

A. Patachonica. Lower half of the demi-bill red; head and throat covered with very black feathers; a yellow orange band, widest towards the occiput, occupies each side, to unite upon the breast, and separate the black of the throat from the gray-ash which covers the back; the feathers of the belly have the whiteness and lustre of satin, and a yellow tint more and more deepened mingles in it towards the upper part of the breast; two bands of deep black occupy the sides; toes strong and robust; wings more elongated than in the other penguins. Height, when erect, upwards of three feet.

It is found in the southern hemisphere in high latitudes, Strait of Magalhaens, Falkland Islands, Antarctic Islands, &c. Weddell ('Voyage to the South Pole') gives a highly interesting account of the habits of this species.

Aptenodytes Patachonica.

The type of the genus *Pygoscelis* of Wagler is *Aptenodytes Papua* of Gmelin, an inhabitant of Papua, or New Guinea, among other localities.

PENICILLIUM. [Mouldiness.]

PENICILLUS (Linnæus), a name for some forms of Corallines. [Corallinaceæ.] It is now applied to a genus of *Confervaceæ*.

PENNATULA. [Polypifera.]

PENNATULARIA. [Polypifera.]

PENNINE, a Mineral belonging to the Hydrous Silicate of Magnesia series. It is near Chlorite, and occurs in hexagonal tables. It is found in the Pennine Alps.

PENNY-CRESS. [Thlaspi.]

PENNYROYAL. [Mentha.]

PENNYWORT. [Hydrocotyle.]

PENTACRINUS. [Encrinites.]

PENTACTÆ, a sub-family of *Holothuriadæ*, a family of *Echinodermata*. [Holothuriadæ; Echinodermata.] It includes the genera *Psolinus*, *Cucumaria*, and *Ocnus*.

Psolinus (Forbes) has an irregular ovate body, arcuated with five rows of distant suckers, those below always bent; tentacula ten; dental apparatus short, truncate; no gizzard.

P. brevis, of Forbes and Goodsir, is the only species. It was discovered in the Shetland seas, adhering to the stems of *Laminariæ*. It links the family of *Psolidæ* with *Pentactæ*. It is about half an inch in length, of an ovate form, with both its extremities bent upwards. The body is pinkish-white, with minute papillæ. The tentacula are long, pedicled, and digitate at the extremity. It is sluggish in its movements, but moves its tentacula freely.

Cucumaria has the body regular, more or less pentangular, with five longitudinal rows of approximate suckers; ten tentacula; dental apparatus composed of nearly square plates.

The species are called Sea-Cucumbers. They are the most typical of the *Holothuriadæ*, and their popular name is very expressive of their usual form. They have all of them the power of changing their shape, so that sometimes they are very long, and others are oval or round. They usually live among sea-weeds or in mud, and are supposed to seize their prey by their large tentacula. They are found very generally throughout the seas of the globe. The following are the British species described by Professor E. Forbes in his 'History of British Star-Fishes':—

C. frondosa (*Holothuria frondosa*, Gunner), the Great Sea-Cucumber. It has been principally found off the coasts of Scotland.

C. pentactes (*Holothuria pentactes*, Müller), the Angular Sea-Cucumber. It has been taken on the coasts of Devonshire and Dorsetshire, and is found in the seas of France and Norway.

C. communis, Common Sea-Cucumber. Great numbers of these animals have been observed off the coast of Fifeshire, and been dredged in the north and south of Ireland, by Mr. W. Thompson and Dr. Ball.

C. fusiformis, the Long Sea-Cucumber. This is the longest of all the species in proportion to its thickness.

C. hyalina, the Glassy Sea-Cucumber. It is remarkable for its hyaline glassy appearance. It inhabits the Shetland seas.

C. Drummondii. This species was named after Dr. Drummond, who discovered it in Belfast Bay.

C. Hyndmanni is named after Mr. Hyndman, who dredged it in Belfast Bay. It has been since taken in large numbers off the western coast of Ireland.

C. fucicola, the Tangle Sea-Cucumber. It has been found in the Shetland seas.

Ocnus (Forbes and Goodsir) has the body regular, cylindrical, pentagonal, with five rows of distant suckers on the angles; tentacula ten; dental apparatus very short.

Professor E. Forbes describes two species of this genus, which he calls, on account of its size as compared with the Sea-Cucumber, the Sea-Girkin. The two British species are *O. brunneus* and *O. lactea*, distinguished by their colour, the latter being milk-white, the former brown.

PENTADESMIS, a genus of Plants belonging to the natural order *Clusiaceæ*. *P. Butyracea* is a tree found in Sierra Leone, from which a fatty substance is obtained, which has given rise to its name of the Butter-Tree and Tallow-Tree. It has an ovate fleshy fruit, about as large as a citron, and its stamens are collected into five parcels, whence its botanical name.

PENTALASMIS. [Cirripedia.]

PENTAPLATARTHRUS. [Paussidæ.]

PENTREMITES. [Encrinites.]

PEONY. [Pæonia.]

PEPO, a kind of fruit of which the Gourd is the type. It has an inferior seed-vessel, filled with pulp inclosed within a hard pericarp, and furnished with parietal placentæ. [Fruit.]

PEPPER. [Piper.]

PEPPERMINT. [Mentha.]

PEPPER-MOTH. [Biston.]

PEPSIN, a substance found in the gastric acid of man and the lower animals. If the glandular portion of the stomach is treated with extremely dilute acids a substance is thrown down from the fluid by corrosive sublimate, which Schwann first called Pepsin. Wasmann afterwards obtained pepsin in a purer form. He proceeded in the following manner:—The glandular layer in the stomach of the pig, which extends chiefly from the greater curvature towards the cardia, was carefully detached and washed, without being cut up, then digested with distilled water at a temperature of from 30° to 35°. After some hours the fluid was poured away, the membrane was again washed in cold water, and then digested in the cold with about six ounces of distilled water, and repeatedly washed, till a putrid odour began to be developed. The filtered fluid was transparent, viscid, and without any reaction; it was now precipitated with acetate of lead or corrosive sublimate; the precipitate was carefully washed and decomposed with sulphuretted hydrogen; the pepsin was then precipitated by alcohol from the watery solution in white flocks.

The pepsin thus obtained, forms, when dry, a yellow, gummy, slightly hygroscopic mass; in its moist state it is white and bulky; it dissolves readily in water, and always retains a little free acid so as to redden litmus; it is precipitated by alcohol from its watery solution; mineral acids induce a turbidity in a solution of neutralized pepsin, which disappears on the addition of a small excess of the acid; but if there be a considerable excess of the acid, there is a flocculent deposit. It is only imperfectly precipitated by metallic salts, and not at all by ferrocyanide of potassium. It has been asserted that pepsin is coagulated by boiling, but Frierichs has shown that the coagulation is merely dependent on its admixture with albumen. This substance possesses the converting power so strong that, according to Wasmann, a solution containing only 1-60,000th part of this substance dissolved albumen in six or eight hours. Similar experiments have been made by Pappenheim, Valentin, and Elsasser.

C. Schmidt has proposed a new view with regard to the nature of the digestive principle. He regards it as a conjugated acid, whose negative constituent is hydrochloric acid, with Wasmann's non-acid, or coagulated pepsin, as an adjunct; and assumes that it possesses the property of entering into soluble combinations with albumen, glutin, chondrin, &c. According to him, it more nearly resembles ligno-sulphuric acid than any other conjugated acid, and as this becomes disintegrated into dextrin and sulphuric acid, so the pepsin-hydrochloric-acid becomes separated at 100° into Wasmann's coagulated pepsin and hydrochloric acid, and in either case it is equally impossible to reproduce the conjugated acid from its proximate elements after their separation. On bringing the complex acid in contact with an alkali, the adjunct—the substance which has been in combination with the hydrochloric acid—is precipitated. Schmidt believes that he has ascertained that an artificial digestive mixture which has expended its solvent and digestive powers, regains them on the addition of free acid; and that when hydrochloric acid is added, the pepsin-hydrochloric-acid is expelled from its combination with albumen, &c., and thus regains its former properties, while the newly added hydrochloric acid enters into its well-known soluble combinations with albumen, &c. By the repeated addition of hydrochloric acid, a digestive fluid or this pepsin-hydrochloric-acid might preserve its digesting power for ever, unless the fluid became saturated with the dissolved substances, or the conjugated acid underwent decomposition.

(Lehmann, *Physiological Chemistry*, translated for the Cavendish Society.)

PERAMELES. [Bandicoot; Marsupiata.]

PERCH. [Percidæ.]

PERCIDÆ, or *Percoides* of Cuvier, a family of Acanthopterygious Fishes, of which the Common Perch may be regarded as the type. They have the body covered with scales whose outer surface is more or less rough, and the free margins of which are denticulated; the operculum and preoperculum are variously armed with spines, and denticulated at the outer margin; they not only have teeth in both jaws, but the vomer and palatine bones are also furnished with them: the number of rays to the branchiostegous membrane varies from five to seven; they never fall short of the lower nor exceed the higher number. The flesh of these fishes is generally well-flavoured and wholesome. They inhabit both salt and fresh water.

The first division of the Percoides, according to Cuvier, comprises all those species which have the ventral fins placed under the pectorals, five soft rays to the pectoral fins, seven branchiostegous rays, and two dorsal fins. This section includes the following genera:—

1. *Perca* proper, in which the preoperculum is denticulated; the operculum is produced behind into a flattened spine; the infra-orbitals are obscurely denticulated, and the tongue is smooth. The Common Perch (*Perca fluviatilis* of Linnæus) is the best example. It is a common fish in the fresh-waters of Great Britain. Closely allied to this is the *P. Italica* of Cuvier and Valenciennes, a species found in tolerable abundance in some parts of Italy; it differs from the *Perca fluviatilis* in being of a shorter and deeper form, and is destitute of the black bands. Several true perches are found in North America; species have also been discovered in Java and New Zealand: it is highly probable therefore, from the extensive geographical range of the Perches proper thus exhibited, that very many species still remain to be discovered.

2. *Labrax* (Cuv. and Val.) differs chiefly from the true Perches in having the infra-orbitals destitute of denticulations as well as the suboperculum; the operculum (which, as well as the preoperculum, is entirely covered with scales) has two spines on the posterior part, and the tongue is furnished with minute teeth. [Labrax.]

3. *Lates* (Cuv. and Val.), a genus also closely allied to *Perca* proper, in fact differs only in having the infra-orbitals more deeply denticulated as well as the humerals; large spines are observable on the angle of the preoperculum; the anterior dorsal is shorter and higher than in the Perch; the tongue is smooth, as in the last-mentioned fish. The fishes of this sub-genus are usually of large size, good eating, and are chiefly found in the rivers in the warmer parts of the Old World.

4. *Centropomus* (Lacép.) includes those perch-like fishes whose operculum is produced behind, but the produced part is rounded at the apex; in the fins and denticulated preoperculum they resemble the perch. In the only species of this genus hitherto discovered the head is more pointed than in the preceding genera. [Centropomus.]

5. *Leucioperca* (Cuv. and Val.) differs from both the preceding genera in having larger sharply-pointed teeth intermixed with the ordinary small teeth; the form of the body is more elongated, and the first dorsal fin is large. The *L. Sandra* (Cuv. and Val.) is found in the rivers and lakes of the north-eastern portions of Europe, and is known to the Germans by the names of Sander, Sandel, or Sandat; it is the

Schil of the Austrians, and the Nagmaul of the Bavarians. A second species, the *L. Volgensis* of Gmelin, inhabits the rivers of Russia, and a third is found in the United States.

6. *Huro* (Cuv. and Val.).—This genus is founded on a fish described by Sir John Richardson, which, with most of the essential characters of the perches, differs in having the opercula simple, a character in fact not found in either of the other genera here described. The species alluded to inhabits Lake Huron, and is called by the inhabitants the Black Bass: it is one of the best-flavoured fishes of that lake.

7. *Etelis* (Cuv. and Val.).—In this genus, as in *Leucioperca*, there are larger teeth intermixed with the ordinary minute ones, but here the larger teeth are confined to the jaws, and are not found intermixed with the palatine teeth, as in *Leucioperca;* the operculum is terminated by two spines, whilst in the genus just mentioned it is simple. Only one species of *Etelis* is known; its body is elongated, the muzzle is rather obtuse, the eyes very large, and the outer rays of the tail-fin are elongated. This fish (the *E. carbunculus*, Cuv. and Val.) is also remarkable for its brilliant red colour, and is adorned with longitudinal golden stripes. It is found in the region of the Seychelle Islands, north of Madagascar.

8. *Niphon* (Cuv. and Val.).—This genus is founded on a single species found in the Japanese Sea, and is remarkable for the large spines with which the opercula are armed; the preoperculum is strongly dentated at its margin and furnished with a long and powerful spine at its angle, and the operculum has three of these large spines; the first dorsal is large, and its spinous rays are strong; the body is somewhat elongated, and the head is pointed. The authors last quoted apply to this species the name *N. spinosus.*

9. *Enoplosus* (Lacépède) is also founded upon a single species (from Australia) originally described in White's 'Journal of a Voyage to New South Wales,' in which work the fish is mistaken for a *Chætodon*, no doubt from its short, deep, and compressed form, and produced muzzle. Like the true Perches, it has two dorsal fins, but these are much extended in the vertical direction; the third ray of the first dorsal is very large and long, and the six anterior rays of the second dorsal are also much elongated; the infra-orbital is denticulated, and so is the preoperculum, which is moreover furnished with a strong spine; the operculum is simple, that is, destitute of spines. It is the *Enoplosus armatus* of Cuv. and Val., a fish of small size, being seldom more than 8 or 10 inches in length; the body is adorned with seven or eight black bands on a silvery ground; some of these bands however are abbreviated.

10. *Diploprion* (Kuhl and Van Hasselt), like the two preceding genera, contains but one species (*Diploprion bifasciatum* of the authors just quoted). This fish is of a short and high form, having a large head somewhat obtusely terminated in front; its colour is yellow; a broad black vertical mark runs through the eye, and a still broader band crosses the body. The infra-orbital is entire, the preoperculum is denticulated, and the operculum is armed with three strong spines. It is found off the coast of Java.

11. *Apogon* (Lacépède).—In this genus the first and second dorsal fins are small in antero-posterior extent, and widely separated; the general form of the body is ovate, but somewhat suddenly less deep behind the second dorsal; the head is without scales, large, and obtuse in front; the scales are very large, and easily dislodged; the preoperculum is denticulated. Many species of this genus inhabit the Indian seas, but that which is most generally known (the *A. rexmullorum*) is found in the Mediterranean. It is a small fish, rarely more than 5 or 6 inches in length, and of a golden-red colour, with a black spot on each side at the base of the tail-fin; there is also generally a spot of the same colour near each angle of this fin, another on the posterior dorsal, and a brown tint between the eye and the tip of the muzzle. Besides these larger blotches, the body is marked with minute black specks.

12. *Cheilodipterus* (Lacépède) has larger pointed teeth mixed with the ordinary ones; the preoperculum is denticulated, and the operculum is entire. [CHEILODIPTERUS.]

13. *Pomatomus* (Cuv. and Val.).—In this genus the dorsal fins are small in antero-posterior extent, and widely separated; the second dorsal fin and the anal fins are thick and covered with small scales; the body is somewhat elongated and thick; the head is large, and the eyes very large; the opercula are covered with scales; those on the body are large, and easily dislodged.

Only one species of this genus is known, the *Pomatomus telescopium* of Risso, and this is said to be exceedingly rare, living, it appears, in very deep water. Risso states that at Nice, where the species has been found, only two specimens were taken during thirty years. The individual from which Messrs. Cuvier and Valenciennes's description is taken was about 20 inches (French measure) in length. The colour of this fish is brownish-violet, with blue and reddish reflections. The authors just mentioned do not appear quite satisfied as to the true affinities of this genus.

14. *Ambassis* (Cuv. and Val.).—This genus is founded upon a small fish found off the coast of the Isle of Bourbon; its principal characters consist in the double series of denticulations on the lower portion of the pre-operculum, a denticulated infra-orbital, a protractile mouth, and a small decumbent spine in front of the first dorsal fin, the point of which is directed forwards. In the form of the body it approaches the common perch. It is the *A. Commersonii* (Cuv. and Val.): a second species is found off the Malabar coast, and there are several in the Indian seas, most of which are described by Hamilton in his 'Account of the Fishes found in the River Ganges and its Branches,' under the generic name *Chanda.*

15. *Aspro* (Cuv. and Val.).—The species of this genus have the body elongated, slender, and approaching to a cylindrical form; the eye is moderate, and placed in the upper part of the head; the muzzle is obtuse, and the mouth is rather small; the first and second dorsals are widely separated, and the ventral fins are large. Two species are known; one found in the Rhône, the Saône, and some other rivers of France, is about six or seven inches in length, of a reddish or yellowish brown colour, and has four black bands extending across the back. It is the *A. vulgaris* of Cuv. and Val., and *Perca aspera* of Linnæus. A second species of *Aspro* (the *A. Zingel* Cuv. and Val.), found in the Danube and its tributaries, attains a much larger size.

16. *Grammistes* (Cuv. and Val.).—The species composing this genus have small scales; their operculum and preoperculum are armed with spines, but not denticulated; the anal fin has no distinct spinous rays; the body is usually moderately deep, somewhat compressed, and suddenly less deep towards the tail; the head is moderately large, the eyes moderate, and the first and second dorsal fins are placed near each other.

The *G. orientalis* (Cuv. and Val.) is of small size; its colour is deep brown, and the head and body are adorned with numerous longitudinal white lines; the number of these lines, it would appear, varies in different individuals. It inhabits the Indian seas.

This genus terminates the first division of the *Percoides* of Cuvier and Valenciennes, a section sufficiently extensive both as to genera and species, and (if we except a few species) in all probability a natural one.

The second division comprises those species in which the first or spinous dorsal is united with the second or soft-rayed dorsal, so as to form one continuous fin, and is composed chiefly of the great genus *Serranus.* [SERRANUS.]

The third division embraces those Percoid Fishes which differ from the preceding in having less than seven branchiostegous rays. The principal genera contained in this division are noticed under the proper heads. Like the *Serrani*, they have the first and second dorsal fins united, but there is often a deep emargination between the spinous and soft-rayed portion.

The fourth division is composed of such species as have more than five soft rays to the ventral fins, and more than seven branchiostegous rays. It contains the following genera:—

1. *Myripristis* (Cuv. and Val.), or fishes having the above characters, combined with a short deep and somewhat compressed form of body, which is suddenly contracted near the tail, and furnished with large and strongly-serrated scales, the head large, the mouth also large, and the eye moderate; the preoperculum is denticulated, and the operculum is serrated, and produced into a strong and large spine; there is a strong spinous ray in front of the ventral fins, and three or four spines in front of the anal, one of which at least is large: the first and second dorsals are almost separated by a deep emargination. The species of this genus inhabit the tropical seas of both the old and new world, and are usually of small size, seldom exceeding seven or eight inches in length: their colouring is usually very brilliant.

2. *Holocentrum* (Cuv. and Val.).—This genus, like the last, contains fishes of very brilliant colouring, the prevailing hue being shades of red. It differs chiefly from *Myripristis* in having a strong spine on the angle of the preoperculum: the operculum is strongly serrated, and armed with large spines. The species are found in the seas of tropical climates.

3. *Beryx* (Cuv. and Val.).—In this genus there is no spine on the angle of the preoperculum, and it moreover has but one rather short dorsal fin, which is not emarginated. [BERYX.]

In this division Messrs. Cuvier and Valenciennes also place Dr. Shaw's genus *Trachichthys*, founded on a fish from the coast of Australia (*T. Australis*, Shaw), which apparently differs chiefly in having a double keel on the abdomen, which is strongly serrated; the preoperculum is armed with a spine.

In the fifth division of Percoid Fishes the ventral fins are placed in advance of the pectorals. It contains the genera *Trachinus, Percis, Pinguipes, Percophis,* and *Uranoscopus.*

In the sixth and last division the ventral fins are placed behind the pectorals. It comprises the genera *Sphyræna, Paralepis,* and *Polynemus.*

PERCNOPTERUS. [VULTURIDÆ.]

PERCOIDEÆ. [PERCIDÆ.]

PERDI'CIDÆ, the name of a family, or, according to some, a sub-family of *Tetraonidæ:* in the latter case the form should be *Perdicinæ.*

The genus *Perdix*, Briss., in Mr. Swainson's arrangement, is made to contain the sub-genera *Perdix* (Partridges); *Chætopus* (Francolins); *Coturnix* (Quails); *Ptilopachus*, Sw.; and *Ortyx*, Stephens.

The *Perdicinæ*, according to Mr. G. R. Gray's arrangement, form the first sub-family of the *Tetraonidæ*, and consist of the following genera:—*Ithaginis*, Wagler; *Francolinus*, Briss.; *Perdix*, Lath.; *Starna*, Bonap.; *Lerwa*, Hodgs.; *Arborophila*, Hodgs.; *Coturnix*, Briss.; *Ptilopachus*, Swains. [TETRAONIDÆ]; *Liponyx*, Vieill.; *Ortyx*, Stephens;

Lophortyx, Bonap.; *Callipepla*, Wagler; *Odontophorus*, Vieill.; and *Tetraogallus* (*Lophophorus* of Jardine and Selby), J. E. Gray.

The birds of this group are widely spread over the earth, no quarter of the globe being without some of the family, all of which are more or less esteemed as affording a nutritious and sapid food to man.

Perdix (Ray; *Starna*, Bonap.).—Bill short, strong, naked at the base; upper mandible convex, deflected towards the tip; nostrils basal, lateral, the orifice partly concealed by an arched naked scale; wings short, concave, rounded in form; the first three feathers shorter than the fourth or fifth, which are the longest in the wing; tail of fourteen or eighteen feathers, short.

P. cinerea; *Starna cinerea*, Bonap. This well-known object of every European partridge-shooter is too familiar to require description.

It is the Perdice, Pernisette, Pernigona, and Starna, of the Italians; Perdris, Perdris Gringette, Perdris Griesche, Perdris Grise, Perdris Gouache, and Perdris des Champs, of the French; Rebhuhn of the Germans; Coriar of the Welsh; Partridge of the English.

Mr. Gould (and he is corroborated by other authors) considers this species as strictly European, though M. Temminck speaks of it as a visitor to Egypt and the Barbary coast.

The ardent temperament of the Partridge has been the theme of many writers on natural history from Pliny downwards, and the parental affection of the female for her young seems to be not less strong than the sexual ardour of the male. The rough nest, which is placed on the ground in corn-fields, meadows, &c., contains from twelve to eighteen or even twenty eggs of a greenish ash-colour; and the hen sits so close that her head not unfrequently falls before the scythe of the mower, as represented in one of Bewick's admirable cuts. To relate all the anecdotes of the maternal affection of this bird would be endless—and indeed the male watches over the young with paternal care: one or two must suffice. Pennant records a strong instance:—A partridge, followed by a large covey of very young birds, was surprised by a violent shower of rain. "She collected them under her," says Pennant, "and to secure them further, spread her wings to prevent every injury. In vain! The storm increased, yet she would not quit her charge; she preferred death, and we found her lifeless (with all the little brood) with distended wings, retaining her attempt to preserve them even to the very article of death." Mr. Selby relates that a person engaged in a field not far from his residence had his attention arrested by some objects on the ground, which upon approaching he found to be a male and female partridge engaged in battle with a carrion crow: so absorbed were they in the issue of the contest, that they actually held the crow till it was seized and taken from them by the spectator of the scene. Upon search, the very lately hatched young were found concealed among the grass, and the crow had been doubtless attacked by the parents during his attempt to carry off some of their offspring. The wiles and stratagems put in practice by the hen to draw the intruder from the place where her affrighted young have taken refuge are wonderful: she will limp about as if lame of a leg or wing, and so induce one unaccustomed to her deceptions to follow her from the brood, to which she flies back by a circuitous route. White saw a hen partridge come out of a ditch, and run along shivering with her wings, and crying out as if wounded and unable to get from him. While the dam acted this distress, the boy who attended White saw her brood, which was small and unable to fly, run to an old fox-earth for shelter. Markwick too observes that it is not uncommon to see an old partridge feign itself wounded, and run along on the ground fluttering and crying before either dog or man, to draw them away from its helpless unfledged young ones. "I have seen it often," says Markwick, "and once in particular I saw a remarkable instance of the old bird's solicitude to save its brood. As I was hunting a young pointer, the dog ran in on a brood of very small partridges; the old bird cried, fluttered, and ran tumbling along just before the dog's nose, till she had drawn him to a considerable distance, when she took wing and flew still farther off, but not out of the field; on this the dog returned to me, near which place the young ones lay concealed in the grass, which the old bird no sooner perceived than she flew back again to us, settled just before the dog's nose again, and by rolling and tumbling about drew off his attention from her young, and thus preserved her brood a second time. I have also seen, when a kite has been hovering over a covey of young partridges, the old birds fly up at the bird of prey, screaming and fighting with all their might to preserve their brood."

Aristotle describes his *Perdix* as tumbling about to draw intruders from her nest, and fixing their attention till the young have time to escape. ('Hist. Anim.,' ix. 8.)

The pairing time is generally about the beginning of February, but notwithstanding the ardour of these birds, the attachment soon seems to be directed to another object, if any accident happen to that first selected; at least as far as the female is concerned. White mentions a sportsman whose zeal for the increase of his game being greater than his humanity, he, after pairing time, always shot the cock bird of every couple of partridges upon his grounds, supposing that the rivalry of many males interrupted the breed: he used to say, that though he had widowed the same hen several times, yet he found she was still provided with a fresh paramour that did not take her away from her haunt. The same delightful author states that he knew a lover of setting, an old sportsman, who had often told him that soon after harvest he had frequently taken small coveys of partridges, consisting of cock birds alone, which he pleasantly used to call old bachelors. It thus appears that the number of males much exceeds that of the females: the rivalry between the amorous combatants in the spring—and their battles are long and bloody—would seem to be the usual provision to secure the strongest males for the continuation of the species. They roost on the ground together, generally in large fields far from hedges or coverts, probably, as White observes, to secure themselves from pole-cats and stoats. There are accidental pied or whitish varieties.

Common Partridge (*Perdix cinerea*).

The above form has been separated from the other partridges, *Perdix Græca*, Brisa., *P. rubra*, *P. petrosa* &c., by Prince C. L. Bonaparte. The first of these (*P. saxatilis* of Meyer, La Bartavelle) is most probably the Πέρδιξ of Aristotle. All these, which are European, as well as *P. Chukar* from the Himalaya Mountains, have a rudimentary blunt spur on the tarsus, which, with their general plumage and red legs and bill, seem to justify the Prince's separation.

The Greek Partridge inhabits the Alps, the Tyrol, Switzerland, Italy, Turkey, and the Grecian Archipelago. *P. petrosa* (the Barbary Partridge) is common on that part of the African coast and in the southern portions of Europe, especially those which are washed by the Mediterranean Sea. In the mountainous parts of Spain, and in the islands of Majorca and Minorca, Sardinia, Corsica, Malta, and Sicily, it is abundant; but it is rare in France, and not known in the north of Europe. *P. rubra*, the Common Red-Legged or Guernsey Partridge, is abundant in France and Italy, rare in Switzerland, and still rarer in Germany and Holland. Mr. Gould observes that it is confined to the European continent and the islands of Guernsey and Jersey, but M. Temminck ('Manuel,' part iv.) states that it is found in Japan, where it was observed by Dr. Von Siebold and M. Bürger, identical in form and colour of plumage. It has been introduced into our preserves, and is now rather plentiful in some parts, especially in Suffolk. But we doubt whether those who have introduced it have much reason to be pleased with the importation. They persecute almost to extermination the Common Partridge (*Starna cinerea*), a much better bird, whether regard be had to the sports of the field or the pleasures of the table. They are most determined runners, and few birds are more calculated to injure the behaviour of a well-bred and well-broken pointer or setter than the Red-Legged Partridge; if anything can make him puzzle, that partridge will. Though the flesh is not so juicy as that of the Common Partridge, a well fed plump young Red-Legged Partridge, split down the back and broiled upon a good clear fire, is not bad eating. It is probably the *Perdix* of the Romans. Martial (xiii. 76), in allusion to the insane epicurism of the Romans, which seems to have valued price more than flavour, says

"Carior est Perdix: sic sapit illa magis."

Francolinus, Briss; *Pternistes*, Wagler; *Chætopus*, Swainson.—Bill stout, moderate in size, convex above, and slightly curved downwards at the tip. Nostrils basal, lateral, partially closed by a naked overarching membrane. Tail of twelve feathers, moderate, slightly rounded. Feet naked, 4-toed, tarsi of the male armed with strong blunt spurs.

The rudimentary spurs of the Red-Legged Partridges become in the Francolins well developed.

The species occur on the old continent and its islands. The form occurs in Europe, Asia, and Africa. The Francolins are forest birds, perch on trees, and feed on seeds, bulbs, &c.

F. vulgaris, the European Francolin, Le Francolin à Collier Roux of the French, Francolino of the Italians, is a fine and handsome bird; and the plumage of the adult male is rich.

Mr. Gould, who has given beautiful figures of the male and female,

of the natural size, in his 'Birds of Europe,' says, "In the bird before us we trace, or fancy we can trace, one of those unions through which the splendid-coloured Pheasants of the East are united to the sober-coloured Quails and Partridges of the European continent, its form and habits connecting it with the latter, while its colouring manifests a relationship to the beautiful Oriental genus *Tragopan*. The near relationship which we fancy exists between the genera *Francolinus* and *Tragopan* consists in their general style of colouring, in their short spurs, and in the conformation of the beak. Another section of the genus *Francolinus*, peculiar to Africa, exhibits also a form differing from these in the structure of the beak, in which particular, as well as in the uses to which it is applied in obtaining food, it assimilates to the oriental genus *Lophophorus;* still between these groups we may yet expect to find others, harmonising with each so as to form a complete concatenation."

This Francolin haunts humid places, perches on trees, and feeds, like the common partridges (which, as Mr. Gould observes, it resembles in the form of the bill), on insects, seeds, &c., but not on bulbs, like others of the genus. M. Temminck, in the fourth part of his 'Manuel,' mentions myrtleberries and the tender tops of herbs as forming part of its food. Nothing particular seems to be known about its nest, &c.

This species is widely distributed. In Europe its habitat appears to be exclusively confined to the southern regions, as Sicily, Malta, and the Neapolitan territories, but it is also found in the north of Africa, and over the greater portion of the Asiatic continent, and in the Himalaya Mountains.

F. Ponticerianus, *Perdix Ponticeriana* of Latham, Ferruginous and Gray Francolin, appears to be confined to Asia.

This species, according to Colonel Sykes, is the Teetur of the Mahrattas, and is called a partridge in the Dukhun (Deccan), where it is the most common of birds, frequenting gardens and cultivated lands. The Colonel describes the irides as intense red-brown, and its length, inclusive of the tail (which is 3 inches 6-10ths) as 14 inches. He states that it is not met with in the Ghauts, unless in well cultivated valleys, and not at all on the mountains. It roosts on trees, in which situation the Colonel, on more than one occasion, shot them during the day-time; but this was a rare occurrence. ('Zool. Proc.,' 1832.)

Gray Francolin (*Francolinus Ponticerianus*).

Another Francolin, *Francolinus spadiceus*, measuring with the tail (which is 5 inches) 14 inches 7-10ths, is very common in the thick brushwood of the Ghauts. Colonel Sykes had both sexes alive in his possession for some time, and has no doubt that they might be successfully introduced into Europe. He describes them as excellent eating, and says that they rarely take wing or perch. The male has a harsh trisyllabic call, Kok-kut-ree, whence the Mahrattan name Koku-tree. The female in confinement uttered little notes, like the twittering of a chicken. A male in Colonel Sykes's collection had three large spurs on one leg and two on the other. ('Zool. Proc.,' 1832.)

F. pileatus (Andrew Smith) is an African species.

The expedition under the direction of Dr. Andrew Smith saw the first specimens of this handsome Francolin on the banks of the Marikwa River, which flows in a north-easterly direction from Kurichane. "It showed," says Dr. Smith, "but little disposition to resort to the jungle, though when disturbed in more open localities, which it by choice frequents while feeding, it, like *Francolinus Natalensis*, seeks concealment in the bosom of the thickets. Early in the morning specimens were observed in moderate abundance upon the open grassy plots which occurred intersecting the wooded regions that skirted both sides of the stream, and there they appeared to find their food in plenty, which was found to consist of small bulbous roots, seeds, insects, &c. To the same localities these birds were also observed to resort towards evening; but at that period they were less readily discovered, owing to their being commonly more silent at that time. During the middle of the day they were rarely observed, and from what was ascertained there were grounds for believing they repose while the sun is warm, and that while enjoying rest they are generally perched upon dwarf trees or shrubs, no doubt to be the more secure from the teeth of the numerous predatory quadrupeds which are constantly traversing the woods in quest of prey."

Francolinus pileatus. (Smith.)

F. Swainsonii of the same author, with its naked throat, wrinkled space round the eye, and more sombre plumage, seems to be a step towards some other rasorial forms, and to differ so much from its congeners as almost, if not quite, to justify separation.

Coturnix (Brisson).—The species of this genus are vernacularly known as Quails.

The bill is naked at the base, slender, convex above, curved towards the end; no red eye-brow. Tarsus spurless. Tail short. Wings rounded. First quill of equal length with the rest.

They are found in the Old World and Australia only.

C. dactylisonans, Mayer (*Tetrao Coturnix*, Linn.; *Perdix Coturnix*, Latham).

This well known bird, a description of which would be superfluous, seems to be the Ὄρτυξ of Aristotle, who mentions the bird repeatedly in such terms as to its habits and migration as to leave little or no doubt on the point; and the *Coturnix* of the Romans. It is the Quaglia of the Italians; Caille of the French; Wachtel of the Germans, Sofliar and Rhinc of the Welsh; and Quail of the English; Lohah and Lowa of the Mahrattas.

Geographical Distribution.—The Quail is very widely distributed. "No individual of the Gallinaceous order," says Mr. Gould, "enjoys so wide a range in the Old World as the common quail; it is abundant in North Africa, most parts of India, and if we mistake not China; while the whole of the southern portions of Siberia, and every country in Europe except those approximating to the polar circle, are visited by it annually, or adopted for a permanent abode. A considerable number are stationary in the southern portions of Europe, such as Italy, Spain, and Portugal, but their numbers are greatly increased in the spring by an accession of visitors which emigrate from the parched plains of Africa in search of more abundant supplies of food and a congenial breeding-place. So vast and countless are the flocks which often pass over to the islands and European shores of the Mediterranean, that a mode of wholesale slaughter is usually put in practice against them, a circumstance which no doubt tends to limit their inordinate increase."

In this country the bird is not very abundant; and the supply for the London market comes principally from France. It arrives here in spring, generally early in May, and departs in October. The males come first, betray themselves by their thrice repeated whistle, and are

frequently lured within reach of the fowler by the imitation of the female's note on a quail-pipe; sometimes by the voice, but the performer must be a perfect mimic.

The ardent and pugnacious nature of these birds was taken advantage of by the ancients, and quail-fighting was a favourite amusement of the Greeks and Romans, as it still is of the Chinese. Their food consists of grain and seeds, insects, and slugs or worms. They are fattened for the table on hemp-seed principally. Pennant is too general when he says that the ancients never ate these birds, supposing them to have been unwholesome, as they were said to feed on hellebore. Pliny indeed ('Nat. Hist.,' x. xxiii.) says they were not eaten on account of their feeding on poisonous seeds; and also because they were subject to the epilepsy, or falling sickness; but this vulgarism did not, we suspect, banish so delicious a bird from the tables of the better informed. (Athenæus, 'Deipn.,' ix. xlvii; ibid. xlviii.; xi. cxiv.)

The Quail is polygamous; and the nest of the female, if nest it may be called—for it is little more than a hole scratched in the ground, generally in some field of green wheat—contains, in this country, from six to twelve or fourteen bluish leeky-green or oil-green eggs. On the Continent, as many as eighteen or twenty have been found; but here six or eight is the usual number of a Bevy, as the brood is called. Covey is the term applied to a family of partridges.

Quails are noted by Hasselquist as having been seen by him in Galilee. The Quail of the Israelites (*Tetrao Israelitarum*, Hasselq.) was considered by him to be a new species of *Tetrao:* he found it at the Jordan, and in the wilderness near the mountains of Arabia Petræa. Col. Sykes states that the Common Quail is the identical species on which the Israelites fed. This is perhaps not the place to discuss such subjects, but it may be necessary to remind the reader that Rudbeck asserted that the living food which "at even came up and covered the camp" (Exod., xvi. 13) was a Flying-Fish. We dismiss this at once. Ludolph, who thought that the animal was a locust, is, at first sight, more worthy of attention; but the word שאר (*sheer*, 'flesh') (Psalm lxxviii. 27) could hardly have been applied to locusts. Then, according to good authorities (Bochart; Harris), the Hebrew word in Exodus is שלו (*selav*, Arabicè 'selwee' or 'selvai,' a quail), and the Septuagint and Vulgate both lead to the conclusion that it was certainly a bird, and almost certainly a quail. See further Scheuchzer, 'Physica Sacra' (vol. i. p. 173) where the Hebrew is translated upon both sides of the page 'coturnix,' as it is at p. 180; but the plate referred to, tab. clxi., represents the Israelites collecting locusts, and beneath the plate is printed "Exod. xvi. 13, Selavim, Locustæ." In the very next plate however, tab. clxii., representing many birds, we have the same chapter and verse quoted, with the following translation: "Selavim, Coturnices, aliæque." Fig. 2 of that plate is no bad representation of a quail. There can be little doubt that quails formed the seasonable supply; and, if this be admitted, we have, as Col. Sykes observes, proof of the perpetuation of an instinct (migration) through upwards of 3300 years, the fact recorded having occurred 1491 years before Christ.

Col. Sykes, in his valuable paper 'On the Quails and Hemipodii of India' ('Zool. Trans.,' vol. ii.), in which he states that he found the tongue and the cæca of birds to be of considerable importance in indicating affinities or dissimilarities between genera, notices *C. dactylisonans*, *C. textilis*, *C. erythrorynchа*, *C. Argoondah*, and *C. Pentah*.

C. Argoondah, the Rock-Quail of Dukhun (Deccan), "is readily distinguished by the numerous transverse narrow black bars upon the breast; but the young males and the females want these bars, and vary so much in the markings on the back, that with those disposed to manufacture species from plumage alone, the eleven specimens before me from Dukhun would furnish at least four new species." (Sykes.)

Rock-Quail (*Coturnix Argoondah*). (Sykes.)

The flesh is perfectly white. Col. Sykes says that this is the species used for Quail fights by the natives, and not *C. dactylisonans* or *C. textilis*.

Ortyx (Stephens).—Bill short, very high; culmen much elevated and curved, gonys thick and ascending; nostrils large, naked. Tarsus smooth; lateral toes unequal; no spurs. Tail moderate.

The species are found in America only.

O. Virginianus, Virginian or Maryland Quail. This, the Quail of the inhabitants of New England, the Partridge of the Pennsylvanians, has the bill black; line over the eye down the neck and whole chin pure white, bounded by a descending band of black, which spreads broadly over the throat; eye dark hazel; crown, neck, and upper part of breast, red brown; sides of the neck spotted with white and black on a reddish brown ground; back, scapulars, and lesser coverts, red brown, intermixed with ash and sprinkled with black; tertials edged with yellowish white; wings plain dusky; lower part of the breast and belly pale yellowish white, beautifully marked with numerous curving spots or arrow-heads of black; tail ash, sprinkled with reddish-brown; legs very pale ash. Length nine inches; extent fourteen inches (male). The female differs in having the chin and sides of the head yellowish brown. (Wilson.)

Virginian Quail (*Ortyx Virginianus*).

Wilson states that this well-known bird is a general inhabitant of North America, from the northern parts of Canada and Nova Scotia to the extremity of the peninsula of Florida; and that it was seen in the neighbourhood of the Great Osage village, in the interior of Louisiana. They are, he adds, numerous in Kentucky and Ohio, and he quotes Pennant for their introduction into the island of Jamaica, where they throve greatly, breeding twice in the year; he also quotes Captain Henderson as authority for their abundance near Belize, on the Bay of Honduras; but there is something in the style of Wilson that makes it almost unpardonable not to give his own words, and, in justice to that most graphic describer and the reader, we shall permit him to go on with his interesting history of this bird in his own way. "They rarely," continues Wilson, "frequent the forest, and are most numerous in the vicinity of well-cultivated plantations where grain is in plenty. They however occasionally seek shelter in the woods, perching on the branches or secreting among the brush-wood; but they are found most usually in open fields, or along fences sheltered by thickets of briars. Where they are not too much persecuted by the sportsmen, they become almost half domesticated; approach the barn, particularly in winter, and sometimes in that severe season mix with the poultry to glean up a subsistence. They remain with us the whole year, and often suffer extremely by long hard winters and deep snows. At such times the arts of man combine with the inclemency of the season for their destruction. To the ravages of the gun are added others of a more insidious kind. Traps are placed on almost every plantation, in such places as they are known to frequent. These are formed of lath or thinly-split sticks, somewhat in the shape of an obtuse cone, laced together with cord, having a small hole at the top, with a sliding lid to take out the game by. This is supported by the common figure-4 trigger, and grain is scattered below and leading to the place. By this contrivance ten or fifteen have sometimes been taken at a time. These are sometimes brought alive to market, and occasionally bought up by sportsmen, who, if the season be very severe, sometimes preserve and feed them till spring, when they are humanely turned out to their native fields again, to be put to death at some future time *secundum artem*. Between the months of August and March great numbers of these birds are brought to the market of Philadelphia, where they are sold from 12 to 18 cents. a-piece.

"The Quail begins to build early in May. The nest is made on the ground, usually at the bottom of a thick tuft of grass that shelters and conceals it. The materials are leaves and fine dry grass in considerable quantity. It is well covered above, and an opening left on one side for entrance. The female lays from 15 to 24 eggs, of a pure white without any spots. The time of incubation has been stated to me by various persons at four weeks when the eggs are placed under the domestic hen. The young leave the nest as soon as they are freed from the shell, and are conducted about in search of food by the female, are guided by her voice, which at that time resembles the twittering of young chickens, and sheltered by her wings in the same

manner as those of the domestic fowl, but with all that secrecy and precaution for their safety which their helplessness and great danger require. In this situation, should the little timid family be unexpectedly surprised, the utmost alarm and consternation instantly prevail. The mother throws herself in the path, fluttering along, and beating the ground with her wings, as if sorely wounded; using every artifice she is master of to entice the passenger in pursuit of herself, uttering at the same time certain peculiar notes of alarm well understood by the young, who dive separately amongst the grass, and secrete themselves till the danger is over; and the parent, having decoyed the pursuer to a safe distance, returns by a circuitous route to collect and lead them off. This well-known manœuvre, which nine times in ten is successful, is honourable to the feelings and judgment of the bird, but a severe satire on man. The affectionate mother, as if sensible of the avaricious cruelty of his nature, tempts him with a larger prize to save her more helpless offspring; and pays him, as avarice and cruelty ought always to be paid, with mortification and disappointment."

Wilson adds, that "the flesh of this bird is peculiarly white, tender, and delicate, unequalled in these qualities by that of any other of its genus in the United States."

Lophortyx (Bonaparte).—Separated by Prince C. L. Bonaparte from the other Ortyges, and differing from them in the ornament of a curious crest, &c.

L. Californicus is a native of California and may be taken as an example.

Lophortyx Californicus.

The editor of the 'Voyage of La Peyrouse' figured this species in the Atlas, stating that they were plentiful in the low woods and plains of California, where they assembled in bands of two or three hundred, and became fat and well flavoured. Mr. Archibald Menzies brought home skins of them from Vancouver's voyage. Captain Beechey, R.N., laudably anxious to naturalise so elegant and delicious a bird in this country, where they would be a great addition to the game preserves, brought a number of living specimens with him as he returned from his well-executed voyage of discovery. His good intentions were however frustrated by the death of all the females on the passage. The males were presented by him to the Zoological Society of London, and one of these lived in the gardens for a considerable time. It is not improbable that these birds might be naturalised in this country.

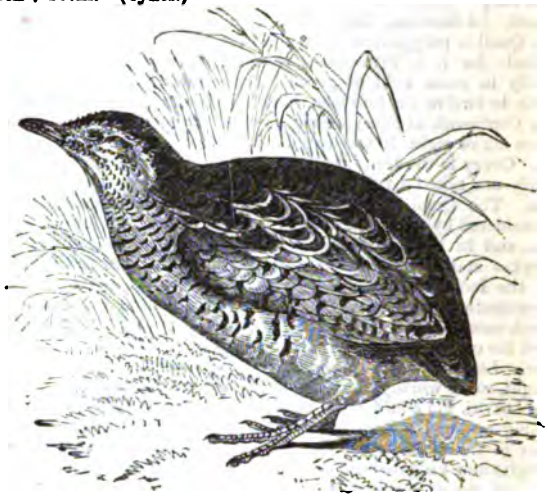
Hemipodius, Temm.; *Turnix*, Bonn.; *Tridactylus*, Lacép.; and *Ortygis*, Ill.—Bill moderate, slender, straight, very much compressed, curved towards the point; nostrils basal, lateral, linear, slit longitudinally down to about the middle of the bill, and partially closed by a naked membrane. Tarsus long; only three toes, all of which are directed forwards and entirely divided. Tail-feathers weak, hidden by the upper coverts. Wings moderate; first quill longest.

The species are found in Europe, Asia, Africa, Australia, and Oceania.

Colonel Sykes, in his paper above alluded to, describes three species —*H. pugnax*, *H. Taigoor*, and *H. Dussumieri*. In the stomach of the first he found the remains of black ants, minute coleopterous insects, and grass-seeds; the flesh was in brown and white layers, and the Colonel states that its pugnacious qualities are quite unknown in Dukhun, and even in Java. They were frequently in pairs, but mostly solitary, haunting cultivated lands, especially chillee fields (*Capsicum annuum*). Their flight he describes as lazy and short, nor are they readily put on the wing. He adds that the Zoological Society had a specimen from Madras, and that it would appear therefore to have an extended geographical range over the Eastern islands and India. We

shall presently notice *H. Taigoor*. Of *H. Dussumieri*, the Button-Quail of European sportsmen in India, he says that it affects short thick grass and fields of pulse of *Dolichos biflorus*, *Phaseolus Max*, and *Ervum Lens*. He never found the bird otherwise than solitary, and says that it is so difficult to flush, that it not unfrequently rises from beneath the feet; and when on the wing, its flight is so abrupt, angular, and short, that it is generally down before the gun is well up to the shoulder.

H. Taigoor is chestnut above, feathers margined with straw colour, and with undulated bands of black; wing-coverts straw-colour banded with black; quills brown, chin and throat white, breast banded with black and white, belly and vent dilute ferruginous, irides pale-yellow, bill blackish. Length of the body 4 inches 8-10ths, of the tail 1 inch 7-10ths. (Sykes.)



Hemipodius Taigoor. (Sykes.)

H. Lepurana (Smith), is an African form of this genus.

Hemipodius (*Turnix*) *Lepurana*, female. (Smith.)

Only a very few specimens of this quail, says Dr. Smith, were obtained, and these not until after the expedition had reached the country north of Latakoo. The grassy valleys south-east of Kurrichane were the only localities in which they were discovered, and even then they appeared to be but thinly scattered, for more than a single individual was seldom found in or even near the same place. When the birds were disturbed, they seldom flew far before they alighted, upon which it would seem that they continued their retreat, for none of those flushed a second time were ever found near the situations where they had been marked down. The food consists of seeds and small insects, with which the birds swallow a considerable quantity of fine gravel.

Dr. Smith remarks that in the Museum of the Army Medical Department at Fort Pitt, Chatham, there are the male and female of an Indian species of *Hemipodius* very closely resembling the Doctor's *Hemipodius Lepurana*. They differ however, he observes, in so many minor points, that he feels disposed to regard them as belonging to a distinct species. In the Catalogue of the Fort Pitt Collection, Dr.

Smith has named this Asiatic species *Hemipodius Sykesii*, in honour of Colonel Sykes, who has added so much to our knowledge of the zoology of India. ('Illustrations of the Zoology of South Africa.')

Before we quit this sketch of the Partridges and Quails, we must notice two forms which particularly demand attention, as leading to other types. The first of these, the Sanguine Partridge (*Perdix cruenta*, Pl. Col., 332), appears to bear the following generic names: *Ithaginis*, Wagler, *Plectrophorus*, J. E. Gray, and *Ptilopachus*, Sw. It is described as a pheasant in 'Linn. Trans.,' vol. xiii., and may be considered as uniting the Partridges with the Pheasants and the Polyplectrons, like the latter of which, it has often more than one spur upon the tarsi. The plumage of this bird, which is a native of Nepaul, is brilliant, and the feathers of the head and neck are elongated.

The *P. Lerwa*, described by Mr. Hodgson ('Zool. Proc.,' 1833) inhabits, according to that gentleman, the northern region of Nepaul, and forms by its half-plumed tarsi a sort of link between the Partridges and the Grouse, the latter of which it resembles in its habits. It is found close to the permanent snows, among rocks and low brushwood, feeding upon aromatic buds, leaves, and small insects. The plumage is black, lineated transversely with white and chestnut; the breast is brown. Mr. Hodgson remarks that the great comparative expanse of the wing, the diminution of its rounded form by the second quill-feather being the longest, the increased length and strength of the tail, and the extent of the feathering of the tarsi, are very remarkable characters, which give to this species a strong interest.

PERDICINÆ. [PERDICIDÆ.]

PERDIX. [PERDICIDÆ.]

PERDIX. [ENTOMOSTOMATA.]

PEREGRINE FALCON. [FALCONIDÆ.]

PERIANTH. [FLOWER.]

PERIBOLUS, synonymous with *Cypræa*. [CYPRÆIDÆ.]

PERICARDIUM. [HEART.]

PERICARP. [FRUIT.]

PERICERA. [MAIIDÆ.]

PERICHÆTIUM is a name given by writers on Mosses to the leaves that surround the bulbous base of the stalk or seta of the seed-vessel, or sporangium.

PERICLASE, a Mineral, occuring crystallised in regular octahedrons. Primary form a cube. Cleavage in three directions parallel to the faces of the cube. Colour obscure green. Hardness equal to felspar. Lustre vitreous. Translucent. Specific gravity 3·78. It is found in the lava of Vesuvius. Its analysis by Damour gives:—

Magnesia	92·57
Oxide of Iron	6·91
Insoluble Matter	0·86
	100·34

PERICRANIUM, the fibrous membrane covering the bones of the skull. It is identical with the periosteum. [BONE.]

PERIDI'NIUM. [INFUSORIA.]

PERIDOT. [CHRYSOLITE.]

PERIECHO'CRINUS. [ECHINODERMATA.]

PERI'ODUS. [FISH.]

PERIOSTEUM. [BONE.]

PERIO'STRACUM. [SHELL.]

PERISTEDION, a genus of Fishes belonging to the *Acanthopterygii* with hard cheeks. The body is covered with bony plates, forming a defensive armature. The nasal bone is divided into two points. The mouth has no teeth.

P. Malarmat, the Mailed Gurnard, was taken, according to Mr. Yarrell, off Plymouth in 1836. It is also a native of the Mediterranean. It is easily known from the other gurnards by its elongated and bifurcated nasal bones. It frequents deep water over rocky ground, approaching the shallows only at the period of spawning. It swims with great rapidity, occasionally breaking its nose against the rocks. It is fished in the Mediterranean, and as an article of food is in greatest estimation during Lent.

PERISTERA. [COLUMBIDÆ.]

PERISTOMIANS. [PALUDINIDÆ.]

PERISTO'MIUM, in Mosses, is the ring or fringe of bristles or teeth which are seated immediately below the operculum, and close up the orifice of the seed-vessel. [MUSCI.]

PERITONE'UM is the membrane by which the walls of the abdominal cavity are lined, and all the abdominal organs are covered. The name is also sometimes applied to the cavity itself. The arrangement of the peritoneum is in every respect similar to that of other serous membranes [MEMBRANE], except that at the extremity of the Fallopian Tube it communicates with the mucous membrane of that tube, and thus is indirectly exposed to the external air. It is the peritoneum, and the epithelium covering it, which gives to all the organs within the abdomen their peculiar shining surfaces, and which by its duplicatures forms the mesentery, omentum, and other folds by which those organs are attached to each other and to the wall of the abdomen, and through which their vessels pass. [MESENTERY; OMENTUM.]

PERIWINKLE. [LITTORINIDÆ.]

PERIWINKLE, a Plant. [VINCA.]

PERLIDÆ. [NEUROPTERA.]

PERMIAN SYSTEM. [MAGNESIAN LIMESTONE.]

PERNA. [MALLEACEA.]

PERNIS. [FALCONIDÆ.]

PERODICTICUS. [LEMURIDÆ.]

PEROPHORA. [CLAVELINIDÆ.]

PEROVSKITE, a Mineral. Its primary form is the cube. Cleavage parallel to the faces of the cube. Colour gray or iron black. Streak grayish white. Hardness 5·5. Lustre metallic, Opaque. Specific gravity 4.071. It is found at Achmatowsk, near Slatoust in the Ural. Rose states that it consists principally of titanic acid and lime.

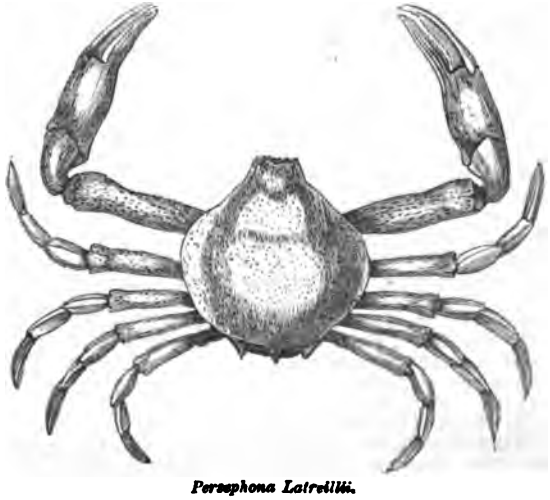
PERSE'A, a genus of Plants belonging to the natural order *Lauraceæ*. *P. gratissima* is the Avocado Pear of the West Indies, and receives its name in consequence of the resemblance in form between its fruit and that of a European pear. The plant which bears it is a tree about the size of an apple-tree; the leaves are oblong, veiny, and the flowers small, and of a greenish-yellow colour. The fruit is the size of a large pear, and is regarded as one of the best produced in the West India Islands. In the inside it is yellow, and contains a kernel inclosed in a soft rind. In taste it is said to resemble the peach, but to be much more agreeable, though not so sweet. It is sometimes eaten with pepper and salt, but more frequently with a little sugar and lime-juice. Three varieties are mentioned, the red, the purple, and the green.

Avocado Pear (*Persea gratissima*).

PERSE'PHONA, Dr. Leach's name for a genus of Brachyurous Crustaceans, placed by M. Milne-Edwards among the tribe of Leucosians. [OXYSTOMA.]

It has the following generic characters:—External and internal stems of the exterior jaw-feet gradually lessening from their base, the external stem being very obtuse at the extremity. Carapace rounded, depressed, and dilated on each side; front rather advanced. Great joint of the abdomen of the male composed of three pieces soldered together. First pair of feet much stouter than the others, which have their two last joints compressed.

P. Latreillii. Anterior part of the shell gradually and obtusely dilated, covered with granulations; three equal recurved spines at its posterior part; arms tuberculous. Length two inches and a half.



Persephona Latreillii.

PERSICA. [AMYGDALUS.]

PERSICA'RIA. [POLYGONUM.]

PERSI'CULA, synonymous with *Marginella*. [VOLUTIDÆ.]

PERSIMON, or PERSIMMON. [DIOSPYROS.]

PERSPICILLA (Swainson), a genus of Water-Chats (*Fluvicolinæ*).

PERSPIRATION. [SKIN.]

PERU, BALSAM OF. [MYROSPERMUM.]

PERUVIAN BARK. [CINCHONA; QUINQUINA.]

PETAL. [COROLLA; MORPHOLOGY; FLOWER.]

PETALITE, a Mineral which occurs massive. Structure perfectly lamellar in one direction. Cleavage parallel to the lateral planes and both diagonals of a rhombic prism. Fracture uneven. Hardness 6·5. Brittle. Colour grayish, greenish, or reddish-white. Streak white. Lustre vitreous, inclining to resinous. Translucent. Specific gravity 2·42 to 2·45. When heated in acids it undergoes partial decomposition; emits a blue phosphorescent light when gently heated. When by itself, it melts with difficulty, and only on the edges; but with borax it fuses into a colourless glass. It occurs at Utö in Sweden, and in North America. It consists, according to Gmelin, of—

Silica	74·17
Alumina	17·41
Lithia	5·16
Lime	0·32
Water	2·17
	99·23

PETASITES, a genus of Plants belonging to the natural order *Compositæ*, the sub-order *Tubulifloræ*, the tribe *Eupatoriæ*, and the section *Adenostylæ*. The heads are many-flowered, subdicecious; the female florets are filiform, obiquely truncate, or shortly ligulate; in many rows in the female heads, none or in one row in the male heads. The male florets tubular; few and central in the female heads, occupying the whole disc in the male heads. Receptacle naked; involucre in one row.

P. vulgaris (*Tussilago Petasites*, Smith), the Common Butter-Bur, has a dense oblong thyrse, with cordate unequally-toothed leaves, downy beneath, and the lobes approximate. The plant is very abundant in wet meadows and by river-sides. It has long creeping roots, by means of which it is rapidly and extensively reproduced, and is a great pest in moist meadows, where it delights to grow. It puts forth its flowers in April and May before its leaves. On account of its early flowering the Swedish farmers plant it near their bee-hives. Dr. Sibthorp found this plant in Greece, and believed it to be identical with the Πεταστης of Dioscorides. This is the specific name of the plant, and comes from 'petasus,' a broad covering for the head. This plant produces the largest leaves of any in Great Britain, sometimes measuring three feet broad. The Butter-Bur was at one time supposed to be a remedy of value in the plague, from which it has got the name of Pestilent-Wort.

P. fragrans, Fragrant Coltsfoot, has a fastigiate thyrsus, radiant heads, roundish cordate unequally-toothed leaves, and downy beneath. This plant blossoms early, has a sweet scent, and has found very generally a place in gardens. It is a desirable flower where bees are kept.

PETAURUS. [MARSUPIATA.]

PETIOLE, the Leaf-Stalk. [LEAF.]

PETIVE'RIA (named after James Petiver), a genus of Plants belonging to the natural order *Petiveriaceæ*. It has 6, 7, or 8 stamens; 4 permanent styles, at length becoming spiny and reflexed; the point is armed with spines at the apex. The species are West Indian herbs, and in pastures are troublesome weeds, giving an unpleasant flavour to the milk of cows which feed upon them.

P. alliacea, Guinea-Hen Weed, is a small bush with a disagreeable odour. It bears an erect downy stem, not branched, and of a deep green colour. The leaves are oblong-obovate or oblong-lanceolate, acute and scabrous at the edge, glandular near the petiole, which is both glandular and downy; the stipules are small and spiny. The spikes are long, slender, and drooping at the upper end. The flowers are white. The juices of this plant are excessively acrid, and if a small portion of it be chewed it will render the tongue as dry, rough, and black as in cases of malignant fever.

The negroes consider it a sudorific, and say that fumigations or vapour-baths of it will restore motion to paralysed limbs. The roots are used in the West Indies as a cure for toothache. The plant is rejected by most animals as food. The Pintado alone seems fond of it; hence its common name, Guinea-Hen Weed.

Martius says *P. tetandra*, another species, is employed in Brazil, under the name of Raiy de Pipi, in warm baths and lotions for defective contractility of the muscles, or in paralysis of the limbs.

(Lindley, *Flora Medica*; Burnett, *Outlines of Botany*.)

PETIVERIACEÆ, *Petiveriads*, a small natural order of Exogenous Plants, of which the principal genus is *Petiveria*. [PETIVERIA.] There are 2 other genera and 10 species.

PETREL. [PROCELLARIDÆ.]

PETRI'COLA. [LITHOPHAGIDÆ.]

PETRIFACTIONS, one of the general terms by which naturalists have at different times sought to designate the vast variety of plants and animals whose remains are preserved in the earth. It may be thus considered as an equivalent for such expressions as 'formed stones,' 'imbedded fossils,' 'organised fossils,' 'organic remains,' &c. [ORGANIC REMAINS.]

PETROCINCLA. [MERULIDÆ.]

PETROICA. [SYLVIADÆ.]

PETROLEUM. [NAPHTHA.]

PETROMYS. [HYSTRICIDÆ.]

PETROMY'ZIDÆ, a family of Chondropterygious Fishes. These fishes constitute the section *Cyclostomi* of the 'Règne Animal,' and are distinguished by their imperfectly-developed skeleton, their want of pectoral and ventral fins, combined with an eel-like form of body. The mouth is circular, consisting of a cartilaginous ring which supports the lips, this ring being formed by the soldering together of the palatine and mandibular bones. The branchiæ, instead of being pectinated as in most other fishes, are purse-shaped; they are moreover fixed, and open externally by several apertures.

From the very imperfect state of their skeleton (which consists chiefly of a ribless series of cartilaginous rings), and some other peculiarities in their structure, these fishes may be regarded as the lowest of the vertebrate animals.

The genus *Petromyzon*, as now restricted, contains the fishes commonly known as Lampreys. These eel-like fishes are of a cylindrical form, compressed towards the tail, and destitute of scales: they have seven branchial openings on each side, and a small opening connected with these on the upper surface of the head, situated nearly between the eyes; the mouth, or maxillary ring, is armed with strong teeth, and on the inner disc there are smaller rasp-like tubercles: there are moreover two longitudinal series of small teeth on the tongue, which is so formed that, by its movement in the mouth, it acts as a piston, and enables the animal to attach itself by suction to any foreign body.

P. marinus, Linn., the Lamprey, is usually about two feet in length, of a yellowish colour marbled with brown; its two dorsal fins are distinctly separated; the second one joins with the tail fin, as well as a small strip which represents the anal fin.

"The lampreys, like the sharks and rays," says Mr. Yarrell, "have no swimming bladder, and being also without pectoral fins, are usually seen near the bottom. To save themselves from the constant muscular exertion which is necessary to prevent them from being carried along with the current of the water, they attach themselves by the mouth to stones or rocks, and were in consequence called Petromyzon, or Stone-Sucker; while the circular form of the mouth induced the name Cyclostomes, or round-mouthed fishes, which was bestowed upon them by M. Duméril."

The Lamprey is highly esteemed for the table, and is consequently much sought after in the various rivers in which it is found. According to the author just mentioned, it is rather common during the spring and summer season in some of the rivers on the southern coast of England, particularly the Severn; and is found in smaller numbers in several of the rivers of Scotland and Ireland about the same period of the year. "In Scotland," Sir W. Jardine says, "they ascend our rivers to breed about the end of June, and remain until the beginning of August. They are not furnished with any elongation of the jaw, afforded to most of our fresh-water fishes, to form the receiving furrows at this important season; but the want is supplied by their sucker-like mouth, by which they individually remove each stone. Their power is immense. Stones of very large size are transported, and a large furrow is soon formed. The *P. marinus* remains in pairs, two on each spawning-place; and while there employed retain themselves affixed by the mouth to a large stone."

The Lamprey feeds upon soft animal substances, and often attacks fishes of large size; and fixing itself upon them, it eats the flesh by means of its rasp-like teeth.

P. fluviatilis, the Lampern, or River Lamprey, is common in many of the English rivers. "Formerly," says the author of the 'History of British Fishes,' "the Lampern was considered a fish of considerable importance. It was taken in great quantities in the Thames, from Battersea Reach to Taplow Mills, and was sold to the Dutch as bait for the turbot, cod, and other fisheries. Four hundred thousand have been sold in one season for this purpose, at the rate of forty shillings per thousand. From five pounds to eight pounds the thousand have been given; but a comparative scarcity of late years and consequent increase of price has obliged the line fishermen to adopt other substances for bait. Formerly the Thames alone supplied from one million to twelve hundred thousand lamperns annually. They are very tenacious of life, and the Dutch fishermen managed to keep them alive at sea for many weeks."

This fish is usually about a foot in length, and coloured like the common eel. The lip surrounding the mouth has a continuous row of small points; there are two large teeth on the maxillary ring; and the dorsal fins, which are elongated, are distinctly separated.

P. Planeri, the Fringed-Lipped Lampern, has the two dorsal fins placed close together; it is of a shorter and stouter form than the Common Lampern, and may moreover be distinguished from it by the lips being furnished with numerous papillæ, forming a thickly-set fringe. The Fringed-Lipped Lampern appears to be usually smaller than the common species. It is found in the Tweed, and in some of the streams in the southern parts of Great Britain, but appears to be comparatively scarce.

The second genus of *Petromyzidæ* is the *Myxine* of Linnæus. In

this genus the maxillary ring is altogether membranous, and only furnished with a single tooth on its upper part; the series of teeth on the tongue are strong, and arranged in two rows on each side, so that the jaws of these fishes appear to be lateral, like those of insects, or the *Nereides*, a circumstance which induced Linnæus to place them in the class *Vermes*. The mouth is circular, and furnished with eight cirri; in its upper margin is a spiracle which communicates with its interior. The body is cylindrical, and furnished with a fin which surrounds the tail. The skeleton is here reduced to a mere cartilaginous tube. These singular fishes pour out such an abundance of mucus through the pores of their lateral line, that the water in the vases in which they are kept seems to be converted into a jelly. They attack and pierce other fishes like the Lampreys. A certain Myxine found in the South Seas (*Petromyzon cirrhatus* of Forster), owing to its possessing seven branchial apertures like the Lampreys, has furnished the type of Duméril's sub-genus *Heptatremus*. In the sub-genus *Gastrobranchus* (Bloch), the intervals of the branchiæ, instead of having separate openings, communicating with a common canal on each side, each of which terminates in a distinct hole situated under the heart. To this section belongs the Myxine, Glutinous Hag, or Borer of English authors, the *Myxine glutinosa* of Linnæus, and *Gastrobranchus cæcus* of modern authors. [MYXINE.]

The next genus of this section (*Ammocetes* of Duméril) has the same general form as the Lampreys, and the branchial orifices are the same; but the mouth is semicircular, and the lip only covers the upper portion; hence the fishes have not the power of fixing themselves, like the true Lampreys. They have no teeth, but the mouth is furnished with a series of fleshy tubercles.

The fish found in our streams, and known by the names Pride, Sandpride, and Mud-Lamprey (*Ammocetes branchialis*, Cuvier), affords an example of this genus. This little fish, which is seldom more than six or seven inches in length, and about the thickness of a quill, lives chiefly in the mud at the bottom of fresh-water streams, and is said to be much preyed upon by eels.

The last division of this family is the genus *Amphioxus* of Yarrell, and this contains but one species, a most extraordinary little fish, which, it appears was first described by Pallas under the name of *Limax lanceolatus*, but had only once been seen since his time, when the subject of Mr. Yarrell's description was discovered by Mr. Couch on the shore near Polperro. [BRANCHIOSTOMA.]

PETROMYZON. [PETROMYZIDÆ.]

PETROPHILA. [MERULIDÆ.]

PETROSELI'NUM (Πετροσέλινον, which means Rock Parsley, rock being the habitat of the species), a genus of Plants belonging to the natural order *Umbelliferæ*. It has an obsolete calyx; roundish entire incurved petals, scarcely emarginate, contracted into an inflexed lobe. The disc is short and somewhat annulate. The fruit ovate and contracted at the side. The species are smooth-branched herbs. The leaves decompound, with wedge-shaped segments. The involucels many-leaved; the flowers are white or greenish, uniform; those of the disc often sterile. The stamens longer than the corolla.

P. sativum, Common Parsley, has tripinnate shining leaves; leaflets of the lower leaves ovate-cuneate, trifid, and toothed; of the upper leaves ternate, lanceolate, entire. It grows wild on rocks and old walls, and is extensively cultivated. [PARSLEY, in ARTS AND SC. DIV.]

P. segetum, Corn Honewort, has pinnate lower leaves; nearly sessile leaflets, ovate and serrated, the upper leaves entire or trifid. The umbels are very irregular, the general involucre having from one to two leaves. The flowers are whitish, the stem erect, roundish, nearly leafless above, from a foot and a half high. It is found on damp fields in a calcareous soil in Great Britain, France, and Switzerland. Goodyer has given an accurate account of this herb, and says that the origin of its name was from the fact of its having cured a swelling in the cheek called a 'hone.'

(Babington, *Manual of British Botany;* Lindley, *Flora Medica.*)

PETRO'SILEX. This name has probably been given to two different minerals, namely, compact quartz and compact felspar; the latter has also been termed Fusible Petrosilex.

PETTY CHAPS. [SYLVIADÆ.]

PETUNTZE, the Chinese name for a white earth used with Kaolin in the manufacture of porcelain. It is stated that while the former [KAOLIN] is derived from the decomposition of the felspar of granitic rocks, the latter, or Petuntze, is the same mineral which has not suffered decomposition, and that on account of its fusibility it is employed in glazing the porcelain.

PEUCE, a Fossil Coniferous Tree, of which the species occur in the Oolitic strata. (Witham.)

PEUCE'DANUM (Πευκέδανον of Theophrastus and Dioscorides, from πεύκη a pine, on account of the resinous smell of the plant), a genus of Plants belonging to the natural order *Umbelliferæ*, and the tribe *Pucedaneæ*. It has a calyx of five teeth, obovate petals, contracted into an inflexed segment, emarginate or nearly entire. The fruit has a dilated thin flat margin, the carpels with equidistant ridges, three dorsal filaments, two lateral close to the base of the dilated margin obsolete. The interstices have single linear vittæ. The species are perennials, generally smooth. The leaves are pinnated, more or less compound. The flowers are white, yellow, or yellowish-green.

P. officinale, Sulphur-Wort, or Hog's-Fennel, is a smooth herb three or four feet high, with a resinous juice and a strong sulphureous smell. The leaves are four or even five times ternate, with linear-lanceolate acuminate flaccid segments. The involucre 3-leaved and deciduous; the pedicels much shorter than the fruit. The fruit of a pale-brown colour, the vittæ of a deep chocolate; the primary ridges much depressed and paler. The commissure a light fawn-colour with two crimson vittæ very evident upon it. It is a native in marshy and shady places throughout Europe and in Great Britain. The juice of the root of this plant is resinous and has a peculiarly strong smell. Many stimulating qualities have been attributed to it, and it is reputed anti-spasmodic and diuretic, but it seems to be rather a dangerous internal remedy.

P. oreoselinum has a taper striated stem. Triternate leaves with the petioles broken back, the leaflets remote, ovate, deeply pinnatifid and shining. The fruit is roundish oval. The flowers white with a tinge of blue. The leaves and stem are bitter and aromatic, as is the fruit in a higher degree. They were formerly used as stimulants, and are still esteemed in some countries.

P. montanum is a native of the north and middle of Europe, and has a tapering simple root with many long fibres. The stem is erect, from four to five feet high, hollow, deeply furrowed, smooth branched, and corymbose at the top, and of a bright purple colour at the base. There are about five or six leaves on a stem, which are alternate, remote, and with bipinnate divisions; the leaflets are opposite, deeply pinnatifid, dark green, and smooth; the petioles striated, smooth, with a reddish membranous margin. The flowers are white and numerous; the fruit a very light straw-colour, shining and obovate. The root is said to supply the place of ginger in Russia. The whole plant abounds in a white bitter fœtid juice which soon hardens into a brown acrid resin. It is famous in Courland as a remedy for epilepsy.

P. palustre has 3-pinnate leaves pinnatifid with linear-lanceolate acuminate segments, the general involucre of many persistent lanceolate deflexed leaves. The stem is furrowed, and from three to five feet high. The flowers are white. It is found in Great Britain, but rarely. Any common garden soil will suit the species of *Peucedanum*, and they are easily raised from seed.

(Don, *Dichlamydeous Plants;* Babington, *Manual of British Botany;* Lindley, *Flora Medica;* Burnett, *Outlines of Botany;* Lindley, *Vegetable Kingdom.*)

PEZI'ZA. [HYMENOMYCETES.]

PEZO'PORUS. [PSITTACIDÆ.]

PHACOCHŒRUS. [SUIDÆ.]

PHACOLITE. [CHABAZITE.]

PHACOPS. [TRILOBITES.]

PHÆNICORNIS. [LANIADÆ.]

PHÆNO'GAMOUS or PHANERO'GAMOUS PLANTS are those which have visible flowers and seeds. The words are used indifferently in contradistinction to Cryptogamous, which includes those plants which either have no sexes or none which are distinctly visible.

PHAËTON, Linnæus, a genus of Palmipede Birds, placed by some ornithologists among the *Pelecanidæ*, and by others among the *Laridæ*.

This genus, so well known to navigators as the harbinger of the tropics, is distinguished at once by the two long slender tail-feathers, which have obtained for the species, of which two only are recorded, the French name of Paille-en-Queue. Their length of wing and comparatively feeble feet proclaim them formed for flight, and they are accordingly swift and untired on the wing, disporting in the air far at sea; and when on land (to which they do not often retreat for any length of time together, except at the period of nidification), perching on rocks and trees. They rarely quit the torrid zone and its neighbourhood.

M. Lesson remarks that the two species form a well-defined artificial and purely geographical group. Their habitual domicile in the torrid zone does not separate them from the land; and they can reach, as they do nearly every night, the isles and lofty rocks that serve them as a place of refuge. Nevertheless M. Lesson met with them so often in sea-tracts entirely devoid of land, and heard them so often above his head in the calms and fine tropical nights, that he thinks they should be considered as oceanic birds.

The same author remarks that sudden squalls or hurricanes, so frequent in the equatorial zone, often sweep these birds beyond their natural limits; and he thus accounts for seeing them, as he many times did, in 30° S. lat.

The Common Tropic-Bird (*Phaëton æthereus*), he says, "semble être confiné dans l'océan Atlantique, et s'arrêter dans les mers de l'Inde." The other species (*Phaëton phœnicurus*), he remarks, appears to belong more particularly to the great equinoctial ocean. Nevertheless, he adds, that both species exist in nearly equal numbers at the islands of Mauritius and Bourbon. He describes the flight of these birds as calm, quiet, and composed of frequent strokes of the wing, sometimes interrupted by a sort of falls or sudden movements.

Mr. G. R. Gray makes the *Phaëtoninæ*, consisting of the genus *Phaëton* only, the second sub-family of his *Pelecanidæ*, placing it between the *Plotinæ* and the *Pelecaninæ*. ('List of the Genera of Birds,' 1841.)

Phaëton, Linnæus (*Lepturus*, Mœhr; *Tropicoliphus*, Leach).—The bill is strong, stout, hard, trenchant, compressed, convex above,

denticulated on its edges, inclined towards the end, pointed; nostrils linear, covered by a naked membrane; face feathered; feet very short; wings long; first quill the longest; tail short, excepting two very long slender tail-feathers.

P. æthereus, Linn., the Tropic Bird of Catesby, Sloane, and others. The following is Catesby's description:—

"This bird is about the size of a partridge, and has very long wings; the bill is red, with an angle under the lower mandible, like those of the gull kind, of which it is a species; the eyes are encompasssed with black, which ends in a point towards the back of the head; three or four of the larger quill-feathers towards their ends are black tipped with white; all the rest of the bird is white, except the back, which is variegated with curved lines of black; the legs and feet are of a vermilion red; the toes are webbed; the tail consists of two long straight narrow feathers almost of equal breadth from their quills to their points.

"These birds," says the same author, "are rarely seen but between the tropics, at the remotest distance from land. Their name seems to imply the limits of their abode; and though they are seldom seen but a few degrees north or south of either tropic, yet one of their breeding-places is almost nine degrees from the northern tropic, namely, at Bermudas; where, from the high rocks that environ those islands, I have shot them at the time of their breeding; but those cliffs being inaccessible, prevented my seeing their nests and eggs. They breed also in great numbers on some little islands at the east end of Porto Rico."

There was a specimen in Tradescant's Museum.

Tropic Bird (*Phaëton æthereus.*)

P. phœnicurus. Length from the extremity of the bill to the origin of the tail, 13 inches 6 lines; of the bill from the point to the commissure, 3 inches 8 lines; breadth across the expanded wings, 31 inches. Length of the tail, 5 inches; of one lengthened tail-feather (brin) taken at the extremity of the tail, 7 inches 6 lines; of the second and smaller long tail-feather (brin) taken from its origin, 6 inches. Ten tail-feathers, without counting the long one, which at its origin is enlarged like the other feathers; the tail forms a fan. Feet, taken from the leg to the toes, 3 inches. Legs white, with a light bluish tint in some places; webs partly black, that between the hind toe pale flesh-colour slightly glazed with white. Bill red, denticulated; nostrils near the origin of the bill, rather large, presenting forwards a canal which scarcely extends to the middle of its length, and of a blackish tint. Plumage satin-white; in front of the eyes a large brown spot. The anal feathers present a great black spot in their centre, as well as some of the feathers which approach the body. The long tail-feathers (brins) are red, the smallest being of the deepest hue. The shafts of the greater quill-feathers, of the tail-feathers, and the long tail-feathers (brins), are black, but towards the extremity they are white. ('Manuel.')

PHAKELLOPLEU'RA, the Rev. Lansdown Guilding's name for a genus of Chitons, with rather small dorsal plates, and the fleshy zone ornamented with a broad single row of elongated spiculate fasciculi. *Chiton fascicularis* is an example of this genus. [CHITONIDÆ.]

PHALACRO'CORAX. [PELECANIDÆ.]

PHALÆNA, one of the three Linnæan genera of Lepidopterous Insects. It corresponded to the division *Nocturna* in the arrangement of Latreille. It included the Night-Moths. The *Phalænæ* are now distributed among many genera, all of which form part of the division *Heterocera* in M. Boisduval's arrangement of *Lepidoptera*.

PHALA'NGER. [MARSUPIATA.]

PHALANGI'STA. [MARSUPIATA.]

PHALANX. [SKELETON.]

PHA'LARIS, a genus of Grasses, of which the seed of one of the species is extensively employed as food for birds, and commonly known as Canary seed. The species of the genus are found in warm parts of the world; but *P. Canariensis*, a native of the Canary Islands, is naturalised in Europe, and is the only one which is cultivated. The seed is imported into the south of Europe from Barbary. It is also cultivated in the Isle of Thanet and some other parts of Kent. It is sown in February and reaped about the end of September; but being a plant of southern climates, and late in ripening its seed, it is an uncertain crop. The produce is from thirty to forty bushels per acre, but sometimes even fifty bushels are obtained.

PHA'LAROPUS. [SCOLOPACIDÆ.]

PHA'LERIS. [AUK.]

PHALLUS, a genus of Plants belonging to the natural order *Fungi* and the division *Angiogastres*. [GASTEROMYCETES.] In this genus the peridium assumes the form of a volva, and the column-like receptacle of the other forms becomes here a stipes, which is surmounted with a rudimentary pileus.

The species, which are sometimes called Stinkhorns, are solitary fungi, growing frequently on wood, and not uncommonly on ordinary soil. They frequently come up in great numbers after rain. All the species emit, whilst growing, a most disgusting odour. They are however very curious in their structure, and will well repay examination. In their early stages of growth they are enveloped in a white volva, which gives them the appearance of an egg. In this state it remains for two or three days, during which time the cells arrange themselves into the ultimate forms which they assume. When fully formed they suddenly burst the volva, and in six or eight hours attain their greatest development. Bulliard asserts that this bursting is sometimes attended with a report as loud as that of a pistol.

P. fœtidus, the Stinking Phallus, is a common species in England. Although this fungus gives out but little scent in its young stage, directly it bursts the smell becomes intolerable. The summit is then covered with a dark green viscid slime, which is at first of a considerable thickness, but in a few hours it liquefies and drops off, and a cellular structure on the surface of the cap is then exposed. This slimy substance, which is the seat of the odour of the plant, also contains the sporidia. Disagreeable as is the odour of this plant, it is more so at first than afterwards, and at a short distance from the plant than close to, and persons have overcome all feelings of dislike to it. Some have even gone so far as to eat it, and have pronounced it as not disagreeable.

(Burnett, *Outlines of Botany.*)

PHANERO'GAMOUS. [PHENOGAMOUS.]

PHANEROTI'NUS, a genus of Fossil *Gasteropoda*, from the Mountain-Limestone of England and Ireland. (Sowerby.)

PHAPS. [COLUMBIDÆ.]

PHARBI'TIS, a genus of Plants belonging to the natural order *Convolvulaceæ*. It has 5 sepals, a campanulate funnel-shaped corolla, 1 style, a capitate granular stigma, a 3-celled rarely 4-celled ovary, and 2-seeded cells. The species of this genus are easily distinguished from others of the same order. They are mostly climbing American herbs, usually beset with retrograde hairs.

P. Nil has twining annual round hairy branches, and stem stalked; 3-lobed downy leaves; axillary peduncles, from 2- to 3-flowered. The flowers large, of a beautiful light bright blue-colour; the capsule is much shorter than the calyx, smooth, 3-celled, with two seeds in each cell. The seeds are sold in the apothecaries' shops of Calcutta under the name of 'Kala Dana,' and are said to act as a purgative and an effectual speedy cathartic. They are roasted like coffee, powdered, and administered in doses of from 30 to 40 grains. It is a native of the tropics in every part, and in the South Sea Islands. There are about 15 species of this genus, but the one described is the only one of use.

(Lindley, *Flora Medica.*)

PHARMACOLITE, a Mineral consisting of Arseniate of Lime; it occurs crystallised and fibrous, and there is a variety, called Haidingerite, which differs in crystalline form and composition.

The primary form of Pharmacolite is an oblique rhombic prism. Cleavage parallel to the oblique diagonals of the terminal planes. Fracture uneven. Hardness 2·0 to 2·5; easily scratched. Colour white. Lustre vitreous. Transparent; translucent; opaque. Specific gravity 2·640 to 2·8.

Fibrous Pharmacolite occurs in white diverging needles and small globular and botryoidal masses, which are frequently coloured by arseniate of cobalt.

When heated by the blowpipe, Pharmacolite emits the alliaceous smell, and fuses with difficulty into a white enamel; it dissolves in nitric acid and without effervescence.

This mineral is found at Andreasberg in the Harz, and in Thuringia, and at Wittichen, near Fürstenberg in Germany, and some other places.

The Pharmacolite of Wittichen was analysed by Klaproth, and that of Andreasberg by John. The results were—

	Klaproth.	John.
Arsenic Acid	50·54	45·68
Lime	25·00	27·28
Water	24·46	23·86
	100	96·82

PHARMACOSIDERITE, *Cubic Arseniate of Iron, Cube Ore*, a Mineral occurring crystallised and sometimes massive. Primary form a cube. Cleavage parallel to the primary planes, indistinct. Colour of various shades between light-green and bottle-green, and yellowish and brownish green; streak paler. Fracture uneven; cross-fracture uneven or imperfectly conchoidal. Hardness 2·5. Brittle. Lustre vitreous. Transparent, translucent. Opaque. Specific gravity 2·9 to 3·0. Massive variety amorphous, structure granular. It is found in Cornwall, and more rarely at St. Leonard in France, Schneeberg, Schwartzenberg in Saxony, and Franklin, North America. Its analysis by Berzelius gives—

Arsenic Acid	38·00
Peroxide of Iron	40·56
Phosphoric Acid	0·70
Oxide of Copper	0·60
Water	10·57
Insoluble Matter	0·35
	100·78

PHARYNX is the cavity in which the food is received in its passage from the mouth to the œsophagus or gullet. In man it is somewhat funnel-shaped, having its widest part above, where it is fixed to the base of the skull. The nasal passages, the mouth, and the air passages, open into the pharynx in front; behind it is attached to the spinal column; and at its sides it is bounded by the deep vessels and muscles of the neck. It is lined by a mucous membrane, but is chiefly composed of layers of strong muscular fibres, called the constrictors of the pharynx, by whose successive contractions the food received from the mouth is gradually forced from above downwards into the œsophagus.

PHASCOCHŒRUS. [Suidæ.]

PHASCO'GALE. [Marsupiata.]

PHASCOLA'RCTOS. [Marsupiata.]

PHASCO'LOMYS. [Marsupiata.]

PHASCOLOTHE'RIUM. [Marsupiata.]

PHA'SEOLUS, a genus of Plants of the tribe *Phaseoleæ*, in the natural order *Leguminosæ*. The name is said to be derived from Phaselus, a little boat, which the pods are thought to resemble; but it may be that the meaning of 'boat' is derived from the resemblance of a boat to the form of a bean. Two species are very well known in this country, *P. vulgaris*, the Common Kidney Bean, and *P. multiflorus*, the Scarlet Runner; their unripe pods being much esteemed as legumes, and also for pickling. The ripe seeds are however employed on the continent, and form the Haricots of the French. The genus is however one of which the species are indigenous in tropical parts both of the Old and New World. Several are cultivated in India, and are some of the principal articles of the agriculturist's attention, as the ripe seeds of several species form pulses which are much used by the natives as a portion of their diet, and some of which, like the Kidney Bean, abound in nutritious matter.

Phaseolus is characterised by having a bell-shaped 2-lipped calyx. The corolla is papilionaceous, and has the keel, as well as the diadelphous stamens and the style, spirally twisted. The legume is compressed or cylindrical, with two valves, and is many-seeded, with more or less conspicuous cellular partitions between the seeds. The hilum of the seed is oval-oblong. The plants are herbaceous or suffrutescent in habit. The leaves are pinnately trifoliate, the leaflets with partial stipules. Racemes axillary. Pedicels usually in pairs, single flowered.

P. vulgaris, Kidney-Bean, is said to be a native of India, but Dr. Royle states that seeds were brought to him from Cashmere, and he is therefore inclined to consider that it was introduced into Europe from the most northern parts, such as Cabul and Cashmere, and that this accounts for our being able to cultivate it at a lower temperature than other species of the genus.

P. multiflorus, the Scarlet Runner, is a native of South America. Both are delicate, and cannot be safely planted in the open air till the beginning of May.

P. Mungo, or Moog, is one of the dry leguminous grains of India, which are of great value whenever the periodical rains fail and rice cannot be grown, and famine is the consequence.

P. Max, Kala Moog of the natives, and Black Grain of the English, is like the former, but distinguished by its black seeds, and is, like it, found in a cultivated state: it takes about the same time to ripen, and yields nearly the same produce.

P. radiatus, called by the natives Mash and Oorud, is, like the two former, found in a cultivated state, and is the most esteemed of all the Indian leguminous plants. Besides using it as an article of diet, the natives make bread of the meal for some of their religious ceremonies.

P. aureus, or Sona Moog of the Bengalees, is found in a cultivated state in the Bengal presidency, but is not known on the Coromandel Coast. It is sown, like the others, about the end of October or beginning of November, and reaped in February or the beginning of March.

P. aconitifolius, Moth of the natives, is cultivated in the north-western provinces, and used for feeding cattle.

PHASIANELLA. [Turbinidæ.]

PHASIA'NIDÆ, a family of Rasorial Birds related to the *Pavonidæ*. [Pavonidæ.]

Mr. G. R. Gray arranges the *Phasianidæ* as the second family of *Rasores*—*Cracidæ* being the first, and he divides the *Phasianidæ* into the sub-families *Pavoninæ*, *Phasianinæ*, *Gallinæ*, and *Meleagrinæ*. The *Phasianinæ* consist of the genera *Argus*, *Phasianus*, *Syrmaticus*, *Thaumalea*, and *Gennæus*. The *Gallinæ* comprehend the genera *Euplocamus*, *Monaulus*, *Lophophorus*, *Gallus*, and *Tragopan*.

Phasianus (Linn.).—Bill of mean length, strong; upper mandible convex, naked at the base, and with the tip bent downwards. Nostrils basal, lateral, covered with a cartilaginous scale; cheeks and region of the eyes destitute of feathers, and covered with verrucose red skin. Wings short, the first quills equally narrowed towards their tips, the fourth and fifth the longest. Tail long, regularly wedge-shaped, and composed of 18 feathers. Feet having the three anterior toes united by a membrane as far as the first joint, and the hind toe articulated upon the tarsus, which in the male birds is furnished with a horny cone-shaped sharp spur. (Gould.)

The type of this genus is generally considered to be *P. Colchicus*, Linn., the Common Pheasant, a bird which, though not originally British, is completely naturalised in our islands, and indeed appears to adapt itself with great facility to most countries where ordinary care is taken to preserve it, and the temperature is not too low for its constitution. The species is too well known to need description.

If we are to listen to the tales which form that period of history which borders upon fable, we owe this ornament of our preserves and tables to Jason and his companions, who brought it from Colchis in the good ship Argo. Martial thus notices its introduction into Europe (lib. xiii., ep. 72): Phasianus loquitur—

> "Argivâ primum sum transportata carinâ;
> Ante mihi notum nil nisi Phasis erat."

In Greece it soon became known under the name of *Φασιανός* and *Φασιανικὸς ὄρνις* (Phasian bird). (Aristophanes, 'Clouds,' 110; 'Birds,' 68.) Indeed it had become sufficiently celebrated in the time of Aristophanes to form a proverb—"Not if you would give me the pheasants which Leogoras feeds," says Strepsiades, in the 'Clouds' (109, 110). Aristotle writes succinctly but clearly of the habits of the Pheasant as a well-known bird ('Hist. Anim.,' v. 31; vi. 2); nor is Athenæus silent concerning so delicate a dish, which appears to have become more common as luxury waxed strong, nor regarding the royal conduct of Ptolemy, who, though he kept them and provided them with hens (*νομάδας ὄρνιθας*) for multiplication, being aware of their excellence for the table, appears not to have tasted them. From the same author it would appear that the ancients, contrary to the opinion of modern epicures, thought the cock birds the best. ('Deipn.,' xiv., lxix. p. 654.) It is the *Phasianus* of the Romans (Pliny, 'Nat. Hist.,' x., xlviii.; xi., xxxvii.), but seems to have only been within reach of the wealthy. Thus Martial (xiii., xlv. 'Pulli Gallinacei')—

> "Si Libyes nobis volucres et Phasides essent,
> Acciperes: at nunc accipe cortis aves."

And again, in the epigram addressed to Bassus (iii. 58), which gives so pretty a picture of a genuine rural Roman villa, and so agreeably fills the imagination with country sights and sounds—

> "Vagatur omnis turba sordidæ cortis,
> Argutus anser, gemmeique pavones,
> Nomenque debet quæ* rubentibus pennis,
> Et picta perdix, Numidicæque guttatæ,
> Et impiorum phasiana Colchorum.
> Rhodias superbi fœminas premunt galli
> Sonantque turres plausibus columbarum,
> Gemit hinc palumbus, inde cereus turtur."

The Pheasant has now been spread over the whole of temperate Europe and the greater part of the old continent; and it is probable that it will be introduced with success wherever the face of the country and the supply of food are congenial to it, and the temperature does not vary too much from that of its native river, the ancient Phasis and the modern Faz, along whose banks Mingrelia, formerly Colchis, extends, between 42° and 43° N. lat., 41° 19′ and 42° 19′ E. long. [Phasis, in Geog. Div.] It is even said to be common in Siberia, a much colder climate, which would prove the facility with which it adapts itself to temperature; and an attempt has, we believe, been made to introduce it into North America, a locality well suited to its habits.

The south of Europe owed the Pheasant, in all probability, partially to the Greeks, and more proximately to the Romans. It is the Fasiano of the Italians, and Faisan of the French. More doubt hangs about its introduction into Great Britain, and the time of that introduction. We are told that the price of one was 4*d.* in the time of our first Edward (1299). In 'The Forme of Cury,' which is stated

* The Flamingo.

to have been compiled by the chief master-cook of King Richard II., we find a receipt "for to boile Fesant, Ptruch (partridges), Capons, and Curlew," which carries us back to 1381. We read of the

"Fawkon and the Fesaunt both,"

in the old ballad of the 'Battle of Otterbourne.' At the 'Intronazation of George Nevell,' archbishop of York, in the reign of our fourth Edward, we find among the goodly provision "Fessauntes, 200." In the 'Northumberland Household-Book,' begun in 1512, "Fesauntes" are valued at twelve pence each. In the charges of Sir John Nevile, of Chete, at Lammas Assizes, in the twentieth year of the reign of King Henry VIII., we find twelve pheasants charged twenty shillings; and they seem to have maintained their value, as, among the expenses of the same Sir John Nevile, for, as he writes it, "the marriage of my son-in-law, Roger Rockley, and my daughter Elizabeth Nevile, the 14th of January, in the seventeenth year of the reigne of our soveraigne lord King Henry VIII.," is the following:—"Item in Pheasants 18, 24 shillings." We trace the birds in 'A C. Mery Talys,'* printed by John Rastell, where we read of "Mayster Skelton, a poyet lauryat, that broughte the byashop of Norwiche ii. fesauntys." Rastell began to print as early as 1517, and ceased in 1533. In Turberville's 'Booke of Falconrie' the 'Fezant' and 'Feasants'—for, with the licence of the time, it is spelled both ways—are mentioned as the subjects of hawking, and so the bird may be traced as a dish for the table, or the object of field sports, down to the present time.

Hen pheasants in this country begin to lay in April, and deposit from eight or ten to fourteen olive-brown eggs, in a rough nest on the ground. Sometimes two will lay in the same nest. The young make their appearance towards the end of May or beginning of June.

Where the country is favourable it is easy to get up a head of pheasants, with the aid of good keepers; but it is more difficult to keep them at home, for they are wandering birds, and will often leave the place where they are bred, in search of food more agreeable to them and localities more congenial to their habits. Warm covers and water are absolutely necessary; and if they are plentifully supplied with grateful food, but few of them will become vagrants. Jerusalem artichokes, potatoes, and buckwheat, as well as barley, are favourites. Small stacks of the latter grain in the straw are frequently placed about the preserves, and there the pheasants may be seen scratching at their feeding-time; but this mode of supply is objectionable, as the poacher soon finds out the several points of attraction, and avails himself of them accordingly. Mr. Yarrell states that one good mode of inducing them to stop at home is to sow, in summer, beans, peas, and buckwheat mixed together, leaving the whole crop standing on the ground. The strong and tall stalks of the beans carry up and sustain the other two, and all three together afford for a long time food and cover. ('History of British Birds.') The same author tells us that at the end of autumn he has found the crops of the birds distended with acorns of so large a size, that they could not have been swallowed without great difficulty. In December 1834 we saw eight ripe acorns and a ripe hazel-nut taken out of the crop of a hen pheasant from Sussex. The acorns had begun to germinate with the heat and moisture of the crop, and they were sent up to the Gardens of the Zoological Society in the Regent's Park, and there planted. For autumnal and winter home-feeding we have seen potatoes used with excellent effect, not only in keeping the birds from wandering, but in increasing their weight and fatness. Carts loaded with raw potatoes were from time to time driven into the covers, and the potatoes were scattered about by hand. The pheasants soon found them out, and throve accordingly, without being collected together at particular spots, as they too often are to their destruction. They are very general feeders; neither blackberries, aloes, nor haws come amiss to them, and grain, seeds, and tender leaves find their way into the pheasant's crop as well as insects. Mr. Selby observed that these birds sought after the root of the acrid Bulbous Crowfoot (*Ranunculus bulbosus*, Common Buttercup) in May and June, and a friend informed Mr. Yarrell that they also feed on the Pilewort Crowfoot (*Ranunculus Ficaria*). Mr. Selby further states that the bulb of the garden tulip is an article of diet which the pheasant omits no opportunity of obtaining, and which, however deeply buried, the bird is almost certain to reach by means of its bill and feet. The size to which these birds attain when well fed is considerable. In the catalogue of Norfolk and Suffolk birds, by the Rev. Revett Sheppard and the Rev. William Whitear ('Linn. Trans.,' vol. xv.), the weight of a cock pheasant killed at Campsey Ash, where the birds were well fed with potatoes, buckwheat, and barley, is stated at four pounds and a half. "Some winters since," says Mr. Yarrell, "my friend Mr. Louis Jaquier, then of the Clarendon, produced a brace of cock pheasants which weighed together above nine pounds. The lighter bird of the two just turned the scale against four pounds and a half; the other bird took the scale down at once. The weights were accurately ascertained in the presence of several friends to decide a wager, of which I was myself the loser."

The assumption of the plumage of the cock pheasant by the female when, through old age or organic defect, she is no longer capable of reproducing the species, is by no means uncommon, not more rare indeed, if so much, as it is in the pea-fowls [PAVONIDÆ], common poultry, &c.; indeed John Hunter ('Animal Economy') remarks that this change has been principally observed in the common pheasant. Mr. Yarrell, in his 'History of British Birds,' also refers to this fact. Blumenbach, in his interesting paper, 'De anomalis et vitiosis quibusdam nisus formativi aberrationibus commentatio,' read before the Göttingen Royal Society in July, 1812, has entered fully and particularly into this subject. The species in which he had known the change of plumage to be observed were—*Columba Œnas*, *Phasianus Gallus*, *Colchicus*, and *Pictus*, *Pavo cristatus*, *Otis tarda*, *Emberiza paradisea* and *longicauda*, *Pipra rupicola*, and *Anas Boschas*. Alluding to the eggs which have been sold as Cock's Eggs, he observes, that to him it seems most probable that such specimens have been laid by hens which had either assumed the plumage of cocks from their youth up, or upon whom the change had come in their old age. Though such phenomena are usually gallinaceous, they are not confined to that family; for he relates that Professor Erhard sent to him an egg laid by a canary bird that sang loudly and excellently, having all the appearance of a cock bird. The egg was one-half less than the usual size, but of the ordinary form and colour.

Hen pheasants which have begun to put on the livery of the male are not always incapable of producing eggs. Sir Philip Egerton has informed us that a hen pheasant at Oulton Park, Cheshire, which had nearly assumed the plumage of the cock, laid a nest full of eggs, from which she was driven by the curiosity of persons who came to gaze at so strange a sight. She then laid another nest full of eggs, sat upon them, and hatched them; but the young all died soon after they were excluded.

There are white and pied varieties. The Ring-Necked and Bohemian Pheasants appear to be considered as varieties by Mr. Yarrell; Temminck and Sir W. Jardine consider the former to be completely distinct. The English reader will find the reasons for the latter opinion stated at length in 'The Naturalist's Library' ('Ornithology'), vol. iii.

Various instances of the Common Pheasant breeding with other gallinaceous birds are on record. Edwards has figured a bird supposed to have been produced between a pheasant and a turkey. Three or four of these were discovered in the woods near the house of Henry Seymour, Esq., of Handford, Dorsetshire, and he shot one in October 1759, the bird which he sent to Edwards. Mr. Yarrell ('British Birds') observes that he has twice been shown birds that were said to be the produce of the Pheasant and the Guinea Fowl, and the evidence of the plumage was in favour of the statement. We have seen such a bird, and its feathers corroborated the allegation that it had been so produced. Hybrids between the Pheasant and Gray Hen are also recorded. [BLACK-COCK.] Mr. Thompson of Belfast describes ('Magazine of Zoology and Botany') another hybrid shot at Lochnaw, Wigtonshire, where it had been seen several times on the wing by persons who supposed it to be a wild turkey. In the surrounding plantations pheasants and black grouse were numerous; but this individual, which was preserved for Sir Andrew Agnew, Bart., M.P., was the only one of the kind observed. Mr. John Leadbeater, in 1837, exhibited a hybrid between the Pheasant and Black Grouse, shot near Alnwick, at a meeting of the Zoological Society. This the Duke of Northumberland presented to the British Museum.

The union between the Common Hen and the Cock Pheasant is by no means rare, as is well known to those whose homesteads border upon pheasant preserves. The produce of this union is called a Pero.

Before we leave the True Pheasants we must notice some of the magnificent Indian species, which exhibit such a prodigality of splendour and beauty in their plumage as almost realises the birds which we read of in fairy tales. Such are the well-known gorgeous Gold-Pheasant (*Phasianus pictus*, Linn.: Genus, *Thaumalea*, Wagler; *Chrysolophus*, J. E. Gray; *Nycthemerus*, Sw.), the equally well-known delicately-pencilled Silver-Pheasant (*Phasianus Nycthemerus*, Linn.: Genus, *Gennæus*, Wagler; *Nycthemerus*, Sw.; *Euplocamus*, J. E. Gray), and the noble Reeves's Pheasant (*Phasianus veneratus*, Temm.: Genus, *Syrmaticus*, Wagler).

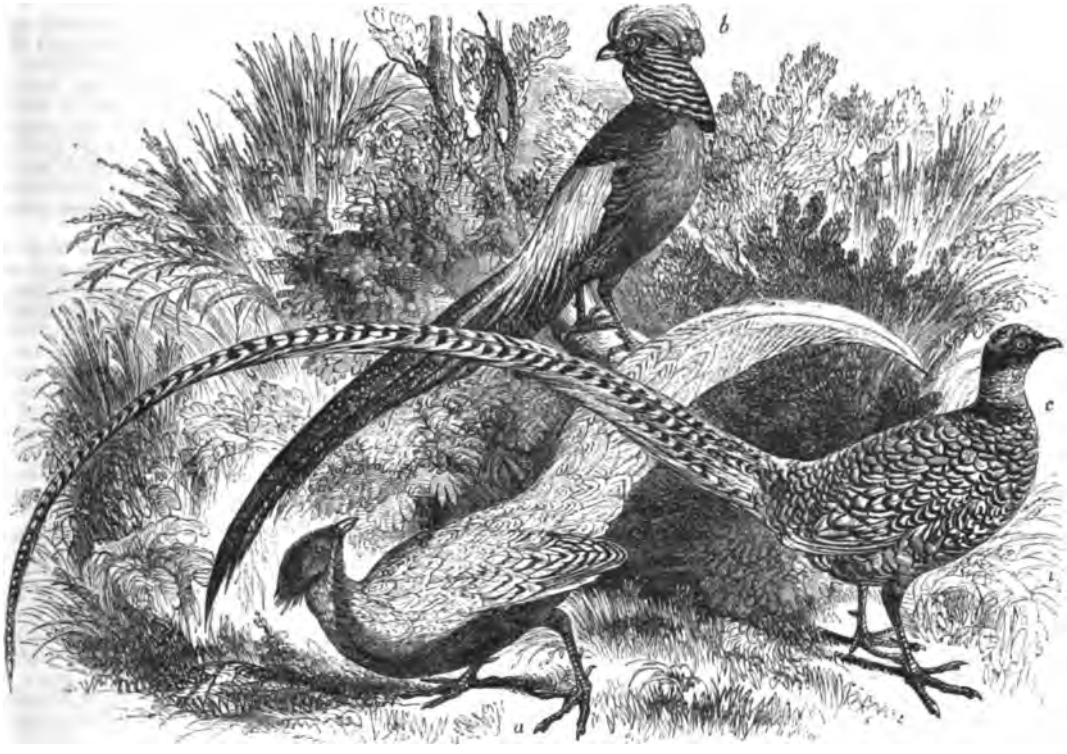
The first two of these (natives of China) are common in almost every aviary, and there is no reason why they should not thrive well if turned out in our preserves; the second species has, we believe, been so turned out with success; the last is also found in China, but, as it would seem, on the very confines of the empire. It is very rare in Pekin. Dr. Latham's description was taken from Sir John Anstruther's drawings, and from some writing under them in the Persian language it appeared that the bird was called Doomdurour, or Long-Tail, and it was found on the snowy mountains of Surinagur.

To Mr. Reeves we are indebted for the first individual ever brought alive to Europe. It was a male, and continued to live for some time in the garden in the Regent's Park. Tail-feathers from it were exhibited to the Society in 1831, measuring each about 5 feet 6 inches in length. A second male specimen was also sent to their menagerie by the same liberal donor in 1834.

Then there are the beautiful Diard's Pheasant (*Phasianus versicolor*, Vieill.), which haunts the Japanese woods, and exhibits the manners and habits of our Common Pheasant; the rare and elegant Sömmering's Pheasant (*P. Sömmeringii*, Temm.), also a native of Japan.

We should also call the reader's attention to the beautiful *P. Staceii* (figured and described by Mr. Gould in his 'Century') as one of the True Pheasants; and to *P. Pucrasia* and *P. albo-cristatus*, also there figured. *P. Pucrasia* appears to lead the way from the True Pheasants

* Alluded to in Shakspere's 'Much Ado about Nothing."



a, Silver Pheasant; *b*, Gold Pheasant; *c*, Reeves's Pheasant (*Syrmaticus Reevesii*), males.

to the *Lophophori*; and *P. albo-cristatus* to be an *Euplocamus*, which, even more immediately than *E. ignitus*, forms a transition from the genus *Phasianus* to the genus *Gallus*.

The Argus Pheasant, which is not a species of *Phasianus* [PAVONIDÆ], has been brought alive to this country, and a specimen is now in the Gardens of the Zoological Society of London in the Regent's Park.

Euplocamus (Temm.).—Sir George Staunton, in his 'Embassy to China,' first made this highly-interesting form known to European

Fine-Backed Pheasant (*Euplocamus ignitus*), male.

zoologists. His host at Batavia had, it appears, a very curious collection in the several departments of natural history. He made presents to his guest of several specimens, and among them was this beautiful pheasant, which was sent to England and described by Dr. Shaw.

E. ignitus, the Fine-Backed Pheasant of Java, the Macartney Cock, *Phasianus ignitus*, Latham. Length of adult male about two feet. Skin of the nostrils stretching backwards over the sides of the head behind the eyes, and bluish-purple. A crest upon the crown of the head composed of naked-shafted feathers, expanding at their tips into slender spreading barbs. Head, neck, breast, belly, and upper part of the back, deep chalybean or steel-blueshot black; lower part of the

Fine-Backed Pheasant (*Euplocamus ignitus*), female.

back fiery orange-red or flame-colour, varying in intensity according to the incidence of the light, and passing like a zone round the body, though more obscure on the abdomen; rump and tail-coverts broad and truncated, brilliant bluish-green with a paler bar at the tip. Tail when erect folded in some degree like that of a hen; the middle

feathers white, and the outside ones black with green reflections. Legs and feet vermilion, spurred.

Female.—Length about 20 inches. Plumage almost entirely rich cinnamon-brown; feathers of the upper parts slightly mottled with black; throat white; lower parts of a paler tint than those above, and having the feathers bordered with white. Elongated head-feathers capable of being erected into a crest, but not equal to that of the male. Tail folded. Legs spurless.

It is a native of Sumatra. ('Atlas' to Staunton's 'Account of Lord Macartney's Embassy to China.')

Gallus (Brisson).—Bill moderate, strong, convex above, curved towards the point, naked at the base, and furnished with two pendant and compressed caruncles or wattles. Head surmounted with a fleshy crest or comb. Tarsi (in the male) furnished with a long and recurved spur; the hind toe only resting on the ground at its tip. Wings short and graduated. The 14 tail-feathers forming two vertical planes with the backs of the feathers towards each other, and so making what may be called a folded tail; the middle feathers longest and recurved.

The ancestors from which our domestic poultry have descended were undoubtedly natives of Asia; but some doubt still hangs over the questions of the precise breed from which they came, and the exact locality where they were found. That fowls were domesticated at a very early period there is no doubt, and both historians and poets speak of the high antiquity of the race. Thus Peisthetærus relates why the cock is called Περσικὸς ὄρνις (the Persian Bird), and how it reigned over that country before Darius and Megabazus. (Aristoph., 'Birds,' 483 et seq.)

To the forests and jungles of India we must look for the race in a state of nature; and though the denizens of our farm-yards may be the result of a mixture of many of the species which there inhabit, zoologists in general agree with M. Temminck in thinking that to the Malay Gigantic Cock or Fowl (*Gallus giganteus*, Temm.), and the Bankiva Cock (*G. Bankiva*, Temm.), we are chiefly if not entirely indebted for our common poultry.

The Domestic Cock and Hen are the 'Αλεκτρυών and 'Αλεκτορὶς of the Greeks; Gallus and Gallina of the Romans; Gallo and Gallina of the Italians; Haus Hahn and Haus Henne of the Germans; and Coq (Gau, Geau, Gal, Gog), Gelline, and Poule, of the French.

Bold, ardent, and vigilant, the cock has been always considered the emblem of watchful courage, whilst the hen has been considered a pattern of maternal solicitude. In this and other polygamous species, the object to be attained is the effective impregnation of the greatest numbers of females by the most vigorous male. In the cock accordingly the spurs are developed as the sexual organs are matured; and it is principally with these weapons of combat that the battle which is to leave the field in the possession of the strongest is decided. The conqueror in his turn, as the weakness of age comes upon him, yields to a younger and more powerful rival; and thus a numerous, healthy, and stout progeny is secured.

How the Domestic Cock and Hen were introduced into Greece and the south of Europe is not known: upon such occasions of doubt the Phœnicians are usually resorted to; but we are ignorant of proof which can bring home the benefaction to them more than others. We find it early on the Greek and Roman coinage, and upon gems; and it figured in the public shows of those nations. It was dedicated to Apollo, to Mercury, to Æsculapius, and to Mars. Socrates, in his dying moments, reminded his disciples that he "owed a cock to Æsculapius." The Rhodian fowls (Martial, iii. 58, above quoted) and those from the Isle of Delos were celebrated for their superiority in fight and their delicacy for the table. The luxurious Roman had his hens fed, perhaps crammed, with meal in the dark. Thus Martial (xiii. 62, 'Gallina Altilis'):—

> "Pascitur et dulci facilis gallina farina,
> Pascitur et tenebris: ingeniosa gula est."

Nor was the same gastronomer ignorant of the value of the capon. (Martial, xiii. 63.)

The bird appears to have been in Britain before the invasion of Julius Cæsar, who tells us that the Britons abstained from tasting the hare, the hen, and the goose; though they bred them for their pleasure. This abstinence seems to have originated in superstitious feeling: "Leporem et gallinam et anserem gustare fas non putant: hæc tamen alunt, animi voluptatisque causa." ('De Bello Gallico,' lib. v.) The race is now spread all over the civilised world.

M. Lesson asks if it is not remarkable to find the Domestic Hen, differing in nothing from that of our countries, in all the islands of the South Sea, and among people with whom Europeans have certainly never communicated? Cocks and hens, he tells us, were very common at Oualan for example, and the natives were ignorant that these birds were good to eat. They were found among the Papuans, and among others there was a white variety with all the feathers frizzled.

G. giganteus, the Gigantic Cock, the Kulm Cock of Europeans, often stands considerably more than two feet from the crown of the head to the ground. The comb extends backwards in a line with the eyes; it is thick, a little elevated, rounded upon the top, and has almost the appearance of having been cut off. The wattles of the under

mandibles are comparatively small, and the throat is bare. Pale golden-reddish hackles ornament the head, neck, and upper part of the back, and some of these spring before the bare part of the throat. Middle of the back and lesser wing-coverts deep chestnut, the webs of the feathers disunited; pale reddish-yellow long drooping hackles cover the rump and base of the tail, which last is very ample and entirely of a glossy green, of which colour are the wing-coverts; the secondaries and quills are pale reddish-yellow on their outer webs. All the under parts deep glossy blackish-green with high reflections; the deep chestnut of the base of the feathers appears occasionally, and gives a mottled and interrupted appearance to those parts. (Jardine principally.)

Lieutenant-Colonel Sykes, in his Memoir on the Birds found in the Dukhun (Deccan), states that it is only there met with as a domestic bird, and that he has reason to believe that it is not a native of India, but has been introduced by the Mussulmans from Sumatra or Java. The iris, he says, of the real game bird should be whitish or straw-yellow. The Colonel landed two cocks and a hen in England in June, 1831; and they bore the winter well. The hen laid freely, and in September, 1832, had reared two broods of chickens. The cock had not the shrill clear pipe of the domestic bird, and his scale of notes appeared to be more limited. A cock in the Colonel's possession stood 26 inches to the crown of the head, but they attain a greater height. The length from the tip of the bill to the insertion of the tail, 23 inches. Hen one-third smaller than the male. ('Zool. Proc.,' 1832.)

G. Bankiva, the Bankiva Cock, is the Coq et Poule Bankiva of Temminck; Ayam Utan, or Brooga ('Linn. Trans.,' xiii.); Javan Cock of Latham; and many Bantams resemble it very closely.

The space round the eyes and throat bare, comb much developed, deeply lobated along the upper ridge, wattles of the lower mandible rather large; long, clear, brilliant, golden-orange hackles cover the head, sides of the neck, back, and rump. Upper part of the back below the hackles bluish-black, the middle and lesser wing-coverts rich deep-chestnut, with the webs of the feathers disunited; greater coverts steel-blue, secondaries the same, with a broad chestnut border; quills brownish-black, edged with pale reddish-yellow. Tail black, richly glossed with green and blue. Under parts black.

Bankiva Cock (*Gallus Bankiva*).

Sir W. Jardine states that he has seen three or four specimens of another bird very closely allied to *G. Bankiva*, but rather larger, and certainly distinct: they were all from the continent of India.

G. æneus, the Bronzed Cock, figured by M. Temminck from a specimen sent from the interior of Sumatra by M. Diard. This is somewhat larger than the Bankiva Cock, and its large comb is without dentilations; indeed the edge is quite unbroken; the feathers of the head, neck, and upper part of the back are rather elongated, but not hackles. The Fork-Tailed Cock (*G. furcatus*, Temm.; *G. Javanicus*, Horsf.) has the comb also entire, and the throat is adorned with a single large wattle springing from the centre. The head, neck, and upper part of the back are covered with feathers, which are not hackles, shorter and more rounded than those in the Bronzed Cock.

G. Sonneratii. This is the Coq Sauvage of Sonnerat; Coq et Poule de Sonnerat of Temminck; Sonnerat's Wild Cock of Latham; Rahn

Komrah of the Mahrattas; Jungle Cock and Jungle Fowl of the English sportsmen in India.

The size of the male is nearly equal to that of a domestic cock; but the bird is altogether lighter, more graceful, and has a higher bred look about it; comb large, and with an unequal margin, but though this margin is jagged, it is not deeply dentilated; wattles double, depending from the base of the lower mandibles; hackles of the neck and of the wing and tail-coverts dark-grayish, with bright golden-orange shafts dilating in the centre and towards the tip into a flat horny plate. In some of these feathers the shaft takes an elliptical or oar-like shape; in others it puts on the appearance of a long inverted cone, from the

Jungle Cock (*Gallus Sonneratii*), male.

Jungle Fowl (*Gallus Sonneratii*), female.

centre of the base of which a battledore-like process arises. The substance and appearance of these plates have been not inaptly compared with the wax-like plates which ornament the wings and tail of the Bohemian Chatterer. [Bombycilla.] The effect produced by this modification of the shafts is singular and beautiful. Feathers of the middle of the back, breast, belly, and thighs, deep rich gray, with paler shafts and edges; tail generally rich deep-green; the feathers which immediately succeed the hackles are rich purple, with a pale-yellow edge; those next in succession are golden-green, with gray

edges, and all are glossed with brilliant metallic reflections. Bill, legs, and feet, yellow. The living bird presents altogether a rich and striking object, especially when the sun shines on the plumage.

Female less than the cock by about a third, without comb or wattles, but a trace of nakedness round the eye. The plumage (generally) is without the horny structure which distinguishes that of the male. Upper parts uniform brown; neck feathers with dark edges, those of the back and wing-coverts with a pale streak along the shaft, and those of the wings, tail-coverts, and tail, waved and mottled with darker pencillings; throat and front of the neck white; feathers of the rest of the lower parts grayish-white, edged with dark brown, which predominates towards the vent. Legs and feet bluish-gray.

Colonel Sykes, in his valuable Catalogue, notes this noble bird as being very abundant in the woods of the western Ghauts, where (and this is well worthy the attention of ornithologists) he says there are either two species or two very strongly marked varieties. In the valleys, at 2000 feet above the sea, he tells us Sonnerat's species is found slender, standing high upon the legs, and with the yellow cartilaginous spots on the feathers, even in the female. In the belts of wood on the sides of the mountains, at 4000 feet above the sea, there is a short-legged variety. The male has a great deal of red in the plumage, which Sonnerat's has not; the female is of a reddish-brown colour, and is without cartilaginous spots at all: "in fact," continues the Colonel, "the female of this variety is the *G. Stanleyi* of Mr. Gray's 'Illustrations.'"

Dr. Latham remarks that this Jungle Fowl is by far the boldest and strongest for its size, and that it is anxiously sought after by cock-fighters in Hindustan, who rely on it for victory when pitted against larger game cocks.

Individuals of this species have been exhibited alive in the Gardens of the Zoological Society in the Regent's Park.

But whatever may have been the source or sources from which our domestic poultry sprang, and the probability is that more than one wild race have contributed to improve it, the varieties in a reclaimed state are almost infinite. The Spanish breed, entirely black, grows to a considerable size, and the eggs are remarkable for their volume. The Dorking poultry have long been celebrated, and they are known principally by having supernumerary toes. The true Dorkings are purely white, and are much esteemed for the table. Dr. Latham mentions one of this breed that weighed nearly 14 lbs. Some of the Sussex fowls are very fine. The fancy breeds are very numerous; for an account of these see Poultry, in Arts and Sc. Div.

Tragopan, Cuvier (*Ceriornis*, Swainson).—Head crested on the crown, partly naked (on the cheeks and round the eyes), the naked parts terminating in horn-like caruncles behind the eyes; under the lower mandible and on the forepart of the throat a subpendent composite carunculated wattle. Tarsi armed with a blunt spur in the male; unarmed in the female.

Mr. Gould ('Century of Birds from the Himalaya Mountains') remarks that the genus *Tragopan* appears to take an intermediate station between that of *Meleagris* and the more typical *Phasianidæ*, forming one of the links of a chain connecting these groups of the Rasorial order. The affinity of this genus, he observes, to that of *Meleagris*, is evident in many characters; nor are some wanting which indicate a relationship to *Numida*, and even to *Francolinus*. [Perdicidæ.]

T. Satyrus appears to have been the only species originally known. Mr. Gould, in his 'Century,' describes another species, *T. Hastingsii*, and refers to another, which Dr. Gray, of the British Museum, has dedicated to M. Temminck. ('Indian Zoology.')

T. Hastingsii. Head of the adult male covered with a pendent crest of feathers, which, as well as the ear-coverts and throat, are black; the neck and shoulders are rich maroon; the chest rich glossy orange-red; the naked skin around the eyes is red; the fleshy horns and wattles mingled blue and purple; the upper parts exhibit a mixture of zigzag lines and marks of dark and light brown, with numerous and distinct spots of white; each of the upper tail-coverts ends in a large white eye, bordered on the sides with brown, and tipped with black; the tail deepens till it ends in uniform black; the feathers of the under surface are maroon, largely tipped with black, in the centre of which is a large white spot; the beak is black, the tarsi brown.

In the young male the plumage is much less brilliant, the wattles being of a pale flesh-colour, and little developed, as is also the naked skin of the face.

The plumage of the female consists of a uniform brown, mottled and barred with mingled lines and dots of various tints, the feathers of the back and chest having a central dash of a lighter colour; the head is crested, with short rounded feathers; the sides of the cheeks are clothed, and there are neither fleshy horns nor wattles. (Gould.)

Mr. Gould observes, that although this species and *T. Satyrus* are closely allied to each other, and doubtless possess similar habits and manners, he is led to believe that their local distribution is somewhat different; at least, he generally receives but one species in a collection from the same quarter; *T. Satyrus* being transmitted from the Nepaulese Hills, while *T. Hastingsii* is sent from the more northern range of the Himalayas. He further well observes that the changes of plumage which birds of this genus, especially *T. Hastingsii*, undergo in passing

from youth to maturity (and this is well illustrated in Mr. Gould's beautiful plates), are such as to have caused an apparently erroneous multiplication of species.

Tragopan Hastingsii, male.

Tragopan Hastingsii, female.

T. Satyrus, according to the same author, is an exclusive inhabitant of the colder regions of the mountains, in conjunction with the *Lophophorus*, its approximate relative, feeding on grains and roots, the larvæ of ants, and other insects. [PAVONIDÆ.]

PHASIANUS. [PHASIANIDÆ.]

PHASMIDÆ, a tribe of Orthopterous Insects, embracing a number of exotic forms which have been often included in the *Mantidæ*, from which they are distinguished by the fore-legs being of the ordinary size, and fitted like the rest for walking rather than running. From the other *Orthoptera* they are distinguished by the hind legs not being saltatorial.

The body is generally long and slender. The head is of moderate size, of an oval subdepressed form, porrected, with large globular eyes, in front of which the antennæ are placed, which are variable in form, but ordinarily long, slender, and composed of a great number of articulations. The ocelli are rudimentary or obsolete. The labrum is deeply notched in front; the jaws are strong and horny. The dorsal surface in both sexes consists of nine segments, but only seven are distinct in the females. All the legs are alike, being long and slender, often armed with short spurs along the edges. The fore wings are of small size, and attached at the posterior part of the mesothorax. The true wings are very large and attached to the anterior part of the metathorax. "As they far exceed the wing-covers in size, it is essential that provision should be made for their defence. This is effected not as in the earwig, by the transverse folding of the wing so as to enable it to be folded beneath the small wing-cover, but by the front margin of the hind wing being greatly thickened, serving as a flat plate, beneath which the other part of the wing is folded longitudinally, the latter part being often differently coloured. Thus in some species the short wing-covers and the front margin of the wing are pale-green, whilst the other part of the wing is pink. Many species however remain throughout their lives without ever acquiring wings or wing-covers." (Westwood, 'History of Insects.')

The odd appearance of these insects have got for them the name of Walking-Sticks, Straws, Leaves, Spectres, &c., and certainly nothing can be imagined more curious than the forms they assume. In many instances they might be mistaken for a portion of the branch of the trees on which they rest.

PHEASANT. [PHASIANIDÆ.]

PHEASANT'S-EYE. [ADONIS.]

PHENAKITE, a Mineral, occurring crystallised. Primary form a rhomboid. Cleavage parallel to the primary faces. Colourless; also bright wine-yellow, inclining to red. Hardness above 6·0. Lustre vitreous. Transparent to opaque. Specific gravity 2·969. It is found near Freiberg and near Framont. Its analysis by Hartwall gives—

Silica	55·14
Glucina	44·47
Alumina and Magnesia	0·39
	——100

PHE'NE. [VULTURIDÆ.]

PHERU'SA, a genus of *Crustacea* belonging to the order *Edriophthalmia*.

PHIBALU'RA (Vieillot), a genus of *Ampelidæ* (Fruit-Eaters or Chatterers), placed both by Mr. Swainson and Mr. G. R. Gray in the sub-family of *Bombycillinæ*, the Swallow-Chatterers of the former zoologist. The genera included by both in the sub-family are the same; Mr. Swainson's genera being *Phibalura*, *Bombycilla* [BOMBYCILLA], and *Procnias*, and those of Mr. Gray *Phibalura*, *Bombycilla*, and *Tersa*, Vieillot, the latter being the *Procnias* of Illiger and others.

It is a native of South America. A beautiful figure accompanies Mr. Swainson's description in the 'Zoological Illustrations,' first series.

PHILADELPHA'CEÆ, *Syringas*, a natural order of Exogenous Polypetalous Plants, with an inferior ovary, the principal genus being that after which the order is named. [PHILADELPHUS.] The species are American, European, and Asiatic shrubs of temperate climates, with opposite leaves, distinct styles, and capsular fruit, containing a large number of minute seeds. Their nearest affinity is, on the one hand, with *Myrtaceæ*, from which they differ in having separate styles, dotless leaves, and albuminous seeds, and on the other with *Saxifragaceæ*, from which their strictly inferior fruit, opposite leaves, and parallel styles sufficiently distinguish them. Many of the species, especially in the genus *Deutzia*, are clothed with beautiful stellate hairs, which are composed of silica. They form excellent opaque objects for examination with the microscope. [DEUTZIA.] The only other genus in this order is *Decumaria*.

Deutzia scabra.

1, a vertical section of a flower deprived of petals; 2, a transverse section of the ovary; 3, one of the stellate hairs.

PHILADELPHUS, a genus of Plants the type of the natural order *Philadelphaceæ*, which is also the name of a tree, now unknown, mentioned by Athenæus, but was applied to the present genus by Bauhin. *Philadelphus* is characterised by having a calyx with an obovato-turbinate tube and a 4-5-partite limb. Petals vary in number

from 4-5. Stamens 20-40, free, are shorter than the petals. Styles 4-5, united together, or more or less distinct. Stigmas 4-5, oblong or linear, generally distinct. Capsule 4-5-celled, many-seeded. Seeds dust-like, inclosed in a membranous aril, oblong, and fringed at one end.

The plants consist of shrubs with white pedicillate flowers arranged in a corymbose cyme, in a panicle-like manner, or sometimes in the axils of their leaves, supported by bracts.

The greatest number of species are indigenous in North America, whence they have been introduced into the shrubberies of this country, to which they form a highly ornamental addition. A species has also been discovered in the Himalayas, at elevations of 6000 and 7000 feet, of which there are two varieties, sometimes considered distinct species, *P. tomentosus* being apparently only a more advanced state of *P. triflorus*. The best known species however is *P. coronarius*, commonly called Syringa, which is so easy of culture, and found in most gardens. It is supposed to be a native of the south of Europe, but it has hardly ever been found in a wild state, and even in these few cases it may have escaped from cultivation. As one species has been found in the Himalayas, there is no reason why other species should not exist still farther to the north-west, as in the Hindoo-Koosh, and that the Syringa may be found to be one of those plants which was in early times introduced from some part of the Persian Region of botanists into the south of Europe.

PHILANDER. [DIDELPHINA.]

PHI'LEDON. [MELIPHAGIDÆ.]

PHILE'MON, Vieillot's name for a genus of Birds (*Anthrochæra*, Vig. and Horsf., *Merops*, Lath.) placed by Mr. G. R. Gray in his subfamily *Meliphaginæ*.

PHILESIACEÆ, *Philesiads*, a small natural order of Plants belonging to Lindley's class of Dictyogens. It has bisexual trihexapetaloideous flowers, with consolidated carpels and parietal placentæ. The species are twining or upright shrubs, with ribbed or 1-nerved coriaceous deciduous reticulated leaves. This order is nearly related to *Smilaceæ* and *Roxburghiaceæ*, with which latter order it was combined by Lindley, and also with *Amaryllidaceæ*. The species are found in the southern provinces of Chili. It has two genera and two species, *Philesia buxifolia* and *Lapageria rosea*. The latter has eatable berries, and roots useful as a substitute for sarsaparilla.

PHILLIPSIA, a genus of *Trilobites*, found in the Mountain-Limestone Strata of England and Ireland. (Portlock.)

PHILLIPSITE, a Mineral, the primary form of which is a right rhombic prism. It occurs crystallised only in macles which have much the appearance of Harmotome. Cleavage imperfect. Fracture conchoidal. Hardness 4·5. It scratches carbonate of lime. Colour white, flesh-red, or grayish. Streak white. Lustre vitreous. Transparent, translucent, opaque. Specific gravity 2·0 to 2·2. This mineral occurs with Gmelinite in the county of Antrim, and at the Giant's Causeway; at Capo di Bove, near Rome; in Sicily; in the lavas of Vesuvius, and at Marburg in Hesse, &c. The analysis from the last-mentioned place, by Gmelin, gives—

Silica	48·02
Alumina	22·61
Potash	7·50
Lime	6·56
Water	16·75
	101·44

PHILLY'REA, the Φιλλυρεα of Dioscorides, is a genus of Mediterranean Evergreen Plants, many varieties of which are cultivated in our gardens. They are much like the evergreen shrubs called *Alaternus*, from which however they are readily known by their leaves being opposite, not alternate. Some botanists regard them as species of olive, to the fruit of which that of the *Phillyrea* has much resemblance. The hardiest and handsomest variety is *P. obliqua*; the most tender and the least beautiful is *P. angustifolia*.

PHILOMELA, a genus of Birds belonging to the family *Sylviadæ*. *P. Luscinia*, the Nightingale, is the most celebrated of the song-birds of the Old World. This well-known species is the Ἀηδών of the ancient Greeks; *Luscinia* of the Romans; Rossignuolo, Rusignuolo, and Usignuolo, of the Italians; Rossignol of the French; Ruisenor of the Spanish; Nachtigall of the Germans; Nachtergahl of the 'Fauna Suecica;' Nattergale of Brunnich; and Eos of the Welsh.

It is the *Luscinia* of Gesner, Aldrovandus, Willughby, Ray, and Brehm; *Motacilla Luscinia* of Linnæus; *Sylvia Luscinia* of Latham and others; *Curruca Luscinia* of Fleming; and *Philomela Luscinia* of Selby, Gould, and Swainson.

The Nightingale, or Night-Singer, is a migratory bird, visiting us early in the spring (about the middle of April), and leaving us about August or September. The male birds arrive first, and are instantly sought after by the bird-catchers, who generally make the most of the interval of ten days or a fortnight that elapses before the arrival of the females, well knowing that those males which are taken after they have paired seldom survive. The bird-fanciers have a notion that a Surrey nightingale possesses the finest quality of tone. To dwell upon the richness and variety of its song, a subject which has employed the pens of poets of all ages, and of all countries where the bird is known, would be superfluous here; but there are points connected with the habits and geographical distribution of the bird which require notice.

Nightingale (*Philomela Luscinia*, Selby).

M. Temminck states that the Nightingale haunts woods, thickets, and gardens; that it is common in nearly all the parts of Europe to Sweden inclusive; and that it migrates in winter into Egypt and Syria. Hasselquist saw it among the willows of Jordan and the olive-trees of Judæa. Mr. Strickland saw it at Smyrna on the 5th of April. Prince C. L. Bonaparte notes it ('Specchio Comparativo') as common in the neighbourhood of Rome, which it leaves in winter only.

Pennant ('Arctic Zoology') says that it visits the temperate parts of Russia, and even some parts of Siberia. The same author ('British Zoology') remarks that the Nightingale is a species that does not spread itself over our island. "It is not," says Pennant, "found in North Wales, or in any of the English counties north of it, except Yorkshire, where it is met with in great plenty about Doncaster. It has also been heard, but rarely, near Shrewsbury. It is also remarkable that this bird does not migrate so far west as Devonshire and Cornwall, counties where the seasons are so very mild that myrtles flourish in the open air during the whole year; neither is it found in Ireland. Sibbald places Nightingales in his list of Scotch birds; but they certainly are unknown in that part of Great Britain, probably from the scarcity and the recent introduction of hedges there; yet they visit Sweden, a much more severe climate." The editor of the last edition of the 'British Zoology' states that in 1808 a Nightingale was several times heard in the gardens of the Earl of Lonsdale, in Fisher-street, Carlisle. M. Nilsson notes its arrival in Sweden by the 1st of May. Montagu informs us that it is said to be found only as far north as Yorkshire (his observations being confined to Britain), and certainly not farther west than the eastern borders of Devonshire; although they are plentiful both in Somersetshire and Dorsetshire. Mr. Yarrell ('History of British Birds') says:—"When we consider that this bird extends its visits during the summer as far north as Russia and Sweden, its very limited range in this country is unaccountable. It is found in Sussex, Hampshire, Dorsetshire, and the eastern part only of Devonshire, along the line of our south coast. It has been heard about Teignmouth and Exmouth, but no farther west in that direction. In North Devon it has been heard near Barnstaple, but not in Cornwall or Wales. A gentleman of Gower, which is the peninsula beyond Swansea, procured from Norfolk and Surrey, some few years back, some scores of young Nightingales, hoping that an acquaintance with his beautiful woods and their mild climate would induce a second visit; but the law of nature was too strong for him, and not a single bird returned. Dyer, in his 'Grongar Hill,' makes the Nightingale a companion of his muse in the vale of Towey, or Caermarthen; but this is a poetical licence, as the bird is not heard there."

Mr. Yarrell, who remarks that it is not included by Mr. Rylands in his 'Catalogue of the Birds of Lancashire,' though it has been heard as high up as Carlisle, but no farther, goes on to state that on the eastern side of our island the bird frequents Essex, Suffolk, Norfolk, some of the more wooded parts of Lincolnshire, and several parts of Yorkshire; but not higher than five miles north of the city of York, as he learned from his friend and correspondent Mr. Thomas Allis. Mr. Yarrell states his belief that it has not been heard in Scotland or in the Scottish islands, which, he adds, considering that it visits Denmark, is extraordinary.

The following is a description of this bird:—Rich brown above; rump and tail with a reddish tinge; throat and middle part of belly

dirty or grayish white; lateral parts of the neck, breast, and flanks, gray; bill and legs light brown. Sexes alike.

The Nightingale shuns observation, abiding in the thickest coverts, and in these the nest is sometimes placed on a low fork, but generally on the ground. Withered leaves, particularly those of the oak, very loosely conjoined with dried bents and rushes, and lined internally with fine root-fibres, form the structure. The eggs, of an olive-brown, are four or five in number. After the young are hatched, generally in June, the melodious song of the male ceases, and is succeeded by a low croak, varied occasionally with a snapping noise; the first is considered to be meant for a warning, and the last as a defiance. The food consists of insects, such as flies and spiders, moths and earwigs. Green caterpillars were the food brought by the parent birds to the nest of young nightingales taken by Colonel Montagu. It is not improbable that the bird's choice of localities is in some measure determined by the absence or presence of some favourite insect food.

There is another European Nightingale (the Thrush Nightingale, *Philomela Turdoides* of Blyth, *Luscinia major* of Brisson, *Sylvia Philomela* of Bechstein) inhabiting central Europe. The song of this species is loud, but far inferior to that of the true Nightingale. It is said to be common in Egypt.

PHILOMELI'NÆ. [SYLVIADÆ.]

PHILO'SCIA. [ISOPODA.]

PHILYDRACEÆ, *Waterworts*, a natural order of Endogenous Plants, constituted by Brown to receive the genera *Philydrum* and *Hæmaria*. They are allied, according to Lindley, to *Commelinaceæ*, *Orchidaceæ*, and *Xyridaceæ*. The species are grassy-looking plants, with dipetalous flowers, no calyx, three stamens, of which two are abortive, and an embryo in the axis of fleshy albumen; they have erect stems, and ensiform leaves. They are found in Australia, Cochin China, and China. (Lindley, *Vegetable Kingdom.*)

PHI'LYRA, a genus of *Crustacea*. [OXYSTOMA.]

PHLEBO'PTERIS, a genus of Fossil Ferns, from the Oolite of Yorkshire. (Brongniart.)

PHLEGM, a common name for Mucus. [MUCUS.]

PHLEUM, a genus of Grasses, contains, among many unimportant species, one of considerable agricultural value. This, the *P. pratense*, Meadow Cat's-Tail Grass, is a general inhabitant of the most fertile pastures, and is regarded as a sign of rich soil. It bears its flowers in a long cylindrical soft head, and is extremely like the Meadow Fox-Tail [ALOPECURUS] in appearance, from which it differs in having unequal glumes, and two paleæ instead of one. This plant is very productive, especially in the early spring, and is a very general component of hay. Nevertheless, according to Mr. Low, it is not a peculiarly good hay-grass, from the wiryness of its stem and the shortness of its aftermath. It is of the greatest use when the object is to procure a sward of permanent herbage. [GRAMINACEÆ.]

PHLŒOMYS. [MURIDÆ, col. 967.]

PHOCA. [PHOCIDÆ.]

PHOCÆ'NA. [CETACEA.]

PHO'CIDÆ, a family of Marine Carnivorous *Mammalia*, including the animals called Seals.

The Amphibious *Carnivora* of Cuvier form a perfectly natural group. Their feet are so short and enveloped in the skin that they are not available for any purpose on land, except a kind of creeping; and indeed terrestrial progression is affected by means of a sort of shuffling jumping motion, in which the spine and the muscles of the body are principally employed, though the extremities are used in getting or rather climbing out of the water upon a rock or other projecting body. The webbed intervals of the toes, which last are completely enveloped in membranes that leave a considerable power of expansion to the extremity, serve as excellent oars, and these animals therefore pass the greatest part of their life in the sea, coming on shore only to bask and sleep in the sun, and suckle their young ones. Cuvier remarks that their elongated body, their very moveable spine, provided with muscles which put it in action with powerful flexibility, their narrow pelvis, their close thick fur, all unite to make them good swimmers, and the details of their anatomy confirm the impression produced by their external form. ('Règne Animal.')

Two genera only, taking the term genus in its most comprehensive sense, belonging to this group, have as yet been discovered—the Seals (*Phoca*, Linn.), and the Walrus or Morse (*Trichechus*, Linn.).

In the structure of their skull the Seals closely approach the Otter. If the skull of the Common Seal (*Phoca vitulina*) be compared with that of an otter, a great resemblance will be found to exist between them in the shortness of the muzzle, the compression of the interorbital region (which is greater in the Seal), the width and flatness of the cranium, and especially of the whole region of its base or under part, with the exception of the tympanic portions, which are large and convex. The orbit is very large in the Seal, and the frontal bone does not complete it backwards by a postorbital apophysis, nor is it distinguished from the temporal bone, except by the convexity of the last-named portion of the skull. The temporal crests are but little marked, and the occipital crest is insensible. The frontal bone does not form in front that triangular enlargement, the traces of which are still to be found in the Otter; but the postorbital apophysis of the zygomatic arch is very strongly marked, and the jugal and temporal bones equally contribute to form it. The intermaxillary bones terminate near the nasal, without reaching to them; their suture below traverses the palate opposite the canines, and even in the middle opposite to the first molars. The bones of the cranium are thin, and there are no frontal sinuses.

The skull of the Monk-Seal (*Phoca Monachus*, Herm.) presents, independently of its size, some rather striking differences when compared with that of the *P. vitulina*. The zygomatic arches are more open and robust in the former; the anterior region of the frontal bone is convex; a very marked sagittal crest commences on the middle of the orbits and proceeds to join an occipital crest as strongly marked, which notches the back part of the cranium with a re-entering angle. There is also a notch at the posterior border of the palate, and the intermaxillary bones are very distinctly articulated to the nasal. On the anterior border of the orbit is a projecting point formed by the maxillary bone; and an obtuse longitudinal crest projects under the basilary region. In the upper jaw there are only four pointed molars, the external ones being very slightly the largest; below there are four, also smaller; altogether five molars on each side of each jaw, less trenchant, and with lateral points much less marked than in *P. vitulina*.

Skull of Monk-Seal (*Phoca Monachus*), seen from above.

Skull of Monk-Seal, seen from below.

Skull of Monk-Seal (profile).

The shoulder-blade of the Seal (Cuvier takes the last-named species as the principal type) widens very much from before backwards; its antespinal fossa is much wider than the other; the anterior border is very convex, and the anterior angle is lost in this convexity. The posterior edge is slightly concave, and the posterior angle rather sharp; the spine projects but little, and is terminated by a small depressed acromion, which does not advance so far as the edge of the articular surface. The acromial tuberosity is almost obsolete. In *P. vitulina* and *P. mitrata*, the antespinal fossa and the shoulder-blade together are much smaller, and there can hardly be said to be an anterior angle. In *Otaria*, on the contrary, the antespinal fossa is still wider in proportion than in *P. Monachus*; it is divided longitudinally by a ridge less elevated than the spine and without an acromion. The humerus is remarkable for its relative brevity, and for the great projection of

its internal tuberosity and of its deltoid crest; its lower pulley is hollowed by an obtuse gorge and divided into two parts—one external and wider, convex in two directions, for the head of the radius; one internal and narrower, for the cubit. Both the *P. vitulina* and the *P. mitrata* have the internal condyle pierced with a hole for the cubital artery, but this hole is wanting in *P. Monachus* and *Otaria*. The upper head of the radius is rounded and has a simple concavity, is short and very much compressed, and dilated vertically for its lower two-thirds.

The ulna or cubit is very much compressed on its upper part, where the olecranon is much higher than it is long, and gives off a pointed apophysis towards the lower part. The hand of the Seal, being principally destined for swimming, is cut obliquely, so that the thumb forms its point and its most powerful edge; it has nevertheless only two phalanges as in ordinary, but its metacarpal bone and its two phalanges make it longer and stouter than the other fingers. The articulations of the phalanges are not well marked. The ungueal phalanges of the Seals have one remarkable conformation, namely, that the point which is sheathed in the claw comes out, in some degree, from the upper surface of the bone, and the rest of the bone forms, as it were, two little wings. In the *Otariæ*, which have no claws before, the ungueal phalanx is simply depressed and obtuse.

The pelvis of the Seals, and especially the ossa ilii, are reduced to very small dimensions.

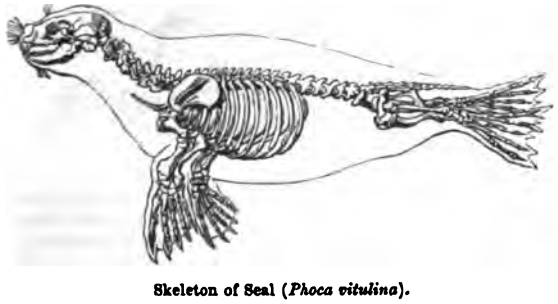
Of all the bones of the Seals the femur is the most extraordinary for its shortness; it is hardly longer than it is wide: in the lower part especially it is flattened and dilated laterally, having a crest at its internal border and a tuberosity on its external border. Its rotular pulley is flat and nearly vertical. The articular surfaces for the tibia are wider than they are long.

The tibia is twice and a half as long as the femur, and is rather stout, especially above, where in age it becomes soldered with the fibula, but always remains distinct from it below. The interval between them is rather wide. The fibula itself is rather stout.

The astragalus of the Seals is very extraordinary; for instead of being more or less hollow in the middle of its articular surface, it offers to the leg a convex pulley formed of two faces, which together form a projecting angle like a roof, and one of which responds to the tibia, and the other (the largest) to the fibula. This bone has not only an apophysis forward for the scaphoid bone, but has another backward, terminated by a tuberosity and forming a sort of internal heel, so that if looked at separate from the rest it might be taken for the os calcis. Upon this tuberosity of the astragalus the long flexor of the toes passes in a groove.

The great and little toes are larger than they are long, and the middle toe is the shortest, so as to give the hind foot a forked appearance; the great toe nevertheless has but two phalanges. All the articulations of these phalanges are as little developed as in the fore feet.

The ribs are angular rather than flat, and slight when compared with those of the Dugongs. In the Seals there are ten whose cartilages are attached immediately to the sternum, and nine only in *Otaria*. The ninth rib in the Seals is attached to the side of the eighth bone of the sternum, and the tenth, as ordinarily, to the interval of the eighth and ninth: this last is cylindrical, longer than the others, and terminated by a cartilaginous dilatation. The others are depressed. In front of the first and last pairs of ribs there is in the Seals a pointed cartilaginous prominence, which in *Otaria* is ossified, and makes part of the body with the first bone. ('Ossemens Fossiles.')



Skeleton of Seal (*Phoca vitulina*).

In these Pinnigrade *Feræ* the whole form is adapted for progression in water. Instead of the lengthened anterior extremities and phalanges of the bats, framed to support a wing for their passage through the air, we have all the bones of those extremities in the Seal short and compact, in order to support the finlike arm and deteriorated hand. We have the conical shape of the body and the extremely narrow pelvis, to favour that shape so as to produce the least resistance in passing through the water, with the short femur and posterior extremities directed backwards. In the skull we have the defective orbit observable in all the *Carnivora*, by which space is gained for the zygomatic arch and the highly developed temporal muscle. The broad development of the transverse processes of the atlas is here also remarkable, and the cervical vertebræ are framed for extensive motion.

The spinous processes of the vertebræ have a posterior deflection so as to act in unison for the necessary aquatic progression. The clavicle is absent, as in the *Feræ* generally, but the scapula is broad. The number of carpal bones is the same as in the lion, and the number of ribs may be stated at fifteen pairs.

Considerable differences exist in the crania of the various *Phocidæ*, well justifying, with other discrepancies of structure, the division of the family into several genera.

The Stomach of the Seal (*Phoca vitulina*) differs from the ordinary form: the œsophagus enters directly at the left extremity, so that there is no blind sac in the stomach.

The seals have the power of opening or closing their nostrils at pleasure, and the interval between their respirations is very long. This may be observed in those which are kept in confinement; and the closing appears to be effected by sphincter-like muscles acting upon valvules which shut the aperture most effectually. Such a provision is absolutely necessary for animals that pass so much of their life in the water and take their food there: for ordinarily the seal eats in the sea, though it can eat upon land, as those who have seen the individual fed, in the Gardens of the Zoological Society in the Regent's Park, well know. The breathing is not only slow, it is also irregular. After opening the nostrils and making a strong expiration, the animal inspires a large quantity of air, and closes the nostrils. In the intervals of this infrequent respiration, it is evident, from the free motion of the ribs and the general deportment of the animal, that the lungs receive their regular supply of air. In a state of nature a quarter of an hour and as much as twenty-five minutes have been known to elapse between their descent from the surface and their ascent thither for the purpose of obtaining a fresh supply; and in confinement they have been observed to remain asleep with the head under water for an hour at a time, and consequently without breathing during that period. To account for this power physiologists were of opinion that the foramen ovale remained unclosed in these animals, and that thus the sanguiferous circle was not interrupted during the time of their stay under water; but Cuvier and Lawrence found it closed in the seals dissected by them, and we must look to some other conformation for the endowment of this faculty. Thus Cuvier states that there is a great venous sinus in their liver, which assists them in their divings by rendering their respiration less dependent upon the circulation; and Mr. Houston has pointed out other venous reservoirs in the neighbouring parts. These provisions seem to be quite different from the great arterial plexus first pointed out by John Hunter in the *Cetaceæ*; for in the Seals the blood appears to be laid up not in a network of vessels, but, so to speak, in wide canals. The term veineux is certainly used by Cuvier, and a reservoir of arterial blood would, reasoning from analogy, be required for the purpose of keeping up healthy life during submersion; but there can be little or no doubt that these reservoirs are intimately connected with the power of remaining long beneath the water, though, as yet, the mode of operation is not satisfactorily made out, as it is in the Whales. The last-mentioned author states that their blood is very abundant and very black.

The Brain of the Seals is well developed, and the degree of sagacity and attachment shown in domestication (for they are very easily tamed and taught to perform tricks) is evidence of superior intelligence. This has been long ago observed:—"Accipiunt disciplinam," says Pliny ('Nat. Hist.,' ix. 13), "voceque pariter et visu populum salutant, incondito fremitu: nomine vocati respondent." F. Cuvier too saw one display much intelligence; he performed what he was ordered to do. When desired to raise himself erect on his hind legs and to take a staff in his flippers, like a sentinel, he obeyed the word of command: he would lie down on his right side or on his left, according to order, and tumble head over heels when directed to do so. He gave a paw when requested, like a dog, and protruded his lips for a kiss. This animal appeared to be very fond of its master.

Blumenbach remarks that it has long been known that the sclerotic coat in several mammals is, as in the human subject, not of equal strength throughout; but that its posterior part is much thicker than its anterior. It has also been conjectured that this structure might influence what are termed the internal changes of the eye, by which the form of the eyeball, and consequently the length of its axis and the relative situation of the lens are adjusted according to the proximity or distance of the object, or indeed with reference to any other relations. Blumenbach remarks that he flatters himself that he has ascertained the truth of this conjecture by discovering the admirable structure of this coat in warm-blooded animals, which have not only the power of seeing at various distances, but also in two media of such different density as air and water. In the eye of the Greenland Seal, where he first noticed the fact, the cornea was thin and yielding; the anterior segment of the sclerotica, or that which is immediately behind the latter membrane, was thick and firm; its middle circle thin and flexible; and lastly, the posterior portion very thick, almost cartilaginous. The whole eyeball was surrounded with very strong muscles; and it may be easily understood how their action, modified according to circumstances, produces the requisite changes; how the axis of the eye is shortened when the animal sees in the air, by bringing the lens nearer to the back of the globe, in order to obviate the strong refraction which the rays of light undergo in

passing from the thin medium of air into the thicker one of the eyes, and vice versâ.

The Auditory Nerve in the Seal is very large, and though the auricular aperture is closed by a mechanism somewhat similar to that which shuts the nostrils in order to protect the internal parts of the organ from the consequences of the great pressure of the water when the animal is in deeps, it is evident that Seals hear very well even under water. The senses of taste, smell, and touch, are all well developed in the *Phocidæ*.

The student will find several preparations illustrative of the anatomy of the Seals in the Museum of the Royal College of Surgeons.

The following are the genera into which the Linnæan genus *Phoca* has been divided:—

Calocephalus (F. Cuv.).—Molars formed principally of one great point placed in the middle, one smaller situated below, and two, also smaller, placed posteriorly. Cranium convex on the sides, flattened on the top: slight rugosities, instead of occipital cristæ.

C. vitulinus. This is the *Phoca vitulina* of Linnæus: Le Veau Marin and Phoque Commun of the French; Vecchio Marino of the Italians; Lobo Marino of the Spanish; Meerwolf and Meerhund of the Germans; Zee-hund of the Dutch; Sæl-hund of the Danes; Sial of the Swedes; Common Seal and Sea-Calf of the English; and Moelrhon of the Welsh.

The ground-colour of the hair or skin, when the animal is alive and dry, is pale whitish-gray with a very slight tinge of yellow; when just out of the water and wet, the ground-colour is ash; after death, and, as seen in museums, the ground-colour is pale yellowish-gray, the oil having penetrated the skin, and rendered the hair of a more yellow hue. The body above is clouded and marbled with blackish-gray. Space round the eyes and muzzle, sides of the body, all the lower parts and the feet, pale grayish, becoming nearly white beneath. There is some brown on the muzzle and upper part of the tail; whiskers moderate, undulated. Claws black, and rather strong. Length from 3 to 5 feet.

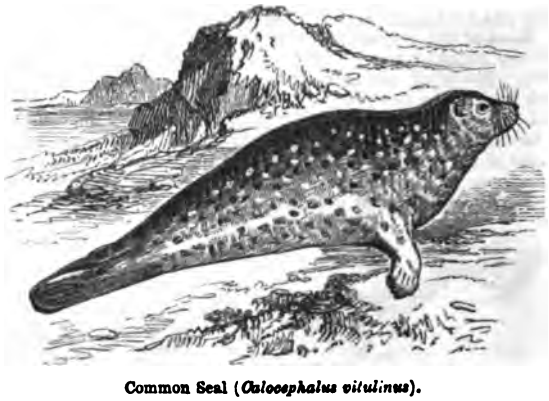
It inhabits the northern seas generally, the coasts of England, France, &c. It is comparatively scarce on the southern coasts of Britain now, but still haunts the estuary of the Tees.

Dental Formula:—Incisors, $\frac{6}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 34$.

Teeth of *Calocephalus*.

Mr. Farrington, then of Dinas in Caernarvonshire, wrote thus to Pennant:—"The seals are natives of our coasts, and are found most frequently between Llyn in Caernarvonshire and the northern parts of Anglesey; they are seen often towards Carreg-y-Moelrhon, to the west of Bardsey, or Ynys Enlli, and the Skerries, commonly called in the British language Ynys-y-Moelrhoniad, or Seal Island. The Latin name of this amphibious animal is *Phoca;* the vulgar name is sea-calf, and on that account the male is called the bull, and the female the cow, but the Celtic appellative is 'Moelrhon,' from the word 'moel,' bald, or without ears, and 'rhon,' a spear or lance. They are excellent swimmers and ready divers, and are very bold when in the sea, swimming carelessly enough about boats; their dens or lodgments are in hollow rocks or caverns near the sea, but out of the reach of the tide. In the summer they will come out of the water to bask or sleep in the sun, on the top of large stones or shivers of rocks, and that is the opportunity our countrymen take of shooting them; if they chance to escape, they hasten towards their proper element, flinging stones and dirt behind them as they scramble along, at the same time expressing their fears by piteous moans; but if they happen to be overtaken, they will make a vigorous defence with their feet and teeth till they are killed."

Dr. Borlase, in a letter dated October, 1763, gives the following account:—"The seals are seen in the greatest plenty on the shores of Cornwall in the months of May, June, and July. They are of different sizes; some as large as a cow, and from that downwards to a small calf. They feed on most sorts of fish which they can master, and are seen searching for their prey near the shore where the whistling fish, wraws, and polacks resort. They are very swift in their proper depth of water, dive like a shot, and in a trice rise at fifty yards' distance, so that weaker fishes cannot avoid their tyranny except in shallow water. A person of the parish of Sennan saw not long since a seal in pursuit of a mullet (that strong and swift fish); the seal turned it to and fro in deep water as a grayhound does a hare; the mullet at last found it had no way to escape, but by running into shoal water; the seal pursued, and the former, to get more surely out of danger, threw itself on its side, by which means it darted into shoaler water than it could have swum in with the depth of its paunch and fins, and so escaped. The seal brings her young about the beginning of autumn; our fishermen have seen two sucking their dam at the same time, as she stood in the sea in a perpendicular position. Their head in swimming is always above the water, more so than that of a dog. They sleep on rocks surrounded by the sea, or on the less accessible parts of cliffs left dry by the ebb of the tide, and if disturbed by anything, take care to tumble over the rocks into the sea. They are extremely watchful, and never sleep long without moving, seldom longer than a minute; then raise their heads, and if they hear or see nothing more than ordinary, lie down again, and so on, raising their heads a little, and reclining them alternately in about a minute's time."



Common Seal (*Calocephalus vitulinus*).

The seal-hunters in Caithness assured Pennant that their growth is so sudden, that in nine tides from their birth they will become as active as their parents. On the coast of that county immense caverns open into the sea, and run some hundred yards beneath the land. These are the resort of seals in the breeding-time, where they remain till their young are old enough to go to sea, which is in about six or seven weeks. The first of these caves, says Pennant in continuation, is near the Ord, the last near Thrumster. Their entrance is so narrow as only to admit a boat; within they are spacious and lofty. Into the mouths of these caverns the seal-hunters enter about midnight in the month of October or the beginning of November, and having rowed up as far as they can, land. Each of them being provided with a bludgeon and properly stationed, they light their torches, and make a great noise. This brings down the seals from the recesses of the cavern in a confused body with fearful shrieks and cries. The men at first are obliged to give way for fear of being overborne, but when the first crowd is passed, they kill as many as straggle behind, chiefly the young, by striking them on the nose. When the slaughter is over, they drag the seals to the boats. This is described as a most hazardous

employment; for should their torches go out, or the wind blow hard from the sea during their continuance in the cave, their lives are lost.

To the Greenlander the seal is all in all: it gives him light, food, and clothing. Mr. Farrington above quoted says of the Welsh seals, that they are taken for the sake of their skins, and for the oil their fat yields: "the former," says he, "sell for four shillings, or four and sixpence a piece, which, when dressed, are very useful in covering trunks, making waistcoats, shot-pouches, and several other conveniences." Pennant, speaking of the Caithness seals, states that those of six weeks old yield more oil than their emaciated dams: "above eight gallons have been procured from a single whelp, which sells from sixpence to ninepence per gallon; the skins from sixpence to twelve-pence." That the flesh was thought not unworthy of the tables of the great in this country is evident from the bill of fare at the 'intronazation' of George Nevell, the archbishop of York; for we there find "Porpoises and Seals 12:" and, indeed, Low, in his 'Fauna Orcadensis,' states that at North Rolandsha they were taken for food, and that they made good hams. The numbers killed on the coast of Newfoundland in a good year amount to hundreds of thousands.

C. Grœnlandicus. This is the *Phoca Grœnlandica* of Müller; *P. semilunaris* of Boddaert; *P. dorsata* of Pallas; Phoque à Croissant of Buffon; Harp-Seal of Pennant and others; and Attersoak of Crantz.

The hair is drier, closer to the leather, and more free from wool than that of the other species; each hair flat and lustrous. A large brown oblique band, irregularly dentilated, commences nearly above the shoulders, where it joins that of the other side, and is carried along upon the sides and up to the hind legs, becoming by degrees brighter there and losing itself in the white of the belly; the posterior extremity approaches that of the other side at the root of the tail. Some small brown spots are scattered about both in the gray of the back and in the pale part of the band. The bands and spots become more and more black with age.

The females and the young have the skin of the same ground-colour, but without bands, and with unequal, well-defined, angular, brown spots, thrown as it were at hazard on different places of the upper and lower part of the body.

Cuvier, whose description this is, says that the ground-colour of the old male is gray-white, and that he is 5 feet long. The face is entirely black.

According to Crantz this species, when newly born, is quite white and woolly. In the first year it is cream-coloured; in the second, gray; in the third, painted with stripes; in the fourth, spotted; and in the fifth, wears half-moons as the sign ofits maturity.

It is found in the Frozen Ocean, Greenland, Newfoundland, Iceland, the White Sea, Kamtschatka. It is rare in Britain.

Harp Seal (*Calocephalus Grœnlandicus*), male.

According to Fabricius this species is very numerous in the deep bays and the mouths of the rivers in Greenland. They leave the coast twice a year: at first in March, returning in May; again in June, and re-appear in September. Their young (one, rarely two, at a birth) are brought forth in spring, and are suckled on the ice far from shore. They avoid the fixed ice, but live and sleep in vast herds near the floating ice-islands, among which they are sometimes seen swimming in great numbers under the guidance of one who seems to act as leader and sentinel for the whole. Their food consists of all kinds of fish, shell-fish included, but they prefer the arctic salmon. When on the feed, and one comes to the surface to breathe, he lifts his head only above the water, and quickly dives without changing his place. These seals swim in many attitudes, on their back, on their sides, as well as in the ordinary position, and occasionally whirl themselves about, as if in sport. They sleep frequently on the water, and are considered incautious, especially on the ice.

They are said to have a great dread of the toothed whales. If a grampus perceive a seal of any species basking on floating ice, it is asserted that he does his best to upset the ice or beat the seal off with his fins, when the latter becomes an easy prey.

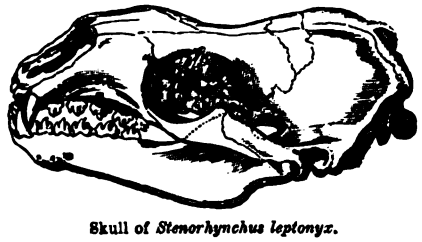
Crantz avers that this is a careless stupid seal, and that it is the only one which the Greenlander will venture to attack alone. He goes to hunt it in his kajak, which is in the form of a weaver's shuttle. When he perceives a seal, he endeavours to surprise it unawares with the wind and sun in his back, that he may be neither heard nor seen. He approaches it rapidly but silently till within 4 or 6 fathoms. He then takes hold of the oar in his left hand, and with his right throws the harpoon. If it is fixed, the Greenlander throws the attached buoy overboard on the same side that the seal dives, and he dives upon the instant. The struck victim often carries the buoy under water, but, wearied and wounded, it must at last come up to breathe. The Greenlander, who is on the watch, now attacks it with his long lance till the animal is exhausted, when he releases it from its sufferings with his short lance; and then blows it up like a bladder that it may swim the easier after his kajak. This is a service of danger to the seal-hunter. If the line should be entangled, or if it should catch hold of the kajak, an oar, the hunter's hand, or his neck, as it sometimes does when the wind is high, or if the seal should make a sudden turn to the other side of the light boat, the kajak would be drawn under the waves. Then, unless the Greenlander has presence of mind and dexterity to disentangle himself, he is lost. Nor is this all the danger, for the dying seal may attack him; and if it be a female followed by young ones, she will not unfrequently turn on the pursuer, injure him, or bite a hole in his kajak and sink it.

C. discolor, Marbled Seal. This seal is a native of the coasts of France, and was at first thought to be a variety of *C. vitulinus*, or one of that species exhibiting a modification of colouring from age or sex. Baron Cuvier observes that it does not appear to be a variety of the last-named species proceeding from age and sex only; but, he adds, that its cranium does not show a sensible variation from that of the Common Seal. Dr. Hamilton states that Professor Nilsson regards it as a distinct species, giving it the name of *C. annellata*.

Marbled Seal (*Calocephalus discolor*).

A specimen of this seal was kept for some time in the Jardin des Plantes, Paris. In the same inclosure with it were two little dogs, and they amused themselves by mouuting on the seal's back, barking, and even biting it: the seal however took it in good part, and seemed pleased with them, though it would sometimes give them slight blows with its paws, as if more to encourage their play than repress their liberties. When the little dogs made their way out of the inclosure, the seal tried to follow them, not deterred by the rough and stony ground. In cold weather they all three huddled kindly and warmly together. If the dogs snatched the fish from the seal's mouth when he was feeding, he bore it patiently: but he exhibited very different conduct to another seal, who shared his mess; for they generally had a fight over their meal, the combat ending, as usual, in the defeat of the weakest.

Stenorhynchus. — Muzzle prominent; teeth composed of a long median, rounded, cylindrical tubercle, curved backwards, and separated from two other tubercles which are rather smaller, one anterior and one posterior, by deep notches. Claws very small.



Skull of *Stenorhynchus leptonyx*.

Dental Formula :—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 32$.

Two species only of this genus appear to be known, *S. leptonyx*, *S. phocaleptonyx*, De Blainv., the Small-Nailed Seal; and *S. Weddellii*, Less., the Sea-Leopard. Of the natural history of the first-named species, which is a native of the Falkland Islands and New Georgia, little or nothing seems to be known; and the accounts of the habits

Teeth of *Stenorhynchus*.

of the latter are very meagre, though there is a very accurate description by Dr. Hamilton in the 'Naturalist's Library' ('Mammalia,' vol. viii.). It has been observed in the South Shetlands.

Sea-Leopard (*Stenorhynchus leopardinus*).

Pelagius (F. Cuv.).—Muzzle enlarged and elongated at its extremity; chanfrein very much arched; upper incisors notched transversely at their extremity; lower ones simple; molars thick and conical, having before and behind small rudimentary points only.

Dental formula:—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 32$.

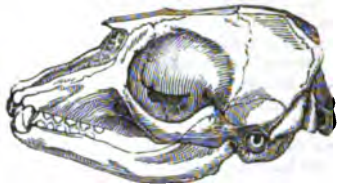
P. Monachus; *Phoca Monachus*, Herm.; Phoque à Ventre Blanc of the French, the Monk Seal. Hair short, smooth, and shining; dark-brown, mixed with gray on the neck and head, above; white below. No external ear. Whiskers smooth and strong. Length from 7 to 10 or 12 feet.

It is a native of the Adriatic; coasts of Sardinia.

This appears to be the *Phoca bicolor* of Shaw, and *P. leucogaster* of Péron. It is the species which afforded Buffon and F. Cuvier their interesting descriptions, and is supposed to be that whose skin was always carried everywhere (semper et ubique) by the emperor Augustus as a protection against lightning. (Suet., 'Octav. Aug.,' 90.) The Romans generally seem to have considered seal-skins in the same light. Pliny, in his chapter headed 'Quæ non feriantur fulmine,' says, "Ideo pavidi altiores specus tutissimos putant: aut tabernacula è pellibus belluarum, quas vitulos marinos appellant, quoniam hoc solum animal ex marinis non percutiat." ('Hist. Nat.,' ii. 55.)

Stemmatopus (F. Cuv.).—Head surmounted by a peculiar organ (whence the name of the genus), the nature of which is not well known

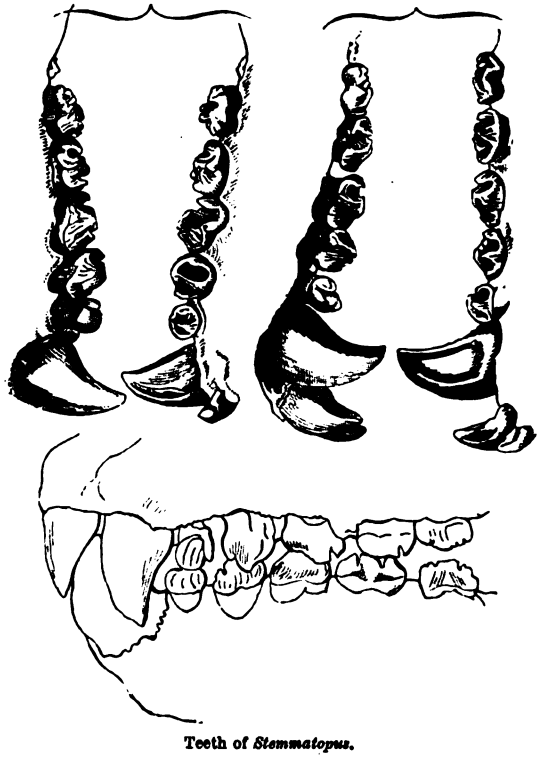
Molars with simple roots, short and wide, and striated only on their crown; muzzle narrow and obtuse.



Skull of *Stemmatopus*.

S. cristatus; *Phoca cristata*, Gmel.; *P. leonina*, Fabr. It is remarkable for possessing, about two inches from the extremity of the upper jaw, on the superior surface, a cartilaginous crest, which rises, increasing rapidly in height as it passes backwards, about 7 inches high at its posterior or vertical edge, which is separated into two planes by an intervening depression an inch deep. The superior edge is slightly convex, and the whole structure is an elongation of the septum of the nose, the true nostrils opening on each side of it by an oblong figure. This crest runs into the hood or sac-like appendage of the head. This hood is strongly muscular, with an aggregation of circular fibres round its external orifices, which are two, situated at the lower anterior part of the head. The females and young have the crest in a very rudimentary state. The length of this species is 8 feet.

Dental Formula:—Incisors, $\frac{4}{2}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 30$

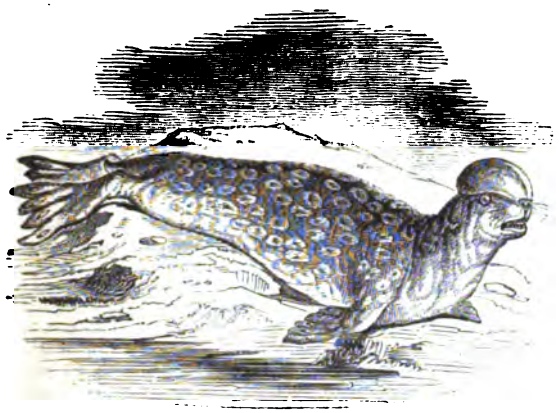


Teeth of *Stemmatopus*.

It is found on the coasts of Greenland and of North America down to the United States.

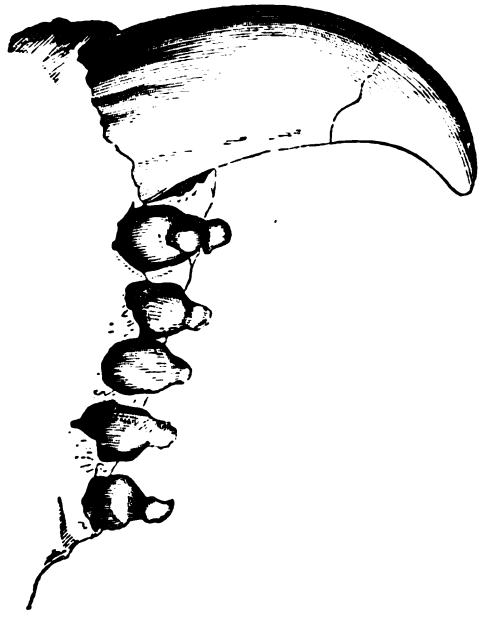
This species, which especially haunts the open sea, is said to visit the land in April, May, and June chiefly. They are found for the most part on large ice-islands, where they sleep without precaution: and occur in great numbers in Davis's Straits, where they are stated to make two voyages a year, in September and March. They depart to bring forth their young, and return in June very lean and exhausted. In July they proceed again to the north, where they appear to procure plenty of food, for they return in high condition in September. The Crested Seal is said to be polygamous, and to have its young on the ice. Its bite is formidable, and its voice is stated to resemble the bark and whine of a dog. When surprised by the hunter it weeps copiously. Among themselves they have fierce encounters, and inflict deep wounds in the conflicts with their claws and teeth.

It is one of the species most generally pursued, and together with the Rough Seal (*Calocephalus hispidus*), furnishes the greatest number of skins brought to Great Britain. The natives clothe their women with the skins of the young, and cover their boats and houses with the skins of the old ones. They head their hunting-spears with the teeth, and blow up the stomachs into fishing-buoys.

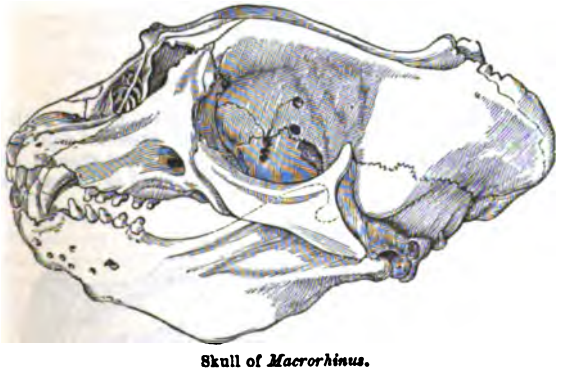


Stemmatopus cristatus.

Macrorhinus (F. Cuvier).—Differing widely from that of the other seals. Incisor teeth curved like the canines, but smaller; canines strong and well developed; molars with simple roots, larger than the crowns, which last resemble a pedunculated mammilla.



Teeth of *Macrorhinus*.



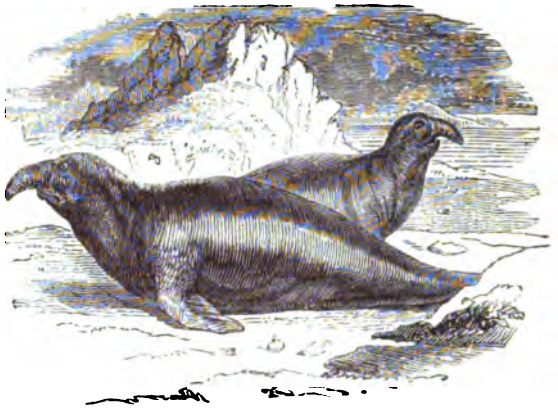
Skull of *Macrorhinus*.

M. proboscideus. This is the Phoque à Trompe of Péron; *Phoca proboscidea*, Desm.; Elephant Marin of the French; Sea-Elephant and Elephant-Seal of the English; Bottle-Nose of Pennant; and Miouroung of the Australians.

Dental Formula:—Incisors, $\frac{4}{2}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 30$.

This species is remarkable for the nose of the male being prolonged into a kind of proboscis, which respires violently when the animal is excited, or is elongated in the form of a tube about a foot long, when it is preparing for attack and defence. When the animal is in a state of repose, the nostrils are shrunk, and the proboscis flaccid, giving the face a larger appearance. The female has no proboscis.

It is found in the southern hemisphere, both in the Atlantic and Southern Oceans, between 35° and 55° S. lat., Kerguelen's Land, South Georgia, Juan Fernandez, South Shetland, and the Falklands.



Elephant Seal (*Macrorhinus proboscideus*). Males.

Elephant Seal (*Macrorhinus proboscideus*). Female.

This enormous animal, which, to use the expression of Mr. Lizars, "compared with any ordinary seal three or four feet long, appears like an elephant when compared to a sheep," owes its name to its size and bulk, most probably, quite as much as to the proboscis with which the male is furnished. These seals are fond of wallowing in fresh-water swamps, and resort to lakes and rivers, whose waters they drink with apparent pleasure. They sleep both afloat and on the sands of the shore: when a flock reposes in the latter situation, some of them keep watch, and if alarmed, down they go to the sea. Those who have seen them in progress describe their gait as very singular, their motion being a kind of crawling, during which their body trembles like a great bag of jelly. At every 15 or 20 paces they halt, as if from fatigue. If any one gets before them, they stop, and if urged to motion by repeated blows, appear to suffer much, and the pupil of the eye, which is ordinarily bluish-green, becomes blood-red. Notwithstanding their unwieldiness however, they have been known to ascend low downs of 15 or 20 feet elevation, in order to reach small ponds of water. The cry of the female and the young is said to resemble the lowing of an ox, but the hoarse gurgling singular voice of the male, strengthened by the proboscis, is described as being audible to a great distance, and as wild and frightful. To obtain shelter from the heat of the sun, when lying on the shore by day, they cover themselves, by the aid of their paws, with the moist sand. They perform a sort of migration in order to avoid the extremes of heat and cold, leaving the south in the beginning of winter for more temperate climes, and retiring southward again in summer. About a month afterwards, the females bring forth one, very rarely two, according to Péron; generally two, according to Anson. The young weigh about 70 lbs., and are between four and five feet long at their birth, the male, even at that early period, being larger than the female. At this time it is stated that the mothers are all collected near the shore, surrounded by the males, who prevent them from returning to sea till the period of suckling is past, during which operation the female lies on her side. The young grow so rapidly that they are said to double their original dimensions in eight days, and at the end of the third year they have attained a length of from 18 to 25 feet and upwards, when they increase principally in fatness.

At this period the proboscis appears in the male. Six or seven weeks elapse before the young are conducted to sea, to familiarise them with which the whole troop abandon the shore, swimming about for three weeks or more, when they return to the coasts for the purpose of breeding. The young males stay with the females till their proboscis is developed, announcing that they have arrived at maturity. During the breeding season, bloody battles take place among the males, in which they are often severely wounded, but rarely killed, while the females calmly wait the issue, and receive the conqueror. The period of gestation is said to be nine or ten months.

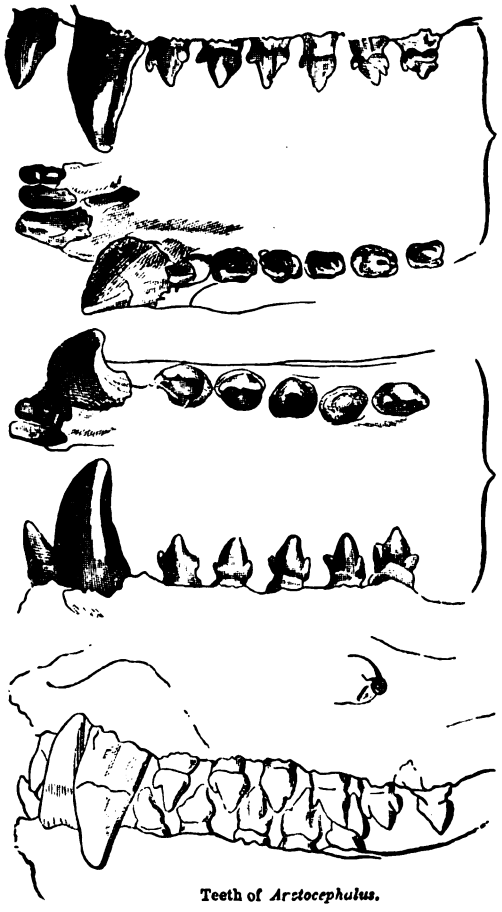
They are a harmless race, never attacking man unless in defence of themselves and their young. One of Anson's sailors lost his life by exasperating a mother, in whose presence he skinned her young one. Their disposition is however gentle and affectionate; and a young one, petted by an English seaman, became so attached to his master from kind treatment for a few months, that it would come to his call, allow him to mount upon its back, and put his hands into its mouth. Their length of life is estimated at 25 or 30 years.

Their tongues, when salted, are considered savoury and wholesome, but the flesh is black, oily, and indigestible. The heart, though tough and hard, is sometimes eaten, but the liver appears to be unwholesome. The skin, though not valued for its fur, is extensively used for carriage and horse harness, on account of its thickness and strength. But the oil is the great object for which the animal is hunted.

Arctocephalus (F. Cuvier).—Head with a narrow retracted muzzle. The four intermediate incisors of the upper jaw separated in their middle by a deep notch; the lower incisors notched from before backwards. Molars with a single root, less thick than the crown, which consists of a tubercle, furnished at its base before and behind with a smaller tubercle. External ears.

Skull of *Arctocephalus*.

Dental Formula:—Incisors, $\frac{6}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{5-5}$ = 36.



Teeth of *Arctocephalus*.

A. ursinus. This is the *Otaria ursina* of Desmarest; *Phoca ursina* of Linnæus; *Ursus marinus*, Sea-Bear, of Steller; L'Ours Marin of Buffon; the Ursine Seal of some authors.

It is the size of a large bear; girth at the shoulder 5 feet, near the tail 20 inches. Fur brown, acquiring a grayish tint at the point of the hairs in old age. External ears one inch eight lines long, conical, erect, covered with short hair, and opening by an oblong slit, which is shut in the water. Nails very slender and minute. Length 7½ feet.

It is found on the islands on the north-west point of America, Kamtchatka, and the Kurile Islands.

When these migratory seals appear off Kamtchatka and the Kuriles early in the spring, they are in high condition, and the females are pregnant. They remain on or about the shore for two months, during which the females bring forth. They are polygamous, and live in families, every male being surrounded by a crowd of females (from 50 to 80), whom he guards with the greatest jealousy. These families, each including the young, amounting to 100 or 120, live separate, though they crowd the shore, and that to such an extent on the islands off the north-west point of America, that it is said they oblige the traveller to quit it and scale the neighbouring rocks. Both male and female are very affectionate to their young, and fierce in their defence; but the males are often tyrannically cruel to the females, which are very submissive. If one family encroaches on the station of another, a general fight is the consequence. They will not, in fact they dare not, leave their stations, for if they did they must encroach on that of some other family. Steller relates that he had been beset by these seals for six hours together, and was at last obliged to climb a precipice to get rid of the infuriated animals, at the imminent peril of his life. They have their war-notes and several other intonations. When amusing themselves on the shore, they low like a cow, chirp like a cricket after a victory, and when they are wounded cry like a whelp. They swim very swiftly, and are as great a terror to other seals as the Sea-Lion is to them.

The skin, which is very thick, is covered with hair, like that of the common seal, but a great deal longer, standing erect, and very thick. The skins of the young are highly prized for clothing; and Steller speaks of a garment which he had made for himself from one, when he was in Behring's Island, with grateful remembrance

Ursine Seal (*Arctocephalus ursinus*).

Platyrhynchus (F. Cuvier).—Incisors pointed; molars with no secondary point, except at their anterior part. Cerebral region very much elevated, and the muzzle much more enlarged than in *Arctocephalus*. The complete number of teeth the same as in that genus. External ears.

Skull of *Platyrhynchus*.

If a number of species have been confounded under the name of Sea-Bear, there have been several honoured with the name of Sea-Lions, and among them the Elephant-Seal above-noticed. M. Lesson enumerates three species of *Platyrhynchus*:—1, *P. leoninus* (*Otaria jubata*, Desm., the Sea-Lion of Steller and Pernetty); 2, *P. molossinus*, Less. (*Otaria molossina* of the Zoology of La Coquille, Lesson, and Garnot); and 3, *P. Uraniæ* (Otarie Guérin of Quoy and Gaimard). To the first of these he assigns the Antarctic islands, such as the Falklands and Tierra del Fuego, adding that Steller found it in the northern hemisphere at the Kuriles; for the second and third the Falklands are the only locality given. ('Manuel.')

Dr. Hamilton also records three species:—1, The Sea-Lion of Steller (*Phoca jubata*, Gmel.); 2, the Sea-Lion of Forster (*Leo marinus*, Buff.); and 3, the Sea-Lion of Pernetty (*Platyrhynchus leoninus* of F. Cuvier). To the first of these he assigns the eastern shores of Kamtchatka and the Kurile Islands, and as far as Matsmai, adding that they abound in Behring's Island, and that Steller also saw them in abundance on the coasts of America in July; he assigns the southern hemisphere to the second, and the Falkland Islands to the third.

P. marinus, the Sea-Lion of Forster, has a thick skin; hair reddish, yellowish, or dark brown; no fur, or short woolly hair under the long hair; a mane on the neck of the male reaching to the shoulders; head small in proportion to the body, which is everywhere equally thick-looking, as Buffon describes it, like a great cylinder, more suited for rolling than walking; ears conical, about 6 or 7 lines long, cartilage firm and stiff, but yet rather curled at the margin; upper lip overhanging the lower, both furnished with long coarse black whiskers, which become white with age. Length from 10 to 14 feet; the females shorter and more slender.

Sea Lion of Forster (*Leo marinus*).

Captain Cook states that it is not at all perilous to go among these animals, for they either fled or stood still. The only danger was in going between them and the sea; for if they took fright at anything they would come down in such numbers that the person in the way would be run over. When he and his party came suddenly upon them, or waked them out of their sleep, they would raise up their heads, snort and snarl, and look fierce, as if they meant to devour the intruder; but when the men advanced the Sea-Lions always ran away. He states that the male is surrounded by from twenty to thirty females, and that he is very attentive to keep them all to himself, beating off every male that attempts to come to his flock. Others again had a less number, some no more than one or two; and here and there was seen one lying growling in a retired place, suffering neither males nor females to come near him. These he judged to be old and superannuated.

Forster relates that the rocks along the shore in New Year's Harbour were covered with multitudes of these Sea-Lions. He says that they were often seen to seize each other with an indescribable degree of rage, and that many of them had deep gashes on their backs, which they had received in the wars. The younger active Sea-Lions, with all the females and the cubs, lay together. When undisturbed, they were often observed caressing each other in the most tender manner, and their snouts often met together as if they were kissing. The same author states that they come on shore on those uninhabited spots to breed, and that they do not feed during their stay on land, which sometimes lasts for several weeks; they then grow lean, and swallow a considerable quantity of stones to distend the stomach. He adds that the stomachs of many of them were found entirely empty, and those of others were filled with ten or twelve round heavy stones, each of the size of two fists.

Halichærus (Nilsson).—Head very flat; muzzle very deep. Molar teeth of the upper jaw consisting of a simple point without tubercles: those of the lower jaw with a rudimentary tubercle before and behind the principal point. The number of incisors given in Mr. Bell's vignette

('British Quadrupeds') is six in the upper jaw, and the same number apparently belong to the lower. No external ear.

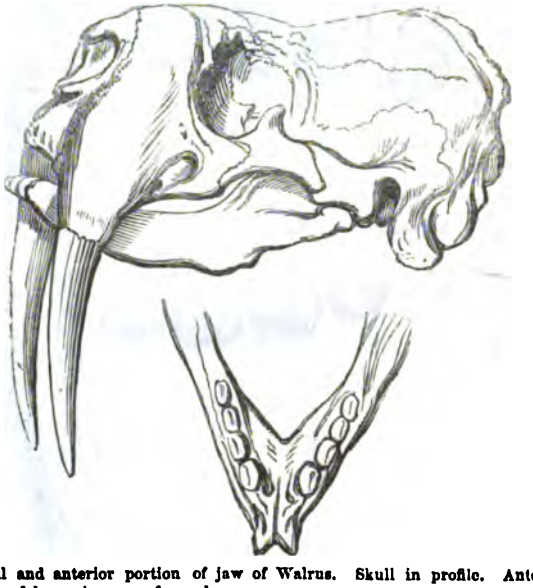
Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 36$.

H. griseus is the Gray Seal. This is the *Phoca Gryphus* of Fabricius; *Phoca barbata* of Fleming; the Long-Bodied Seal of Parsons. Its coat is white and silky, the hair two inches long, passing into a grayish lead-colour on the back. Wool under the hair short and white. Length from 7 to 8 feet. It is found in the seas of the North of Europe, Baltic, coasts of Pomerania, and the south coast of Ireland.

Professor Nilsson states that in the Baltic it is solitary; but Mr. Ball says that on the south coast of Ireland (Cork and Waterford) he has often seen this seal in small parties, and he learned from the fishermen that they had noticed as many as thirteen congregated on a rock. The same author has heard them in a cave baying like large dogs.

The comparatively small cerebral development and great expanse of the bones of the face, compared with that of the cranium, indicate a form inclining from the true Seals to the Walrus. All that is known of the habits of the Gray Seal tends to the conclusion that it is less susceptible of domestication and less intelligent than the other Seals.

The group of animals to which the Walrus belongs differs in many points from the Seals. Though the general structure of the skeleton resembles that of the Seals, there is a striking difference in the cranium and the teeth. In the adult lower jaw there are neither incisors nor canines, and the lower jaw itself is compressed anteriorly so as to fit between the two enormous tusks (canines) of the upper jaw, which are sometimes two feet long and proportionably thick, and directed downwards. The great alveoli, or sockets for containing these formidable teeth, produce the characteristic form of the skull of the Walrus, and make the anterior part of the upper jaw present an immense convex muzzle, the nostrils having an upward direction, and not terminating at the snout. All the molars are cylindrical, short, and truncated obliquely. Between the two canines are two incisors similar to the molars, but Cuvier observes that the greater number of authors have not considered them as incisors, although they are implanted in the intermaxillary bone; and between them, besides, in young individuals, are two small and pointed teeth.



Skull and anterior portion of jaw of Walrus. Skull in profile. Anterior portion of lower jaw seen from above.

The stomach and the intestines are nearly the same as those of the Seals. ('Règne Animal.')

Mr. MacGillivray found in the cranium of a young Walrus, in the Museum of the Royal College of Surgeons in Edinburgh, three incisors on each side of the upper jaw; the first or inner very small, the second a little larger, and the third or outer both disproportionately large, being equal to the largest molars. There were two very small incisors on each side in the lower jaw. The incisors are obliterated in adults.

There is a general resemblance between the organisation of the Walrus and that of the Seal; but the development of the brain is not so great in the former as it is in the latter, and the Walrus appears not to be gifted with so high a degree of intelligence as the Seal, though it is far from stupid.

Trichechus is the generic name for the Walrus. It has the following characters:—Head well proportioned, round, obtuse, eyes small and brilliant, upper lip remarkably thick, covered with pellucid whiskers or bristles as large as a straw. Two very large canines (in the upper jaw only) directed downwards. Nostrils large, rounded, placed on the upper part of the snout. No external ears.

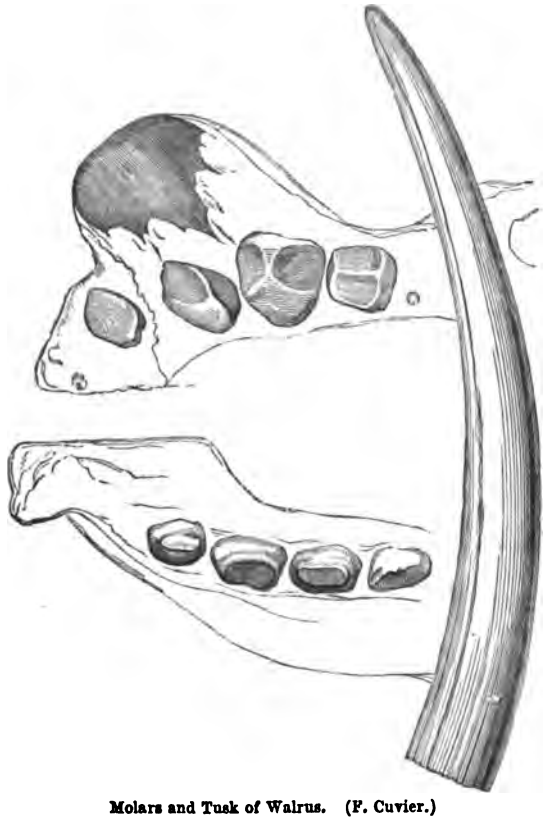
In adults, according to Mr. MacGillivray, from whom the formula is taken, the incisors are obliterated, except the lateral pair of the upper jaw; the fifth grinder also disappears, and sometimes the fourth.

T. Rosmarus, the Walrus, Sea-Horse, Morse, and Sea-Cow of the British; Morse, Vache Marine, Cheval Marin, and Bête à la grande Dent of the French. It is the Horse-Whale or Whale-Horse (Hval-Ros) of Octher the Norwegian, who, about the year 890, made his report of it to Alfred, as having in its teeth bones of great price and excellency, some of which he brought to the king on his return from his voyage beyond Norway; also Rosmar of the Norwegians; Morss or Morsh of the Russians; and Morsk of the Laplanders.

The neck is short, body very bulky, broadest round the chest, and diminishing towards the very short tail. Hair close; colour, according to Fabricius, varying with age, the young being black, then becoming brown, and gradually paler and paler, till the animal in old age becomes white. Limbs very short. Inside of the flippers defended by a horny kind of coat, or callous, produced, in all probability, by climbing over ice and rocks. Length from 10 to 15 or even 20 feet in the case of the largest bulls. Girth 8 or 10 feet, and upwards. Length of the tusks when cut out of the skull generally from 15 to 20 inches, sometimes 30 inches, and their weight from 5 to 10 lbs.

It is a native of the Icy Sea and Northern Ocean, Spitzbergen, Nova Zembla, Hudson's Bay, Gulf of St. Lawrence, &c. Rare on the north coasts of Britain.

Dental Formula:—Incisors, $\frac{6}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5}$ = 34.



Molars and Tusk of Walrus. (F. Cuvier.)

The contents of the stomach of a walrus noticed by Sir E. Home, consisted entirely of the *Fucus digitatus*, and Schreber affirms that it is not at all carnivorous. Fabricius and Crantz are of opinion that walrusses feed on shell-fish and marine vegetables which adhere to the bottom of the sea, and that one of the uses of their tusks is to root up their food from the spot to which it is fixed. Buffon states that they live on fish, like the seals, especially on herrings and the smaller fishes. The Rev. Dr. Scoresby found in their stomachs shrimps, a kind of crawfish, and the remains of young seals. Upon the whole of this evidence, the conclusion would be that the Walrus is omnivorous. The molar teeth certainly appear to be more adapted for bruising the long branches of sea-weeds (*Fucus digitatus*), which Mr. Fisher informed Sir Everard Home filled the stomach of the animal that he examined, than for dividing fish or flesh; and the probability is, that though the Walrus does not abstain entirely from carnivorous habits, marine plants form the bulk of its food. The tusks must be a great help as ice-hooks or grapplings in assisting the animal to climb upon the ice from the sea. Though they swim so rapidly, that, according to some authorities, it is as difficult to follow them with boats in rowing as the whale itself, their progress on land is awkward and tedious. Martens compares their gait to a kind of jerking, probably like that of the Seals, but he says they can make considerable springs, and can advance pretty rapidly with the help of their teeth.

They appear to be monogamous, and consequently are exempt from the terrible combats which are the result of the jealousies of the polygamous seals. The female is said to bring forth her young, one only at a birth, either on shore or on the ice. When born the young is about the size of a year-old pig. Till taught by fatal experience, the Walrus seems to be a fearless animal, and to be undisturbed by the face of man; but he soon learns his lesson of distrust. Still the animal is not incautious, for Captain Cook never found the whole herd asleep, some being always on the watch. These, on the approach of the boat, would rouse those next to them, and the alarm being thus gradually communicated the whole herd would presently awake. In the North Pacific Ocean he got entangled with the edge of the ice, on which lay innumerable sea-horses. They were lying in herds of hundreds, huddling one over the other like swine, and were roaring and braying very loud; and indeed in the night or in foggy weather they gave the voyagers notice of the vicinity of the ice before it could be seen. They were seldom in a hurry to get away till after they had been once fired at, when they would tumble over each other into the sea in the utmost confusion. Vast numbers of them would follow the boats and come close up to them, but the flash in the pan of a musket sent them down instantly. Before they were put upon their guard by persecution as many as 300 or 400 were killed at a time. That they are not without courage or sympathy for their wounded companions there is ample testimony. When Martens wounded one others speedily surrounded the boat, and whilst some endeavoured to pierce it with their tusks, others raised themselves out of the water and endeavoured to board her. Captain Phipps, afterwards Lord Mulgrave, relates that when near a low flat island opposite Waygat's Straits, in 1773, two of the officers went in a boat in pursuit of sea-horses. They fired at one and wounded it. The animal was alone when it was wounded, but diving into the sea it brought back a number of others. They made a united attack upon the boat, wrested an oar from one of the men, and were with difficulty prevented from staving or oversetting her; but a boat from the Carcass joining that from the Racehorse, they dispersed. Captain Phipps adds that one of that ship's boats had before been attacked in the same manner off Moffen Island. Sir Edward Parry encountered about 200 in Fox's Channel, lying piled as usual over each other on the loose drift-ice. A boat's crew from both the Fury and the Hecla went to attack them, but they made a desperate resistance, some with their cubs mounted on their backs: and one of them tore the planks of a boat in two or three places. Their parental affection is great. The boats from the Resolution and Discovery were hoisted out to attack sea-horses in Behring's Straits. Captain Cook states that on the approach of the boats to the ice all the walruses took their cubs under their fins, and endeavoured to escape with them into the sea. Several whose young were killed and wounded, and were left floating on the surface, rose again and carried them down, sometimes just as the people were going to take them into the boat; and they might be traced bearing them to a great distance through the water, which was coloured with their blood. They were afterwards observed bringing them up at times above the surface, as if for air, and again diving under it with a dreadful bellowing. The female in particular whose young had been destroyed and taken into the boat, became so enraged that she attacked the cutter, and struck her tusks though the bottom of it.

That the Walrus is capable of a degree of domestication, in youth at least, appears from the testimony published by John De Laet, who gives no bad wood-cut of a full-grown animal and a young one, and relates that "Ælius Everhardus Vorstius, M.D. et Professor," saw a cub ten weeks old, according to those who had brought it from Nova Zembla, about the size of a mastiff (canis Britannici majoris), which followed its master (magno nisu et grunnitu) for its food, consisting of a mash of oatmeal or millet (pulmentarium ex avena miliove), which it ate slowly (et suctu magis quam deglutiendo). The tusks had not yet projected from the mouth, but tubercles were perceived in the upper lip. There were two heads of adults, and those who showed them said that with the tusks they ascended rocks and suspended themselves from them, and that their food consisted of the long and great leaves of some plant growing from the bottom of the sea. "Vidi ibidem," adds Vorstius, "penem ejusdem animalis osseum, rotundum, cubitum et amplius longum, crassum, ponderosum, ac solidum, in fine prope glandem longe crassiorem ac rotundiorem. Hujus pulvere ad calculum pellendum Muscovitæ utuntur."

The flesh of the Walrus is highly valued by the inhabitants of the Arctic Regions, nor does it seem to have come amiss to our northern voyagers. Cook, after stating that he procured some, being in want of fresh provision, observes that till then they had thought them Sea-Cows (*Manatus* probably), so that they were not a little disappointed, especially some of the seamen, who, from the rarity of the thing, had been feasting their eyes for some days. Nor would they, continues Cook, have been disappointed now, nor known the difference, if they had not had some on board who had been in Greenland, and declared what animals these were, and that no one ate them. Notwithstanding this however, Cook and his crew lived upon them as long as they lasted, and there were few on board who did not prefer

them to salt meat. Sir Edward Parry remarks that the flesh was found tolerably good, affording a variety amid the ordinary sea-fare. But the tusks, the skin, and the oil, are the parts and products for which the Walrus is more particularly hunted. The ivory of the first is highly esteemed, and is used in Europe for artificial teeth. The skins make excellent carriage-braces, and are very useful about shipping, making very good wheel-ropes, &c. The oil is more valued than that of the whale, though not more than 20 or 30 gallons are afforded by one animal.

It is not at all improbable that some of the stories of Mermen and Mermaids have taken their origin from those who have seen walruses or seals with their heads lifted out of the water. The former especially, in such a situation, bear a strong resemblance to the human head before their tusks have grown, and when seen at some distance.

Walrus (*Trichechus Rosmarus*). (Bell.)

The following is Dr. J. E. Gray's arrangement of the family *Phocidæ* in his 'Catalogue of Specimens of Mammalia in the British Museum':—

a. Stenorynchina.

1. *Leptonyx Weddellii*, the Sea-Leopard.

b. Phocina.

2. *Phoca vitulina*, the Seal.
3. *P. Grœnlandica*, the Atak or Harp-Seal.

c. Trichecina.

4. *Halichœrus gryphus*, the Gray Seal.
5. *Trichechus Rosmarus*, the Morse or Walrus.

d. Cystophorina.

6. *Morunga proboscidea*, the Sea-Elephant.

e. Arctocephalina.

7. *Otaria jubata*, the Sea-Lion.
8. *Arctocephalus ursinus*, the Sea-Bear.

PHŒNICIRCUS. [PIPRINÆ.]
PHŒNICOPHA'US. [CUCULIDÆ.]
PHŒNICOPTERI'NÆ. [DUCKS.]
PHŒNICO'PTERUS. [DUCKS.]
PHŒNICO'RNIS. [LANIADÆ.]
PHŒNICU'RA. [SYLVIADÆ.]
PHŒNISO'MA. [TANAGRINÆ.]

PHŒNIX, a genus of Palms, which has been so named from one of its species, the Date-Tree, having been called so by the Greeks: this name is thought by some to be derived from Phœnicia, because dates were procured from thence. The genus is common in India and in the north of Africa, and one of the species grows in Arabia, the lower parts of Persia, and along the Euphrates to Syria. The genus is characterised by having flowers dicœcious, sessile, in a branched spadix, supported by a simple spathe; calyx urceolate, 3-toothed; corolla 3-petalled; stamens 3 or 6; filaments very short, almost wanting; anthers linear; (female) calyx urceolate, 3-toothed; corolla 3-petalled, with the petals convolute; pistil with three ovaries, distinct from each other, of which one only ripens; stigmas hooked; drupe 1-seeded; seeds marked on one side with a longitudinal furrow; albumen reticulate; embryo in the back of the seed; palms with stems of a moderate height and ringed, or marked with the seams of the fallen leaves; fronds or leaves pinnate; pinnæ or leaflets linear, with the spadix bursting among the leaves, surrounded with an almost woody 2-edged sheath; flowers yellowish-white; fruit soft, edible, of a reddish-yellow colour.

P. dactylifera, the Date-Tree, or Date-Palm, is one of the best known and probably the earliest known of the palms, and though belonging to a family which abounds and flourishes most in tropical regions, itself attains perfection only in comparatively high latitudes. It is no doubt the species to which the name *Palma* was originally applied, as we may infer from its being common in Syria, Arabia, the lower parts of Persia, as well as Egypt and the north of Africa, whence it has been introduced into the south of Europe, and cultivated in a few places, not only as a curiosity, but on account of its leaves, which are sold twice in the year, in spring for Palm Sunday, and in September for the Jewish Passover; and also, from the name not being applicable to the other species known to the ancients, as it is considered that the bunches of dates were likened to the fingers of the hand, as appears from the present specific name, *dactylifera*, from the Greek δάκτυλος, a finger. It is the Palm-Tree of Scripture, and was emblematic of Judæa, as we see in coins with the inscription of *Judæa capta*. It is found in oases in the desert, and round Palmyra, which is supposed to have been named from its presence. This appears indeed to be only a translation of the Oriental name, which is Tadmor, supposed to be a corruption of Tamar (from 'Tamr,' a Date), a city built in the desert by Solomon. The Date-Tree is therefore a subject of classical as well as of scriptural interest, besides its fruit forming a large portion of the food of a great part of the Arab race, and also a considerable article of commerce.

The Date-Palm being dicœcious, that is, the stamens and pistils, or the male and female parts being not only in different flowers, but even on different plants, the crops entirely fail, or the fruit is worthless and unfit for food, if fertilisation is in any way prevented. To ensure this, the Arabs have long been in the habit of hanging the clusters of male flowers on the trees which bear only female ones, and therefore the Date-Tree is one of those which led to a knowledge of the sexes of plants.

The extensive importance of the Date-Tree is, says Dr. Clarke, one of the most curious subjects to which a traveller can direct his attention. A considerable part of the inhabitants of Egypt, Arabia, and Persia subsist almost entirely on its fruit. They make a conserve of it with sugar, and even grind the hard stones in their hand-mills for their camels. In Barbary they form handsome beads for paternosters of these stones. From the leaves they make couches, baskets, bags, mats, brushes, and fly-traps; the trunk is split and used in small buildings, also for fences to gardens, and the stalks of the leaves for making cages for their poultry. The threads of the web-like integument at the bases of the leaves are twisted into ropes, which are employed in rigging small vessels. The sap is obtained by cutting off the head of the palm and scooping out a hollow in the top of the stem, where, in ascending, it lodges itself. Three or four quarts of sap may be obtained daily from a single palm, for ten days or a fortnight, after which the quantity lessens, until, at the end of six weeks or two months, the stem is exhausted, becomes dry, and is used for firewood. This liquor is sweetish when first collected, and may be drunk as a mild beverage, but fermentation soon takes place, and a spirit is produced, which is distilled, and forms one of the kinds of aruk (arrack), or spirit of eastern countries. Such being the importance and multiplied uses of the Date-Tree, it is not surprising that in an arid and barren country it should form so prominent a subject of allusion and description in the works of Arab authors, and that it should be said to have 300 names in their language. Many of these are however applied to different parts of the plant, as well as to these at different ages.

P. sylvestris is a species common in the arid parts of India, and there commonly called Khujjoor by the natives, and the Date-Tree by Europeans, which it resembles in appearance. In its parts of fructification it is like the following species, but differs in growing to be a tree, with a tall pretty thick trunk and large yellowish or reddish fruit. It yields Tarri, or palm wine, commonly called Toddy. The mode of obtaining this is by removing the lower leaves and their sheaths, and cutting a notch into the centre of the tree near the top, from which the liquor issues, and is conducted by a small channel, made by a bit of the palmyra-tree leaf, into a pot suspended to receive it. This juice is either drank fresh from the tree, or boiled down into sugar, or fermented for distillation, when it gives out a large portion of spirit, often called Paria Aruk. Mats and baskets are made of the leaves.

Sugar has always been made from this species, and accounts of it have been given by Drs. Roxburgh and Buchanan Hamilton. Date-sugar is not so much esteemed in India as that of the cane, and sells for about one-fourth less. It has sometimes been imported in considerable quantities into this country, but is not distinguished from the cane sugar. Dr. Roxburgh calculated, 40 years ago, that about 100,000 lbs. were made annually in all Bengal. At the age of 7 or 10 years, when the trunk of the tree is about 4 feet high, it begins to yield juice, and continues productive for 20 or 25 years. The juice is extracted during the months of November, December, January, and February, during which period each tree is reckoned to yield from 120 to 240 pints of juice, averaging 180 pints. Every 12 pints, or pounds, is boiled down to one of goor, or jagari, and four of goor yield one of good sugar in powder, so that the average produce of each tree is about 7 or 8 lbs. of sugar annually.

P. farinifera is a dwarf species of this genus, which is a native of dry ground or sandy hills, not far from the sea on the Coromandel Coast. It flowers in January and February, and the fruit ripens in May. The leaflets are wrought into mats for sleeping on, and the common petioles are split into three or four, and are used for making baskets. The small trunk is generally about 15 or 18 inches long.

and about 6 inches in diameter. It incloses in its substance a large quantity of farinaceous matter, which the natives use for food in times of scarcity. To procure this meal, the small trunk is split into six or eight pieces, and dried and beaten in wooden mortars till the farinaceous part is detached from the fibres; it is then sifted, to separate them; the meal is then fit for use. The only further preparation which this meal undergoes is the boiling it into a thick gruel, or canji. It seems to possess less nourishment than common sago, which is obtained in a similar manner from another palm, and is less palatable when boiled, but it has saved many lives in times of scarcity.

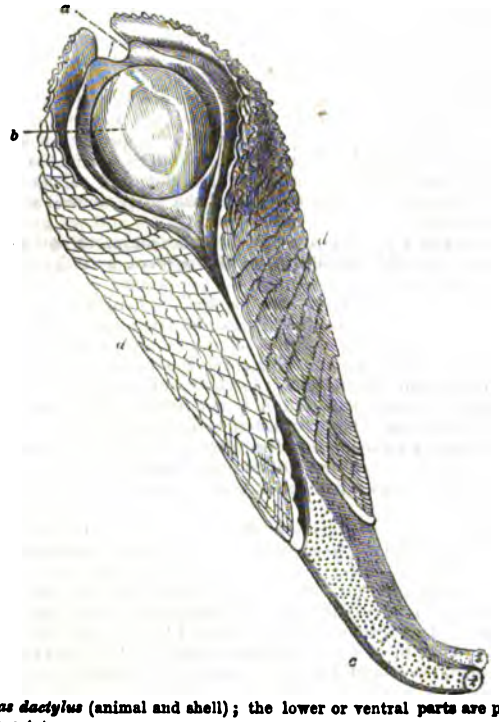
PHŒTHORNIS. [TROCHILIDÆ.]

PHOLADA'RIA, Lamarck's name for a family of Conchiferous *Mollusca*, consisting of the genera *Pholas* and *Gastrochæna*.

PHOLADIDÆ, a family of Conchiferous *Mollusca*, embracing the genera *Pholas*, *Pholadidea*, *Xylophaga*, and *Teredo*. It has the following characters:—Shell gaping at both ends, thin, white, brittle, and exceedingly hard; armed in front with rasp-like imbrications; without hinge or ligament, but often strengthened externally by accessory valves; hinge-plate reflected over the umbones, and a long curved muscular process beneath each; anterior muscular impression on the hinge-plate; pallial sinus very deep. Animal club-shaped or worm-like; foot short and truncated; mantle closed in front, except the pedal orifice; siphons large, elongated, united nearly to their ends; orifices fringed; gills narrow, prolonged into the exhalent siphon, attached throughout, closing the branchial chamber; palpi long; anterior shell-muscle acting as a substitute for a ligament.

The *Pholadidæ* perforate all substances that are softer than their own valves. The burrows of *Pholas* are vertical, quite symmetrical, and seldom in contact. The Ship-Worms (Teredines) also make symmetrical perforations, and, however tortuous and crowded, never invade each other, guided either by the sense of hearing or by the yielding of the wood. The burrow has frequently a calcareous lining, within which the shell remains free. *Teredina* cements its valves to this tube when full grown; the opening of the burrow, at first very minute, may become enlarged progressively by the friction of the siphons, which are furnished with a rough epithelium, but it usually widens with much more rapidity by the wasting of the surface. As the timber decomposes the shelly tubes of the *Teredo* project; and as the beach wears away the *Pholas* burrows deeper. (Woodward.)

Pholas.—Animal more or less thick and elongated, rarely shortened; mantle reflected on the dorsal part, for the purpose of tying together

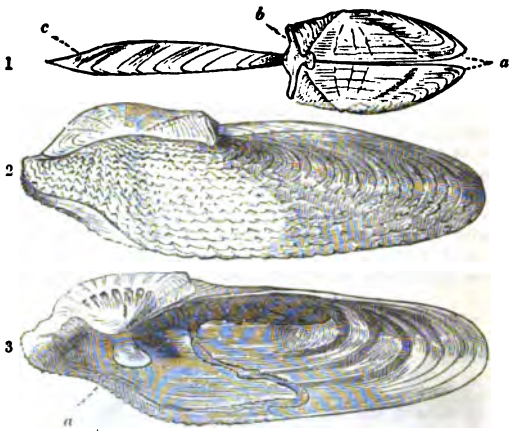


Pholas dactylus (animal and shell); the lower or ventral parts are presented to the spectator.

a, mantle; *b*, foot; *c*, tube; *d d*, shell.

Animal of a *Pholas* (Julan—*Pholas clavata* (?), Lam.), from Adanson—side view.

a, tube; *b*, mantle; *c*, foot.



Shell of *Pholas Dactylus*.

1, Accessory valves: *a*, anterior pair; *b*, central piece; *c*, posterior piece.
2, Exterior view of shell, side view.
3, Internal view of valve: *a*, spoon-shaped process.

the valves and the accessory pieces; anterior aperture rather small; foot short, oblong, and flattened; siphons often elongated and united into a single very extensible and dilatable tube; mouth small, with very small labial appendages; branchiæ elongated, narrow, slightly unequal on each side, united on the same line nearly throughout their length, and prolonged even into the siphon.

Shell delicate, milky white, rather transparent, covered sometimes with a thin epidermis, oval, elongated, inequilateral, gaping posteriorly, and especially at the antero-inferior part; umbones hidden by a callosity; hinge toothless, ligament doubtful; a flat, recurved, spoon-shaped process enlarged at its extremity, elevating itself within each valve below the umbo; muscular impressions very distant, the posterior one large, oblong, elongated, always very visible, the anterior one small, rounded, but little distinct, both more or less approximated to the edge of the shell, particularly the anterior edge, and joined by a pallial impression, which is long, narrow, and deeply excavated backwards.

Many accessory pieces or none (?); sometimes a calcareous tube enveloping all the parts, but leaving an aperture backwards. (Rang.)

M. Rang remarks that there are some species of *Pholades* which seem to lead to *Teredo*. These shells inhabit stones, madrepores, wood, and sometimes mud or sand (vase). When the reflux of the sea leaves them, and the animals are disquieted, they eject through their siphon to a considerable distance the water contained in their mantle, and which bathes the gills. ('Manuel de l'Histoire Naturelle des Mollusques.')

Dr. Leach divided the Linnæan *Pholades* into several genera, but as his distinctions consisted principally in the number of the accessory valves, Mr. G. B. Sowerby has not adopted any of his genera; they may, according to Mr. Sowerby's opinion, appear to be calculated for divisions of the genus, but are not sufficiently strong for generic distinctions. Mr. Sowerby admits indeed that some species (*Pholas clavata*, Lam., for instance) may, on account of their being closed at both ends, be distinguished generically, because this circumstance implies a difference in the habits of the animals by which they are formed: this character therefore, he remarks, has been seized by Dr. Leach, and upon it the doctor founded his genus *Martesia*, an example which Mr. Sowerby says he should have been induced to have followed had he been convinced of its necessity.

M. Ch. des Moulins has formed a genus of *Pholades* which he calls *Jouannetia*.

M. Rang speaks highly of the discovery of this genus by M. des Moulins, and having studied it with that naturalist, he pronounces it to be very distinct from the *Pholades*, and its place to be clearly fixed between them and the *Teredines*, to which it leads so naturally by its valves. *Jouannetia*, he observes, has no enveloping calcareous tube, as sometimes happens to the *Pholades*, &c.; and though only one species is yet known (*Jouannetia semicaudata*, fossil, from the faluns of Mérignac, in the interior of madrepores, &c.), he does not think that a similar tube ever exists, if the amplitude and disposition of the scutcheon, which appears to him to take its place, is a generic character.

Mr. Swainson makes the *Pholidæ* the first family of his tribe *Macrotrachiæ*, and thus characterises that family:—"Shell bivalve, sedentary, generally perforating, opening at one or both ends; the valves often prolonged into a shelly tube, sometimes of great length, representing the *Tubulibranchia*."

Under this family he assembles several forms, and makes it consist of the following genera and sub-genera:—

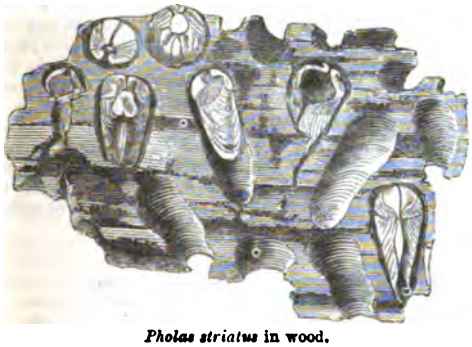
1. *Aspergillum*; including the sub-genera *Aspergillum*, *Clavagella*, and *Fistulana*.
2. *Gastrochina* (*Gastrochæna*), Lam.
3. *Pholadomya*, Sow.

4. ***Pholas***, Linn., with the sub-genera *Pholas*, Linn.; *Pholidæa*, Leach; *Martesia*, Leach; and *Xylophaga*, Sow.

5. *Teredo*, Linn., with the sub-genera *Teredo*, Linn., and *Teredina*. ('Malacology,' 1840.)

The geographical distribution of the *Pholades* is very wide, and their habit of boring hard substances, such as indurated mud or clay, wood, and stone, renders them, as well as other terebrating testaceans, an object of anxious interest to those who construct submarine works. The Breakwater at Plymouth was soon attacked by the *Pholades*, and in Dr. Goodall's fine collection, which has since been sold, there was a specimen from the Breakwater perforated by these testaceans. Wood is also attacked by this genus, and submarine piles are consequently exposed to their ravages. To counteract their operations in the latter substance, nails closely driven into the submerged part of the timber, as in the piles which support the pier at Southampton, seem to be the best safeguard hitherto applied. When unmolested, the young *Pholades* excavate burrows in the substance which chance has opposed to them, or to which choice—for it is not improbable that the young shell-fish may in some cases have the faculty of making the selection of the material in which it is to pass the whole of its life—has directed it.

The accompanying cuts will convey some notion of their ravages upon the substances which they penetrate :—



Pholas striatus in wood.

A block of stone perforated by *Pholas dactylus*.

Pholas (*Xylophaga*) *dorsalis* in wood.

The mode in which the operation of boring is conducted has been frequently discussed. From the observations of M. Cailliaud it would

appear that the valves are quite equal to the task of boring limestone. [Lithophagidæ; Clavagella; Gastrochæna.] Mr. G. B. Sowerby, in his description of *Pholas acuminata*, found by Mr. Cuming at Panama in limestone at low water, notices one specimen in that gentleman's collection as demonstrating a fact of considerable importance to geologists: it is in argillaceous limestone, very much resembling lias, and, in forming the cavities in which it resides, it has, by such chemical process as in Mr. Sowerby's opinion frequently takes place, absorbed a much greater quantity of the rock than could be retained or converted; this is again deposited at the upper part of the cavity, and thus the rock is recomposed. ('Zool. Proc.,' 1834.)

Pholas has been found at depths varying from the surface to 17 fathoms, and *Xylophaga* from the surface to 45 fathoms.

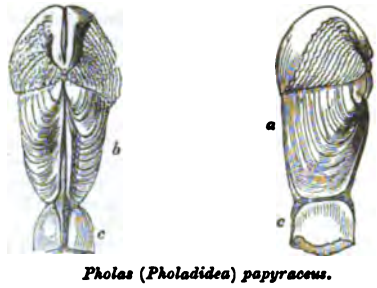
The species are numerous, and some are very abundant on our own coasts. "Of these," says Mr. G. B. Sowerby, "*Pholas crispata*, *P. dactylus*, *P. candida*, and *P. parva*, are the most common; several others are described by Turton in his 'British Bivalves,' of which we are quite convinced the *P. lamellata* is only the young of *P. papyracea*: we are not acquainted with his *P. tuberculata*. Much confusion appears to prevail in regard to several very distinct species: among these we believe the *P. papyracea* of Turton is the *P. striata* of Montagu; the *P. clavata* of Lamarck is the *P. striata* of Linnæus, but not of Mont." * The number of living species of *Pholas* noted by M. Deshayes in his Tables is 15, and of these one, *P. candida*, is recorded as living and fossil. Woodward, in his 'Manual of the Mollusca,' gives 25 recent species of *Pholas* and 25 fossil. Forbes and Hanley give the following as British species:—*P. dactylus*, *P. parva*, *P. crispata*, *P. candida*, *Xylophaga dorsalis*, *Pholadidea papyracea*.

The following cuts, with those previously given, will show the variety of form put on by the shells of this genus :—

Xylophaga dorsalis.

a, enlarged view of interior; *b*, dorsal view, natural size; *c*, ventral view, natural size.

This species, which is found in cylindrical cavities eaten (?) in wood (see cut in previous column), bears some resemblance to *Teredo*, but is without the shelly tube, nor has it the posterior hiatus.



Pholas (*Pholadidea*) *papyraceus*.

a, side view; *b*, dorsal view; *c*, cup-shaped membrane.

Teredo is the name given by Linnæus to a genus of Testaceous Molluscs, highly interesting on account of the ravages which one of the species commits upon submerged wood.

Linnæus, in the twelfth edition of the 'Systema Naturæ,' placed the genus among his *Vermes Testacea*, between *Serpula* and *Sabella*.

Cuvier, in his last edition of the 'Règne Animal,' makes *Teredo* one of the genera of his Enfermés, the fifth family of his Acephalous Testaceans, arranging the genus between *Pholas* and *Fistulana*.

The following are its characters :—

Animal very much elongated, vermiform, with a very delicate mantle, open in front and at its lower part for the passage of a mammiliform foot; tubes separated, very short, especially that for the dejections; mouth small; labial appendages short; anus situated at the extremity of a small tube floating in the cavity of the mantle; branchiæ riband-like, united on the same line throughout their length, and a little prolonged in the siphon; a muscular ring at the point of junction of the mantle and the tubes, in which is implanted a pair of pediculated corneo-calcareous appendages or palmules, playing laterally one against the other.

Shell rather thick, very short, annular, equally open before and behind; equivalve, inequilateral, angular, with triangular valves, trenchant in front, and only touching each other by the two opposite edges; no hinge; an elongated, nearly straight, subfiliform, spoon-shaped process; a single slightly-marked muscular impression.

* Zoologists sometimes make the word 'Pholas' masculine, sometimes feminine. Linnæus makes it masculine, and so it should be considered.

Tube cylindrical, straight or flexuous, closed with age at the buccal extremity, so as to envelop the animal and its shell; always open at the other, and lining the cavity into which the animal has introduced itself.

Such is M. Rang's definition of *Teredo*, excluding *T. gigantea* (*Septaria*), of which he gives the following definition, observing that it closely approximates to the *Teredines* and *Fistulanæ*:—

Animal unknown. Shell unknown. Tube calcareous, thick, solid, in the shape of a very elongated cone, and irregularly flexuous, furnished internally with small incomplete annuliform septa; terminated at one of its extremities by a convexity, and at the other by two slender and separated tubes.

The number of species of *Teredo* (exclusive of *Septaria*) recorded by Lamarck in the 'Animaux sans Vertèbres' (1818) were two, *T. navalis* and *T. palmulatus*; of the latter, Lamarck, who had seen neither its tube nor its shell, says that it probably only differs from *T. navalis* in its greater size, its longer palmules having been more easily observed.

Messrs. Forbes and Hanley record three as true British species—*T. Norvegica*, *T. navalis*, *T. Megotaca*; and three as doubtful—*T. bipennata*, *T. malleolus*, and *T. palmulata*. Woodward gives 14 as the number of recent species, and 25 fossil.

For our early knowledge of the nature and structure of the *Teredo* we are indebted to three investigators, Pierre Massuet, Jean Rousset, and Godfrey Sellius. The work of the last-named author was a very remarkable production, and he was the first to recognise the molluscan nature of this animal. The study of these animals was neglected in this country till it was taken up by Sir Everard Home. He wrote a paper entitled 'Observations on the Shell of the Sea-Worm found on the Coast of Sumatra, proving it to belong to a Species of Teredo, with an account of the Anatomy of the Teredo Navalis.' Sir Everard remarks that the internal structure and economy of Teredines were so little known, and so much of what was said of them by Sellius was so vague, that it became necessary to acquire an accurate knowledge of the common *Teredo navalis*, before any adequate idea could be formed of the new species, which he names *Teredo gigantea*.

On examining the shell of *T. navalis* while in the wood, Sir Everard found its external orifice very small, just large enough, in fact, to give a passage to the two small tubes. The greatest thickness observed was 1-24th of an inch. The canal in the wood at its termination, and for an inch in length, was not lined with shell, but smeared over with a dirty green-coloured mucus, which was also spread upon the last-formed portion of shell. According to Mr. Hatchett's analysis, the shell of *T. navalis* was perfectly similar to that of *T. gigantea*, being devoid of phosphate of lime, and composed of 97 parts of carbonate of lime and 3 parts of animal matter.

While the animal was in the shell alive and undisturbed, what is termed the head was in contact with the end of the canal in the wood; but on laying the head bare, it was drawn in for an inch into the shell. The body of the animal filled the area of the shell completely, but appeared much smaller when taken out, in consequence of the sea-water which it contained having escaped. The largest of the worms examined, which were of different lengths, measured 8 inches. Many of them were alive 24 hours after being removed from their shell, and in these the heart was seen to palpitate. The blood in the vessels going to the head was red, as also the parts near the liver; but this colour disappeared soon after death.

The head of the worm was inclosed between the two concave boring shells, so that what Sir Everard calls the face was the only part exposed. These shells were united together on what is termed the back part of the head by a very strong digastric muscle, having a middle tendon from which the fibres go off in a somewhat radiated direction, partly for insertion into the concave surface of each shell, and partly into a long semicircular process projecting from the posterior part of each shell. The two inclose the œsophagus and other parts surrounding it. The double muscle was inclosed in a smooth shining fascia. When first exposed it was of a bright red.

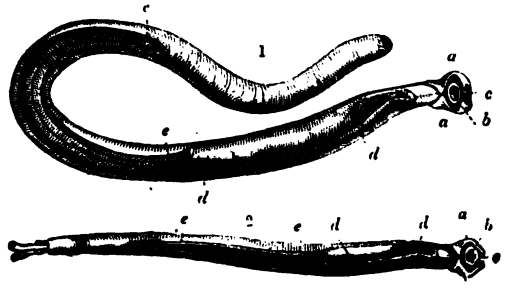
On the opposite side of the head the shells were united by a ligament from which they were readily separated; at this part were two small tooth-like processes, one from the narrow edge of each shell, where they were joined together.

From the middle of the exposed part of the head projected a kind of proboscis; which in the living animal had a vermicular motion: its extremity was covered by a cuticle not unlike the cornea of the eye. On removing this, the cavity immediately beneath it was found to contain a hard brown-coloured gelatinous substance, like a Florence flask, with the large end uppermost in form. Sir Everard remarks that as this proboscis has no orifice, there is reason to believe that it adheres to the wood, acting as a centre-bit, while the animal is at work with the shell, and thus the canal in the wood is perfectly cylindrical. The mouth was nearly concealed by the projection of the proboscis, but, when exposed, presented a very distinct round orifice between the proboscis and the large digastric muscle.

"The body of the worm," proceeds Sir Everard, "is inclosed in one general covering, extending from the base of the boring shell, with which it is firmly connected to the root of the two small tubes, which appear out of the wood. It terminates in a small double fold forming a cup, on the inside of which are fixed the long small stems of two opercula, which become broad and flat towards their other extremity. These, when brought together, shut up the shell, and inclose the two contracted tubes within it: not one operculum corresponding to each tube, but in a transverse direction. In the *T. gigantea*, the opercula are similarly situated, each shutting up one-half of the bifurcation. At the base of this cup the general covering is thick and ligamentous, for about one-fourth of an inch in length, where the stems of the opercula are connected with it; and at one spot of this thickened part there is an adhesion to the cylindrical shell, which is the only part of the animal connected with it. There is a depression in the shell pointing out this spot. The double fold of the outer covering, that forms the cup, contains the sphincter muscle, which closes the orifice by bringing the opercula together. The general covering is composed of two membranes, the outer the strongest, and made up of circular fibres, the inner much finer, having no fibrous structure. On the back of the animal, this covering is firmly connected to the parts underneath, and is there strongest. On the belly it forms a cavity, and is thinner. It is everywhere sufficiently transparent to show the different viscera through it."

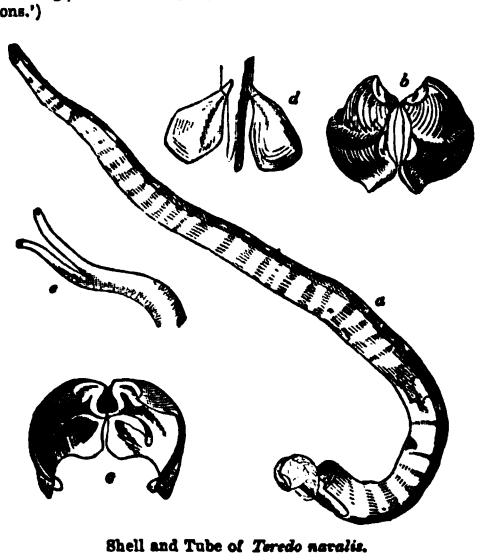
In this paper Sir E. Home examines in detail the anatomy of these creatures, and left little further to be known on that point.

With regard to *T. gigantea*, he observes that, when arrived at its full growth, it closes up the end of its shell, and so does *T. navalis*. Sellius believed that the animal by this act formed its own tomb, since it could no longer destroy the wood in which it was contained. Sir Everard however remarks that in *T. gigantea* death is not a consequence of seclusion from the substance in which it is imbedded. In some of Mr. Griffith's specimens the shell was just covered in, and the part close to the termination extremely thin, whilst in others it was increased twenty-fold in thickness. In others again the shell had not only become thick, but the animal had receded from its first inclosure, and had formed a second three inches up the tube, and afterwards a third two inches further on, and had made the sides thicker and thicker, so as to diminish the canal in proportion to the diminution of its own size.



Animal of *Teredo navalis* out of the shell.

1, the opercula are wanting, and the tubes retracted. 2, the opercula in their situation, and the tubes protruded. *a a*, the boring-shells; *b*, the proboscis; *c*, the mouth; *d d*, the contents of the abdomen seen through the transparent external covering; *e e* breathing organs seen in the same way. ('Philosophical Transactions.')



Shell and Tube of *Teredo navalis*.

a, Tubes and valves in their position at the end; *b*, *c*, two views of the valves; *d*, double operculum; *e*, representation of the protrusion of the two tubes of the animal. ('Philosophical Transactions.') G. B. Sowerby.

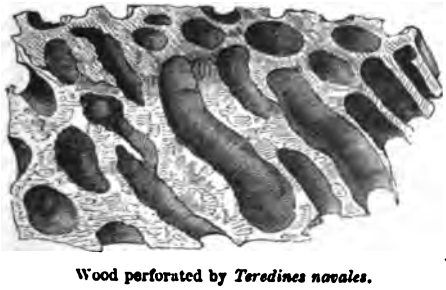
Sir Everard considers these facts as proving that *Teredo gigantea*, when arrived at its full growth, or whenever it is prevented from

increasing in length, closes up the end of its shell, and lives a long time afterwards, furnished with food from the sea-water. *Teredo navalis*, he observes, closes up its shell in the same manner: it must therefore, after that period, be supplied with food entirely through the medium of sea-water. The Teredines, he adds, turn round in the shell, to which they are not attached, and with which their covering only has a slight connection at one particular spot, to prevent the external tubes from being disturbed. This motion, Sir Everard observes, is for the purpose of boring.

Some of the Teredines examined by Sir Everard Home were sent from Sheerness in the wood alive, and they lived in salt-water for three days after being brought to town. Sir Everard observed that when the surface of the wood was examined in a good light, while only an inch in depth in the water, the animal threw out sometimes one tube, at others two small tubes. When one only was protruded, the other almost immediately followed it. One of them was about three-quarters of an inch long; the other only half that size. When the largest was exposed to its full extent, there was a fringe on the inside of its external orifice of about twenty small tentacula, scarcely visible to the naked eye: these were never seen except in that state; for when the tube was retracted, the end was first drawn in, and so on, until the whole was completely inverted: and therefore in a half-protruded state it appeared to have a blunt termination with a rounded edge. The smaller tube was not inverted when drawn in. "These tubes," says Sir Everard Home in continuation, "while playing about in the water appeared at different times to vary in their directions, but usually remained at the greatest convenient distance from each other. The largest was always the most erect, and its orifice the most dilated; the smaller one was sometimes bent on itself with its point touching the wood. In one instance, where a small insect came across the larger one, the point of the smaller turned round and pushed it off, and then went back to its original situation. In several instances the smaller one appeared to be the most sensible; since by touching the larger one gently it did not retract; but on touching the smaller one they both were instantly drawn in. Indeed whenever they were retracted they always were drawn in together. When the worm was confined within the shell the orifice was not to be distinguished in the irregular surface of the wood, which was covered with small fuci. The worm appears commonly to bore in the direction of the grain of the wood, but occasionally it bores across the grain to avoid the track of any of the others; and in some instances there was only a semi-transparent membrane as a partition between two of them."

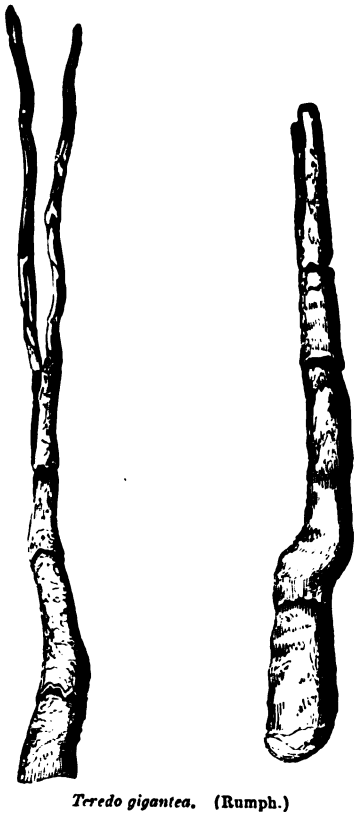
T. navalis has been found at depths ranging from the surface to ten fathoms.

It is said, probably with truth, that *T. navalis* was introduced into Europe from warmer climates. However that may be, it now unfortunately swarms in our seas. The ravages of this apparently insignificant animal are terrible. Ships, piles, all submarine wood-works, are ruinously affected by it: small as it is, it threatened the submersion of Holland by its destruction of the dykes. The living specimens which formed the subject of Sir Everard Home's observations were furnished from one of the royal dockyards. The rapidity of its growth and the destructive celerity with which it works are hardly credible. A piece of deal, after a submersion of forty days, was riddled by them, and some had attained considerable size. Those from the dockyard at Plymouth, examined by Montagu, were in piles which had been recently taken up to be replaced with new; they had not, according to the information given to Montagu, been under water above four or five years, but they were greatly perforated, though they were sound solid oak when they were driven. The only effectual way of preventing the attacks of this animal upon piles appears to be by covering all that part which is continually beneath the surface with short broad-headed nails. The action of the sea-water on the nails produces a strong coating of rust, said to be superior to a copper sheathing.

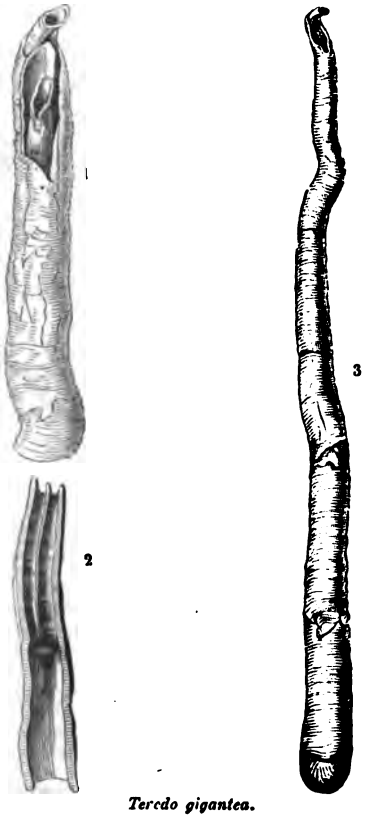


Wood perforated by *Teredines navales*.

T. gigantea. Rumphius, in his 'Amboinische Raritätkammer,' gives two figures, here copied, of a species of tubular shell found in shallow water among mangrove-trees. He describes the ground whence they were brought, and the mode in which the large end of the shell is closed, so as to leave little doubt that it was *T. gigantea*, though the separation of the two tubes through which the parts of the animal pass out is different from the specimens brought home by Mr. Griffiths. This difference however, as the latter observes, may have been connected with the situation in which the animal was found, namely, shallow water among the mangroves.



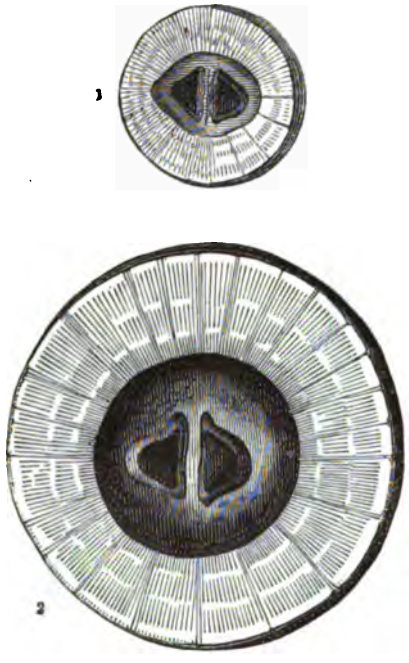
Teredo gigantea. (Rumph.)



Teredo gigantea.

1, the small or upper extremity of the shell, the external covering broken away and showing the termination of the tubes, one of which is broken; 2, a longitudinal section of that part of the shell where the double tubes are formed; 3, the shell complete, or nearly so, the exception being the imperfect state of the upper extremity. ('Philosophical Transactions.')

Mr. Griffiths relates that a short time after a very violent earthquake that occurred in Sumatra in the year 1797, which produced "a most tremendous" inundation of the sea, did great damage, and caused the loss of many lives, these shells were procured in a small sheltered bay with a muddy bottom, surrounded by coral reefs, on the island of Battoo. More than twenty specimens were brought to Mr. Griffiths, but not one was complete: a portion of the shell with the apex nearly perfect, and another with the opposite closed extremity nearly so, were however procured. The length of the longest of Mr. Griffiths's shells was 5 feet 4 inches, and the circumference of the base 9 inches, tapering upwards to 2¼ inches. There were other good ones of smaller size. The large specimen was nearly perfect, having a small part of the lower extremity entire. Most of the shells had adhering to them, about one foot or more from the top, the small cockscomb oyster, small serpulæ, &c.; consequently, Mr. Griffiths observes, they must have been protruded that distance from the hard mud; but the water being thick and discoloured, the people of Battoo had not taken notice of them antecedent to the earthquake. The specimens were milk-white on the outside and within were tinged with yellow. Mr. Griffiths remarks that the large end of the shell is completely closed, and has a rounded appearance; at this part it is very thin. The small end, or apex, is very brittle and divided by a longitudinal septum running down for 8 or 9 inches, forming it into two distinct tubes, inclosed within the outer one, whence the animal throws out tentacula. Mr. Griffiths goes on to describe the substance of the shell as composed of layers having a fibrous and radiated appearance, covered externally with a pure white crust, and internally as having a yellow tinge; and the external surface as frequently interrupted in a transverse direction by a sudden increase of thickness, which, he observes, probably indicates different stages in the growth of the shell, although they are at unequal distances, sometimes at 6 inches, sometimes at 4 inches, in the same shell. Many of the shells, he adds, are nearly straight, others crooked and contorted.



Teredo gigantea.

1, a transverse section of shell, giving a front view into the orifices of the double tube, and showing the thickness of the shell at that part; 2, transverse section of shell at the thickest part after it had been polished, showing the structure, and giving a front view of the orifices into the double tube. ('Philosophical Transactions.')

PHOLADOMYA, a genus of Conchiferous *Mollusca*, which is thus characterised:—Shell very thin, rather hyaline, transverse, ventricose; inside pearly; posterior side short, sometimes very short, rounded; anterior side more or less elongated, gaping; upper edge also gaping a little. Hinge with a small rather elongated triangular pit, and a marginal lamina in each valve, to the outer part of which is attached the rather short external ligament. Muscular impressions two; these, as well as the muscular impression of the mantle, in which there is a large sinus, are indistinct. (G. B. Sowerby.)

The genus *Pholadomya* is a most interesting form, for the knowledge of which we are indebted to Mr. G. B. Sowerby, who described it from a recent species brought from the island of Tortola by Mr. Nicholson, and in the possession of Mrs. Mawe, from whom it passed into Mr. Broderip's collection, and consequently is now in the British Museum.

The discovery of this recent species led at once to the more perfect knowledge of several fossils, whose genus, as Mr. Sowerby observes in his 'Genera' (No. xix.), was before exceedingly doubtful, inasmuch, that from a consideration of their external appearance alone, authors had been induced to place them in several genera, to none of which they really belonged—as for instance those named *Cardita* (!) *producta*, *C. obtusa*, *C. lyrata*, *C. deltoidea*, and *C. margaritacea*; and *Lutraria lyrata*, *L. ovalis*, *L. ambigua*, and *L. angustata*. These occur in several rocks of the Oolitic Series, particularly the Cornbrash, Inferior Oolite, and Fuller's-Earth; as well as in the Lias, the London Clay, and the Sutherland Coal-Field; also in the dark-coloured clay at Alum Bay.

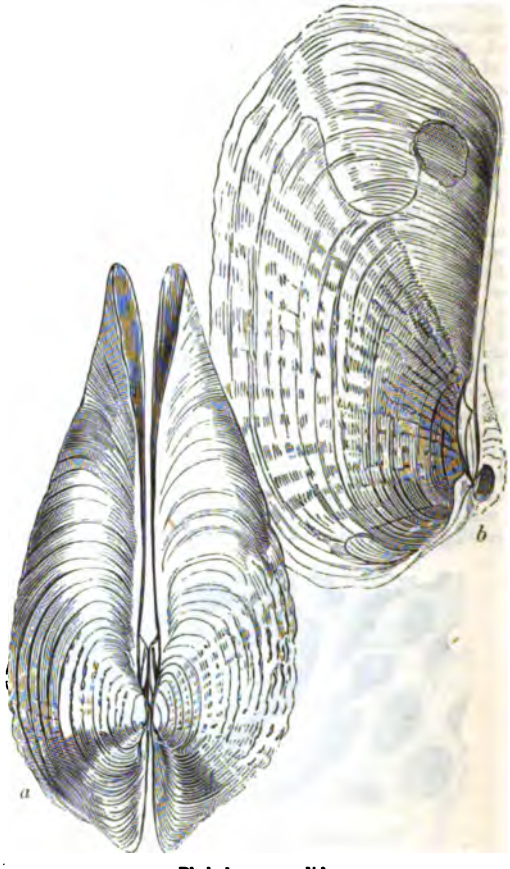
Professor Owen gives the following description of the animal:—"*Pholadomya* presents all the family characters of the *Inclusa*, or Enfermés, but differs generically from all those, the organisation of which has hitherto been described, by the presence of a fourth aperture leading to the interior of the mantle, that is to say, besides the linear slit for the protrusion of the narrow foot at the anterior part of the ventral aspect of the mantle and the two siphonic tubular passages, there is, at the under or ventral part of the base of the united siphons, a small round aperture, which is continued upon a truncated pyramidal papilla projecting into the pallial cavity, forming a valvular obstruction to the exit of fluids, but admitting their entry. This doubtless relates to some curious and peculiar feature in the economy of the mollusc: the foot is compressed, half an inch long, three lines broad; the siphonic tube two inches long, half an inch in diameter, bifid at the extremity; the labial appendages short; the two branchiæ of each side conjoined, and those of the right united to those of the left side along their posterior fourth. More of the anatomy I have not at present worked out; but there is enough, I think, here stated to serve as an answer to M. De Blainville's question."

P. candida (G. B. Sowerby) may be given as an example.

The shell is transversely oblong, very short posteriorly, rounded; median part marked with divaricated, decussate striæ, which are decurrent from the umbo; anteriorly elongated, subquadrate.

It is a marine species, and most probably inhabits deep water. The specimen from which Mr. Sowerby characterised the genus was thrown upon the beach at Tortola after a hurricane.

This is the only living species, but several fossil forms from the Coal, Oolite, and Lias have been found.



Pholadomya candida.

a, valves shut, the umbones towards the spectator; *b*, inside view of valve, showing the impressions and the umbo worn through.

PHOLERITE, a Mineral, a Hydrated Silicate of Alumina. This substance occurs in small pearly scales, which are usually convex. These are white, soft, and friable, and they adhere to the tongue.

It occurs in the department of Allier in France, in the Coal Formation of Fins.

PHOLAS. [PHOLADIDÆ.]

PHOLIDOPHORUS, a genus of Fossil Fishes. [FISH.]

PHONE'MUS, a genus of *Foraminifera*.

PHONOLITE. [CLINKSTONE.]

PHONY'GAMA, a genus of Birds belonging to the family *Corvidæ*.

PHORCY'NIA. [ACALEPHÆ.]

PHO'RMIUM, a genus of Plants of the natural family of *Liliaceæ*, tribe *Agapanthea* of Endlicher, *Asparageæ* of Lindley, contains only a single species, which is remarkable for its useful product, so well known under the name of New Zealand Flax, and which is found indigenous in New Zealand and Norfolk Island.

P. tenax has a coloured tubular perianth, of which the tube is very short, and divides into six segments, of which the three inner are the longest; stamens six, inserted into the base of the tube, ascending, exserted; capsule oblong, 3-cornered; seeds numerous, compressed; embryo in the centre of the seed, longer than half the albumen, with its radicle next the umbilicus. The root is tuberous, fleshy, and bitter tasted; the leaves are numerous, all radical, linear-lanceolate, five or six feet long, and from an inch and a half to two inches broad, 2-rowed, equitant at the base, leathery, and very tough. Its flowers are numerous, showy, yellow-coloured, arranged on a tall branched panicle.

The leaves of this plant yield a very beautiful and a very strong fibre, which has been imported in considerable quantities under the name of New Zealand Flax. It was expected to be much more useful than it has proved to be, in consequence of its having the defect of breaking easily when made into a knot. Being a plant of high southern latitudes, it was supposed that it might easily be grown in different parts of Europe. The French have attempted to cultivate it near Cherbourg, Toulon, and other places, and it has been introduced into Ireland, the moist insular climate of which is probably favourable to its growth. It grew remarkably well for a number of years in the Chelsea Botanic Garden, but was killed by the severe winter of 1837-38. Its cultivation has also been attempted in Australia, but has not yet succeeded to any extent.

PHO'RUS. [TROCHIDÆ.]

PHOS (De Montfort), a genus of Turbinated Gastropodous *Mollusca*.

PHOSPHATITE, a name proposed for the native Phosphate of Lime derived from organic sources, and usually called *Coprolites*. The latter term conveys an impression which is evidently wrong, with regard to large quantities of the phosphate of lime now obtained for agricultural purposes. In that which is obtained from the Red Crag fragments of bones of large size are constantly present, and it is questionable if any portion of this phosphate has ever been excrementitious matter. Hence the impropriety of the term coprolite. The more probable origin of these masses seem to be that they are the debris of a huge sepulchre of *Cetacea*, sharks, and other animals, which was formed previously to the existence of the beds in which these remains are now found. After deposition in this sepulchre, the animal matter of the bones was gradually washed away, and the large quantities of phosphate of lime found in the water-worn nodules of the Red Crag are thus accounted for. [COPROLITES.]

PHOSPHORESCENCE. [LUMINOSITY IN ORGANIC BEINGS.]

PHOSPHORITE, a name for the native Phosphate of Lime obtained in Spain. [APATITE.]

PHOTIZITE, a name for Manganese Spar. [MANGANESE.]

PHRAGMATURUS. [IGUANIDÆ.]

PHRAGMI'TES, a genus of Plants belonging to the natural order *Graminaceæ*. *P. communis*, the Reed, is a plant formerly regarded as a species of *Arundo*, but now separated from that genus on account of its lower floret being male while the others are hermaphrodite, and its rachis being fringed with long silky hairs. It is a tall plant with annual stems and a perennial root, and is found exclusively in places overflowed even during summer. In such situations it is found abundantly in Great Britain, and occurs all through Europe, is common in Siberia, Japan, North America, and even Australia, forming thick coverts, and yielding an abundance of stout durable grass of great value for the purpose of thatching the roofs of buildings. This is undoubtedly the φραγμίτης of the Greeks. A second species is said to grow in Egypt, and a third in the island of Mauritius; the two latter species are however little known.

PHRAGMO'CERAS. [ORTHOCERATIDÆ.]

PHRO'NIMA, Latreille, a genus of Amphipodous *Crustacea*. It has two very short setaceous antennæ composed of a small number of joints. Four first feet (mâchoires extérieures of Latreille) in the form of small compressed arms, terminating in a point, and dentated below: the two interior the smallest, and annexed to the head.

P. sedentaria (*Cancer sedentarius*, Forsk.; *Cancer gammarellus sedentarius*, Herbst.), has a transparent body, which is nacreous and dotted with reddish. Length not exceeding an inch.

It lives at some distance from the coast, and keeps, according to M. Risso, in the interior of the body of *Radiata* belonging to the genera *Pyrosoma* and *Beröe*. Found in the Mediterranean and near Burray in Zetland.

P. Custos is smaller than the preceding, and very white. Found near Nice, in the interior of *Medusæ* (*Equorea* and *Geronia* of Péron and Lesueur). (Risso.)

PHRO'SINE, Risso, a genus of Amphipodous *Crustacea*, namely, those furnished with four antennæ. The two superior antennæ are large and spoon-shaped; two lower antennæ, setaceous and very small. The ten feet properly so called monodactyle, formed of five flattened joints: the first pair short, delicate, and hooked; the second a little shorter than the third; the fourth very large, with its first joint wide and oval, the two following triangular, the fourth oval and spiny, and the last long, pointed, arched, and falciform; the fifth pair shorter than the preceding, but of the same form. (Desm.)

P. semilunata has an oblong body, yellowish anteriorly, red posteriorly; the head is provided with two small horns, which form a sort of crescent; eyes small. Total length seven to eight lines.

This species is rather rare in the neighbourhood of Nice, where it appears in the spring at the season of reproduction. It inhabits deeps on a sandy bottom. Eggs transparent.

P. macrophthalma has an oblong violet-red body, with a transparent head; no horns. Found on *P. Pyrosoma*, in February and July: at the latter period, the female is loaded with a quantity of very small globular eggs. (Risso.)

PHRYGANEA. [NEUROPTERA.]

PHRYNOCEPHALUS. [DRACONINA.]

PHRYNOSOMA. [IGUANIDÆ.]

PHYCIS, a genus of Fishes belonging to the family *Gadidæ*. It has an elongated body; two dorsal fins, the first short, the second long; ventral fins with a single ray only at the base, afterwards divided; chin with one barbule.

P. furcatus, the Forked Hake, the Hake-Dame, the Common Fork Beard, is a rare fish on the British coasts. It has been taken most frequently in Cornwall. It is about two feet in length, but not very good eating.

(Yarrell, *British Fishes*.)

PHYLLASTREPHUS. [MERULIDÆ.]

PHYLLIDIA. [INFEROBRANCHIATA.]

PHYLLIDIANS (Lamarck), a family of Gasteropodous *Mollusca*, including the genera *Phyllidia*, *Chitonellus*, *Chiton*, *Patella*, *Patelloidea*, and *Siphonaria*. [CHITONIDÆ; PATELLIDÆ.]

PHYLLITE, a name for *Otrelite*. [OTTRELITE.]

PHYLLO'DIUM is that organ which in the greater part of the Australian Acacias, or Wattle-Trees, stands in the place of leaves. [LEAF; ACACIA, col. 22.]

PHY'LLODOCE, a genus of Plants belonging to the natural order *Ericaceæ*. It has a 5-parted calyx, an ovate corolla with a contracted 5-toothed mouth, 10 stamens inclosed, slender glabrous filaments longer than the anthers, short truncate cells opening by pores at the apex. The seeds are compressed and shining. The species are small evergreen shrubs, natives of the north of Europe, Asia, and North America.

P. cærulea has linear leaves with denticulated margins, glandular hairy peduncles; calycine lanceolate-acute segments; anthers three times shorter than the glabrous filaments. The stem is from 4 to 5 inches high, determinately branched, naked below, densely hairy above. The flower is large, pale, bluish-red; the peduncles terminal, aggregate, and simple. The plant is a native of Perthshire and the north of England. There are three other species of *Phyllodoce*, which are natives of North America.

(Babington, *Manual of British Botany*.)

PHY'LLODUS, a genus of Fossil Fishes. [FISH.]

PHYLLOGRAPTUS. [*See* GRAPTOLITES, in SUPPLEMENT.]

PHYLLO'PODA (Latreille), a section of Entomostracous *Crustacea*. [ENTOMOSTRACA; BRANCHIOPODA.]

PHYLLOSO'MA, a family of *Crustacea* called by Milne-Edwards Double-Cuirassed (Bicuirassés). It is composed of forms which are very remarkable for their rounded shape and the transparency of their teguments. The carapace is large, lamellar, extended like a leaf horizontally above the base of the antennæ and a more or less considerable portion of the thorax. The thorax is equally depressed, so as to resemble a thin blade or plate placed horizontally, and to the existence of these two bucklers, so to speak, they owe the name (Bicuirassés) given to them by Latreille. The ophthalmic ring is but little if at all distinct from the interior border of the carapace, and it is from this border also that the antennæ spring. The eyes are very large and projecting. The antennæ spring below and behind their peduncle, on the same transversal line, and are directed forwards; those of the first pair are bifid at the end, and the conformation of those of the second pair varies. The mouth is situated very far from the base of the antennæ, and is found towards the anterior third or the middle of the lower surface of the carapace; it has the form of a rounded tubercle, and is composed essentially of a large upper lip, a pair of hooked mandibles which want a palpiform stem, a membranous and bilobated lower lip, and a pair of jaws; sometimes there are to be found a second pair of jaws and even jaw-feet applied against the mouth, but in general those organs are rudimentary and thrown rather far backwards. The great flattened blade or plate, which constitutes the thorax, commences immediately behind the mouth, and presents no annular divisions; in general it reaches a good deal beyond the carapace, and gives insertion to the feet by its lateral borders, so that those organs are very distant from the median line. The number of feet consists of from seven to eight pairs, but those of the first pair, and sometimes those of the last, are very short, whilst the others are very long; all are very slender, and lead, towards a third

of their length, to a large flabelliform appendage, which is analogous to the external branch of the thoracic feet of the Mysians, but which takes its origin much farther from the body. The abdomen is slender, and sometimes rudimentary; in general, nevertheless, it is terminated by a fin composed of five blades disposed in a fan-shape, as in the family of the Caridoïda. The false feet are always more or less rudimentary.

These Crustaceans do not present any organs which can be considered as branchiæ; some naturalists give this name to the ciliated appendages which represents the palp of the thoracic feet, but without resting this conclusion on any facts and M. Milne-Edwards is disposed to believe that respiration is carried on by means of the general surface of the body. ('Histoire Naturelle des Crustacés.')

M. Milne-Edwards, whose definition of this family we have above given, makes it consist of two genera only, *Phyllosoma* and *Amphion*. He observes that the *Phyllosomata* are easily recognised by their foliaceous carapace, which leaves part of the thorax exposed. In *Amphion*, the carapace hides the thorax entirely.

Phyllosoma (Leach).—This, one of the most remarkable genera known, is composed of animals whose body is so much flattened, that there is scarcely an interval between the teguments of the upper and lower surfaces, so that it is difficult to comprehend how the viscera are there lodged. This lamellar body is divided into three distinct parts; the head, the thorax, and the abdomen.

The head has the form of a delicate disc or of an ordinary oval leaf, and only adheres to the thorax by its central portion, so that the borders all round are free. This species of buckler is wide and horizontal; at its anterior extremity it gives insertion to the eyes and to the antennæ. The eyes spring near the median line, and are globular; they are carried on slender, cylindrical, and very long peduncles.

The thorax is lamellar like the carapace, and constitutes a second buckler, the anterior portion of which only is covered by the first of these foliaceous discs. It is in general wider than it is long, and striated transversely, but it presents no trace of a division into rings. The feet are inserted all round the disc. The disposition of the abdomen varies: sometimes it is elongated, divided into very distinct rings, and perfectly distinct from the thorax which covers its base; sometimes it is confounded with the buckler, and only seems to be a prolongation of it.

The nervous system of the *Phyllosomata* presents a remarkable mode of conformation; the mass formed by the cephalic ganglion is situated near the base of the antennæ, and communicates with the thoracic ganglions by means of two very long chords. The thoracic ganglions are not united on the median line, but communicate with each other by transversal commissures: there are nine pairs. The abdominal ganglions are very small, and amount to six pairs. The intestine seems to be straight, and in the interior of the cephalic buckler are to be perceived a great number of vessels which diverge laterally.

The species are found in the seas of warm countries. M. Milne-Edwards remarks, that were it not for the beautiful blue of their eyes, they would not be perceived as they float on the surface of the water, so transparent are their bodies. The seas of Africa and India, Australia and New Guinea furnish the greatest number of species. M. Milne-Edwards divides the genus into the three following natural groups:—

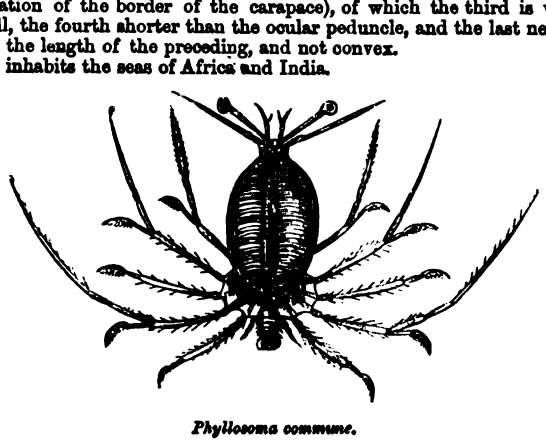
1. Ordinary *Phyllosomata*.

Abdomen very distinct from the thorax, large, divided into rings, and terminated by a well-developed caudal fin.

The *Phyllosomata* of this division approach, more than the others, the Caridoids and the Amphions, for their abdomen, though flattened, much resembles that of the Shrimps (*Salicoques*).

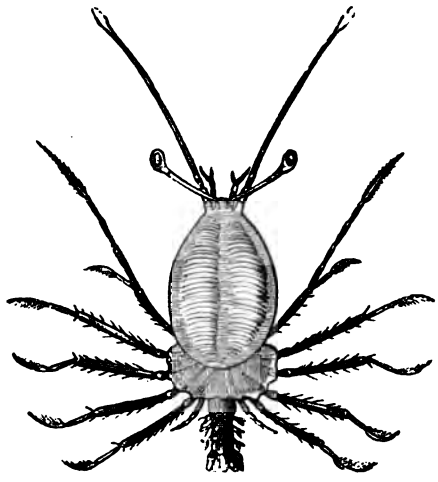
P. commune has the cephalic plate less than the thoracic plate, covering the base of the second pair of feet (or external jaw-feet), elongated, and narrowed forwards. External antennæ styliform, much longer than the ocular peduncles, and composed of five joints (without reckoning the peduncle that supports them, and which is only a prolongation of the border of the carapace), of which the third is very small, the fourth shorter than the ocular peduncle, and the last nearly half the length of the preceding, and not convex.

It inhabits the seas of Africa and India.



Phyllosoma commune.

P. clavicorne, from the seas of Africa and Asia, is another example of this section.



Phyllosoma clavicorne.

The other two sections consist of those *Phyllosomata* whose abdomen is intimately united with the thorax, without well distinguished divisions, and terminated by a very small caudal-fin.

2. Short-Tailed *Phyllosomata*.

Abdomen in general rudimentary and lodged in the middle of a great notch on the posterior border of the thorax.

P. laticorne and *P. brevicorne*, the eyes and antennæ of which are represented below, are examples of this section.

a, Eyes and Antennæ of *Phyllosoma laticorne*; *b*, Eyes and Antennæ of *Phyllosoma brevicorne*. The first of these species is found in the Indian Seas, and the second in the seas of Africa and Asia.

3. Broad-Tailed *Phyllosomata*.

Abdomen large, triangular, and occupying the whole length of the posterior border of the carapace.

P. spinosum (Azores) and *P. Mediterraneum* (Mediterranean), &c., are examples of this section.

Amphion (Milne-Edwards).—M. Milne Edwards states that the *Crustacea* which he has designated under the name of *Amphion* approach nearer to the *Phyllosomata* than any of the other Stomapods, but in some respects they resemble also the genera *Alima* and *Mysis*; and he is of opinion that they establish the natural passage between these animals. Their cephalic buckler or carapace is foliaceous, like that of the *Phyllosomata*, whilst the form of the abdomen and the caudal-fin is that of *Mysis*.

The only species known, *Amphion Reynaudii*, was taken at sea in the Indian Ocean by M. Reynaud, naval surgeon. Its length is about an inch, and its teguments, with the exception of those of the abdomen, are diaphanous.

(*Histoire Naturelle des Crustacés.*)

PHYLLOSTOMA. [Cheiroptera.]

PHYSA. [Limnæadæ.]

PHYSALIA. [Acalephæ.]

PHYSALIS (from φῦσα, a bladder, in reference to the inflated calyx), a genus of Plants belonging to the natural order *Solanaceæ*. It has a 5-toothed calyx; a campanulate rotate 5-lobed corolla; converging anthers opening longitudinally; a capitate stigma; smooth 2-celled berry, covered with the angular membranous inflated calyx. The species are annual or perennial herbs, rarely shrubs.

P. somnifera has several shrubby branched stems, round and downy. The leaves are in lateral pairs, short-stalked, ovate, downy, and from two to four inches long. The flowers are axillary, subsessile, small, crowded, and of a greenish-yellow or white. The berry is red and smooth, and about the size of a pea. This plant is the Στρύχνος ὑπνωτικός of Theophrastus ('Hist. Plant.,' 9, 12); and the Στρύχνον αλικάκαβον of Dioscorides (4, 72). It is a native of rocky places in the south of Europe and the East Indies. It is reputed to be narcotic, diuretic, and alexipharmic. The leaves steeped in oil are in India applied to inflammatory tumours, and they are used in a similar way in Egypt. Kunth recognised this plant in Egyptian mummies.

P. Alkekengi, the Winter Cherry, is an herbaceous downy plant, with a perennial creeping root; ovate deltoid leaves; spotless flowers, ovate coloured calyx, and subulate segments. It is a native of Europe on

exposed hills, and of Japan. The corolla is a dirty white; the calyx reddish-yellow, inclosing a red berry. The fruit of this plant was well known to the ancients, and is described by Dioscorides. In this country however the fruit is seldom eaten, and the plant is cultivated chiefly on account of its appearance. In Arabia and Armenia, Spain, and Germany however the berries frequently supply the place of other eatable fruits. They have a subacrid and not unpleasant flavour, but the persistent calyx with which they are invested is very bitter. Ray speaks of these berries as a preventive of gout, and others have extolled them as diuretics, and recommended them in the treatment of dropsy.

P. pubescens, Downy Winter Cherry, is a native of North America and the East Indies. The whole plant is densely clothed with down. The corolla is yellow, marked with five roundish brownish-violet spots at the throat. The berries are yellowish when ripe; they are called Gooseberries, and are used as a substitute for them in many parts, and when preserved with sugar make an excellent sweetmeat. It is the Camara of Brazil.

(Lindley, *Flora Medica;* Burnett, *Outlines of Botany;* Fraas, *Synopsis Plantarum Floræ Classicæ.*)

PHYSALITE, an opaque variety of topaz. [TOPAZ.]

PHY'SALUS. [ACALEPHÆ; CETACEA.]

PHYSE'TER. [CETACEA.]

PHYSIC-NUT. [JATROPHA.]

PHYSIOLOGY (*φυσιολογία*, from *φύσις*, nature, and *λόγος*, discourse) is the science which treats of the phenomena of living bodies. Its several departments are considered in separate articles, in which a complete system may be found. The reader is referred to the articles VITALITY, DIGESTION, ABSORPTION, CIRCULATION, HEART, RESPIRATION, NUTRITION, SECRETION, GLAND, BONE, SKELETON, ARTICULATION, MUSCLE, LARYNX, NERVOUS SYSTEM, BRAIN, the several organs of the SENSES, REPRODUCTION, and the articles on the anatomy and special physiology of the individual organs of animals and plants, which are referred to in each of the preceding.

PHYSOGRADA. [ACALEPHÆ.]

PHYSONE'MUS, a genus of Fossil Fishes. [FISH.]

PHYSOSPERMUM (from *φύσα*, a bladder, and *σπέρμα*, a seed, in reference to the tegument not adhering to the seed when young), a genus of Plants belonging to the natural order *Umbelliferæ*. It has a 5-toothed calyx; obovate petals, with an inflexed point; the fruit laterally compressed; the carpels reniform, globose, didymous, with five filiform slender equal ridges, the lateral within the margin; the interstices with single vittæ. The species are perennial herbs. The flowers white.

P. Cornubiense has triternate radical leaves; wedge-shaped leaflets deeply toothed; the stem-leaves ternate, lanceolate, and entire; the stem from one to three feet high, erect, round, striated, minutely scabrous, bearing a few small ternate leaves with linear-lanceolate segments; the umbels are terminal; the carpels longer than broad; the coat loose. It is a native only of Cornwall, in bushes and hedges; in great plenty in the neighbourhood of Bodmin. Cattle are so fond of this plant that they will eat it down to the ground. The root contains a yellow resinous juice. There are but few species of this genus.

(Babington, *Manual of British Botany.*)

PHYSSO'PHORA. [ACALEPHÆ.]

PHYTELEPHAS (from *φυτόν*, a plant, and *ἐλέφας*, ivory), a genus of Plants belonging to the natural order *Pandaneæ*, of Brown, and originally referred by Lindley to the order *Cyclanthaceæ*, but in his 'Vegetable Kingdom' he places it with the Palms. Under this name it was first described by Ruiz and Pavon, in their 'Systema Vegetabilium Floræ Peruvianæ.' It was also described by Willdenow under the name *Elephantusia*, but the former name is now generally used. The substance called Vegetable Ivory consists of the seeds of species of *Phytelephas*.

This genus is characterised by possessing pinnated fronds and an erect stem. The flowers are arranged on a spadix inclosed in a universal spathe, and are of two sorts, the one containing both stamens and pistils, the others only pistils. The spadix is crowded with flowers, and the stamens are very various; the style is divided into 5 or 6 deep segments; there is no visible calyx or corolla; the fruit consists of quadrilocular drupes, which are aggregated into a large muricated coriaceous head. The seeds are about the size of a pigeon's egg, and of an oblong-ovate triangular shape. When young they contain a crystalline liquor without odour or taste, which is regarded as a refreshing drink by travellers. In the process of growth however this once opaline liquid becomes milky and opaque, acquiring some taste and odour, and at last it is converted into a substance in many instances whiter and harder than ivory. If the liquid of the seed is kept long, even when it is clear, it becomes sour, thus indicating that although clear and tasteless it contains some carbonaceous principle, as well as water. There are two species of *Phytelephas*, yielding seeds of the same kind: the *P. macrocarpa* has a low stem and large fruit, whilst the *P. microcarpa* has little or no stem and small fruit. These plants, which have an external character something between a palm and a cycas, occur in South America, in the valleys of the Peruvian Andes, and especially on the borders of the river Magdalena. The natives of these districts have used the seeds from time immemorial, for the purposes of making buttons, heads to walking-sticks, and various trinkets; but it is only within a recent period that they have been used for these purposes in Europe. They are now extensively used, as far as their size will permit them, for the manufacture of almost all the articles for which ivory had been in use before; and, as they can be made at a cheaper rate, their sale is at present somewhat extensive. In the use of the nuts for turning, considerable difference is found in their quality; some are comparatively oily and soft, and work up with ease, whilst others are so brittle as to be unmanageable in the lathe. They do not answer so well as ivory for the construction of delicate articles, as they are much more easily fractured; and although at first these seeds are whiter than ivory, they are not found to retain their colour so well.

It might at first appear difficult to account for the germination of these plants, as the albumen, which is destined to nourish the young plant, is as hard as ivory; but this is provided against by the hard albumen absorbing water, and thus not only becoming soft and capable of being used by the embryo, but it also loses its whiteness. It regains these properties when dry. The embryo is small compared with the size of the seed, of a sweet taste, and lies inclosed in a little bag at one end of the seed, the presence of which is indicated by a slight swelling on the external part of the seed. When the seeds are brought into this country they are contained in a soft external tegument of a light colour, and about the eighth of an inch in thickness, with a dark mark indicating the point of attachment. This covering is easily removed, and the seed underneath is of a dark brown colour, from a membrane which is closely attached to the albumen. In some cases this is of a reddish colour, especially on the smaller seeds, and these are probably the produce of the smaller species of the plants. When the seed is cut completely through, an irregular cavity is found in the centre. This should be attended to in working it.

(Ruiz and Pavon, *Systema Vegetabilium Floræ Peruvianæ;* Cooper, Paper *On Vegetable Ivory*, in *Microscopical Journal*, No. 16.)

PHYTEUMA (a name adopted by Dioscorides), a genus of Plants belonging to the natural order *Campanulaceæ*. It has a 5-parted calyx; a rotate corolla with 5 long linear segments; free anthers; and filaments dilated at the base.

P. orbiculare, Round-Headed Rampion, has the heads of its flowers globose, those of the fruit oblong, the leaves crenate-serrate, the lower ones cordate-ovate, stalked, the upper ones linear, lanceolate, sessile. It is a native of the mountains of Europe and of England in chalky soil. The flowers are of a deep blue colour.

P. spicatum, Spiked Rampion, is distinguished by having the heads of its flowers oblong, those of the fruit elongated, cylindrical; the lower leaves cordate-ovate, the upper ones linear-lanceolate, sessile; the flowers are white, cream-coloured, or blue. It is a native of the temperate parts of Europe, and of Sussex in England. *Campanula Rapunculus* is likewise known as the Rampion.

(Babington, *Manual of British Botany.*)

PHYTO'CRINUS. [ENCRINITES.]

PHYTOLACCA, a genus of Plants the type of the natural order *Phytolaccaceæ*. The species are tropical or subtropical herbaceous plants, with erect or occasionally twining stems, a thickish, turnip-

Phytolacca decandra.

1, an expanded flower; 2, the pistil; 3, a ripe fruit; 4, the same, cut through transversely; 5, a vertical section of a seed.

shaped root, alternate undivided broad leaves, and leafless erect racemes of flowers, succeeded by deep purple fruits. They have a 5-parted calyx; no corolla; from 5 to 30 stamens inserted into a fleshy disc; and the pistil consists of several unilocular distinct carpels united at the base or along the whole inner angle. The fruit is an umbonate depressed berry, with solitary seeds whose embryo is turned round mealy albumen.

P. decandra, a species found wild in Virginia, where it is called Pocan, whence the vulgar name of Poke applied to this species, has a root which acts as a powerful emetic, but its exhibition is attended with narcotic effects; its berries are also reported to possess the same quality; they stain an intense purple colour, and are said to be employed in Portugal as a means of improving the appearance of inferior red wines. Notwithstanding the acridity of its leaves, this plant, when very young, is said to be eaten in the United States as asparagus; and Dr. Royle relates that he found *P. acinosa*, a Himalayan species, employed in the same manner in the north of India, to be very palatable when boiled.

PHYTOLACCA'CEÆ, a natural order of Plants belonging to the class Exogens. According to most writers they are regarded as apetalous plants, and allies of the Chenopodiaceous and Polygonaceous orders, from which their distinct ovaries chiefly distinguish them; but Endlicher, in his arrangement of plants, probably influenced by the form of their embryo and by the plurality of the carpels, considers them as related on the one hand to the Caryophyllaceous and on the other to the Malvaceous orders. Notwithstanding the apparent difference between these two stations it is probable that both are correct, and that *Phytolaccaceæ* are really plants connecting *Chenopodiaceæ* and *Caryophyllaceæ*. If so, they furnish a new proof of the badness of the fundamental divisions proposed for Exogens by both De Candolle and Jussieu. With the exception of *Phytolacca*, no plants of this order appear to be of much importance to man; their properties seem to be generally acrid.

PHYTOSAU'RUS, Jaeger's name for a genus of Fossil Saurians. Two species are recorded, *P. cubicodon* and *P. cylindricodon*, both from the Dolomitic Sandstone (Keuper Formation).

PHYTO'TOMA. [MUSOPHAGIDÆ.]

PHYTOZOA'RIA (Ehrenberg), a name for the animals included in the families *Rotifera*, *Infusoria*, and *Rotatoria*. [ROTIFERA; INFUSORIA.]

PIA MATER. [BRAIN.]

PIAHAU, or PIAUHAU, the name assigned to certain Cotingas (*Ampelis*, Linn.), whose bill is more strong and more pointed than the ordinary Cotingas. [MUSCICAPIDÆ.]

PIAUZITE, a kind of mineral resin or wax insoluble in alcohol.

PICA. [CORVIDÆ.]

PICATHARTES. [CORVIDÆ.]

PICIDÆ, a family of Scansorial Birds. The order *Picæ* of Linnæus is thus characterised:—Bill (cuneus sarriens) cultrated, with a convex back. Feet walking, short, rather strong. Body 'tenaciusculum,' impure. Food 'quisquilliæ.' Nest in trees; the male feeding the incubating female. Monogamy. Order analogous to the *Primates*.

This order seems to be the most arbitrary in the ornithological system of Linnæus, for under it birds of very discordant habits are collected. The Woodpeckers, the Crows, the Trogons, the Orioles, the Cuckoos, the Kingfishers, the Humming-Birds, are there associated with others in the following succession:—

Genera:—*Psittacus*, with its three sections; *Ramphastos*, *Buceros*, *Buphaga*, *Crotophaga*, *Corvus*, *Coracias*, *Oriolus*, *Gracula*, *Paradisea*, *Trogon*, *Bucco*, *Cuculus*, *Yunx*, *Picus*, *Sitta*, *Todus*, *Alcedo*, *Merops*, *Upupa*, *Certhia*, and *Trochilus*.

Brisson had previously arranged the Wryneck, the Woodpeckers, and the Jacamar in the first section (bill straight) of his thirteenth order of birds—those, namely, with four toes, two before and two behind.

Latham's *Picæ* consist of even a more heterogeneous group than that assembled under the *Picæ* of Linnæus.

The fourth order of Birds, in the Method of Lacépède, consists of those which have the bill straight and compressed, and under it two genera only, *Galbula* (Jacamar) and *Picus*, are arranged. The Count's third and fifth orders are formed respectively of the genera *Bucco* and *Yunx*.

The first family (*Cuneirostres*, or *Sphenorampheæ*) of M. Duméril's third order (Grimpeurs, or Climbers) comprises the genera *Picus*, *Yunx*, *Galbula*, *Crotophaga*, and *Cuculus*.

The *Pici* form M. Meyer's third order, and are divided into two sections:—

1. With stiff feathers. Genera—*Picus*, *Certhia*.
2. With soft feathers. Genera—*Yunx*, *Sitta*, *Tichodroma*.

Illiger's *Scansores* consist of the *Psittacini*; the *Serrati*; the *Amphiboli*; the *Sagittilingues*; and the *Syndactyli*. The *Sagittilingues* embrace the genera *Yunx* and *Picus*.

The great genus *Picus* is placed by Cuvier in his third order, Grimpeurs, between *Galbula* and *Yunx*.

The *Zygodactyli* are the first tribe of the *Sylvicolæ*, the second order of birds according to the method of M. Vieillot: the second family of that order, the *Macroglosses*, consist of the genera *Picus* and *Yunx*.

The *Zygodactyli* are the fifth order in M. Temminck's arrangement; and the genera *Picus*, *Galbula*, and *Yunx* constitute the second family of that order.

The Cuckoos and the Woodpeckers form the *Zygodactyles* of M. De Blainville.

Mr. Vigors separates the Parrots [PSITTACIDÆ] and Woodpeckers from the other families of *Scansores* [SCANSORES], associating them together in consequence of their affinity in the essential characteristics of the tribe; and, in his view, they compose its normal groups, as Climbers par excellence, differing however as to the mode in which they climb: the Parrots using the foot chiefly in grasping the object which assists them in their ascent, and in conjunction with the bill; while the *Picidæ* rely upon the strength and straightness of the hind toes in supporting them in a perpendicular position on the sides of trees, in which posture they are also assisted by the strong shafts of the tail-feathers.

The Proglosses of M. Latreille are arranged between the *Cuculides*, and the *Grandirostres* (Toucan and Araçari); the Proglosses consists of the genera *Yunx*, *Picoides*, and *Picus*.

In the method proposed by M. De Blainville in 1815 and 1821, and developed by M. Lherminier in 1827, the Woodpeckers (*Picus*) stand between the Toucans and the Hoopoes, in the first sub-class (Normal Birds).

In the Projet of M. Lesson the Picées comprise the genera *Yunx*, *Picoides*, *Picus*, and *Picumnus*, and are placed between the Cuculées and the Ramphastidées, forming the fourth family of the first tribe (*Zygodactyles*) of *Insessores*, or Grimpeurs.

Mr. Swainson is of opinion that the structure of the *Picidæ* constitutes them the most perfect of all the climbing birds, for nature has rendered their whole organisation subservient to this particular power. The feet, he observes, although very short, are unusually strong; the nails are broad and crooked, and the toes placed in pairs, that is, two forward and two backward.

Foot of Woodpecker.

As an additional and powerful support in their rapid and perpendicular ascent up the trunks of trees, their tail-feathers, he remarks, terminate in points, and are uncommonly hard, so that being pressed against the bark, they assist the bird in its progress or in keeping its position. The bill, destined for the laborious operation of penetrating the wood or stripping off the bark of forest-trees, is beautifully adapted for the purpose, being wedge-shaped, furnished with regular-sided angles, and in one species (*Picus principalis*) nearly of the colour and consistency of ivory, whence it has been termed the Ivory-Billed Woodpecker. Mr. Swainson then calls attention to the worm-like tongue barbed at the point, and capable of being protruded to a great length.

Bill of Woodpecker.

In the College of Surgeons in London, are several preparations illustrative of the structure of the muscles of the base of the tongue in these birds. The end attained by the arrangement of these muscles is the rapid and extensive protrusion of the tongue in the transfixion of the insects which constitute the food of the Woodpecker, and which are dislodged from their hiding places under the bark of trees

Head of Woodpecker, showing the mechanism of the tongue. (Yarrell.)

by means of its powerful bill. For the more effectual retention of the stronger insects, it may be observed that the horny sheath at the tip of the tongue is barbed; the tongue is also lubricated by a glutinous secretion, abundantly furnished by the two large submaxillary glands, which may be seen extending from behind the angles of the lower jaw along the under side of the rami to the symphysis.

This mechanism enables the bird to introduce the tongue into holes and crevices, and under the loose bark of trees, to the destruction of insects there harboured. A similar conformation, directed to a different end, exists in the Humming-Birds. [TROCHILIDÆ.]

Mr. Yarrell observes, that another anatomical peculiarity remarkable in the skeleton of the Woodpecker, but admirably adapted to the habits of the bird, is the small size of the keel of the breast-bone. "Moderate powers of flight," says this observing zoologist, "sufficient to transport the bird from tree to tree, are all that it seems to require; large pectoral muscles with a deep keel to the breast-bone would to this bird be an inconvenience. The advantage of a narrow shallow keel is immediately apparent, on looking at a representation of the skeleton in a climbing position; the low keel, allowing the bird to place its body close to the tree, brings its centre of gravity in a perpendicular line before the points of support, and thus materially diminishes the labour of, and the strain upon, the muscles of the legs and thighs. The descending position of the bones of the tail indicate the mode by which the stiff points of the tail-feathers are brought into contact with the surface of the bark of the tree to form an accessory prop." ('British Birds.')

Skeleton of Woodpecker. (Yarrell.)

In the opinion of Mr. Swainson the divisions of this family are strongly marked; because, as some few intervening forms are wanting, the circle is, in one sense, incomplete. Thus the Nuthatches (*Sittæ*), he observes, although clearly approximating to the Woodpeckers, are not directly united to them; neither does the intervention of the Wryneck, with its worm-like tongue, or of *Oxyrhynchus*, with its acute bill, do more than indicate the broken links of the chain. The absolute connection between the true Woodpeckers (*Picinæ*) and the sub-family of Barbets (*Buccoinæ*) is, he thinks, unquestionably established by two very singular little birds; one being the Minute Woodpecker of Linnæus (*Asthenurus*, Sw.), the other a Barbet (*Picumnus*, Temm.).

The true Woodpeckers (*Picianæ*, Sw.) are, Mr. Swainson observes, typically represented by the great ivory-billed species already noticed. The upper and lower ridge of the bill in this bird exactly correspond, he remarks, in their inclination towards the tip, rendering the organ a perfectly straight wedge. This construction is, he points out, rendered still more perfect by a ridge, forming a strongly carinated line, which runs parallel to the culmen, and is situated nearly half way between that and the external margin of the upper mandible. Mr. Swainson then draws attention to the crests in these birds—short, rigid, and turned upwards; but their chief generic distinction rests, in his opinion, on the structure of the feet, the hinder external toe being manifestly longer than that in front: this peculiarity is, he observes, even extended to such aberrant species as have one of the small toes wanting—the two northern species *Apternus tridactylus* and *A. arcticus*, for instance. To this group therefore he restricts the generic name of *Picus*, which includes in his arrangement all the British species excepting *P. viridis*.

In the next group, *Chrysoptilus*, he finds a diminution of the typical excellences; the bill, as in the Common Green Woodpecker, is still

nearly straight, but the lateral ridge is close to the culmen, and the hind toe is either of equal length or slightly shorter than the fore toe: the crest, though still short, is less rigid, and not so much developed. Mr. Swainson remarks that the colours of these birds are always gay; green and soot-black predominate, and most of the typical species have the quills of a beautiful golden hue, whence the generic name above stated.

The third genus, *Malacolophus*, Sw., is described to be highly elegant: the bill is no longer straight, the culmen being more arched than the lower ridge or gonys, and the latter particularly short, owing to the prolonged advancement of the chin, which occupies full one-half of the lower mandible. The lateral ridge of the upper mandible is as in the last genus; but the anterior toe is longer than the hind toe; the crest is long, formed of loose feathers, and, like the rest of the plumage, particularly soft, whence the generic name.

Colaptes (Sw.) is distinguished from *Malacolophus* by the greater curvature and compression of the bill, and by the disappearance of the ridge on the upper mandible; thus, in Mr. Swainson's opinion, assimilating the group to the *Tenuirostres*, and exhibiting the weakest structure among the Woodpeckers.

Melanerpes (Sw.), the fifth and last genus, may, Mr. Swainson thinks, be not unaptly called Swallow-Woodpeckers, for they resemble those birds in their migratory habits, their long wings, and their black glossy plumage, destitute in the typical examples of spots or bands.

Mr. Swainson concludes his observations on the *Picidæ* by stating that the other genera, whose climbing habits have induced naturalists to place them with this family, are *Yunx* and *Oxyrhynchus*: the first of these types belongs exclusively to the Old World; the latter, in Mr. Swainson's opinion, seems to be the representative of it in America.

The following is Mr. Swainson's systematic arrangement:—

Picidæ.—Bill straight, more or less conic. Toes placed in pairs.

Sub-family:—*Picianæ* (*Picinæ*?), the True Woodpeckers. Bill wedge-shaped. Tongue vermiform.

1. *Picus*, Typical-Woodpeckers.—Bill perfectly wedge-shaped, cylindrical; the culmen straight; lateral ridges removed from the culmen. Versatile (outer posterior) toe always longer than the anterior (outer fore toe).

Sub-genera:—*Picus* (America and India); *Hemicircus* (India); *Dendrobates* (Africa, except two species from Tropical America); *Apternus* (Arctic Regions); and *Dendrocopus* (Universal.)

2. *Chrysoptilus*, Green-Woodpeckers.—Versatile and anterior toes of equal length. Lateral ridge nearest to the culmen, which is sharp, and either quite straight or very slightly bent. Bill depressed or widened at the base. Colour green banded or spotted with black. Sub-typical genus.

Sub-genera:—*Dendromus* (Africa and India); *Chloronerpes* (Tropical America); *Dryotomus* (America and Europe); *Chrysoptilus* (Tropical America).

3. *Malacolophus*, Rasorial-Woodpeckers.—Versatile toe shorter than the anterior, culmen curved. The lateral ridge (except in the typical group) wanting. Tarsus shorter than the versatile toe. Hind head with a crest of very soft feathers.

Sub-genera:—*Brachylophus* (Old World only); *Hemilophus* (India only). Typical:—*Malacolophus* (Tropical America only); *Meiglyptes* (India); *Chrysonotus* (India only).

4. *Colaptes*.—Tarsus lengthened and equal to the versatile toe; which latter is shorter than the anterior. Bill broader at its base than it is high; the sides compressed; the culmen considerably curved from its base; the lateral ridge either obsolete or entirely wanting. Nostrils partially defended by feathers.

Sub-genera:—*Geocolaptes* (Africa only); *Colaptes*.

5. *Melanerpes*.—Bill straight, more or less cylindrical; base wide; the ridge of the culmen slightly bent, but not very prominent; the sides rounded; the lateral ridge slight, and placed near but not close to the culmen. Gonys very long, as in the typical group. Nostrils nearly concealed. Wings long; the first quill spurious or very small; the second nearly as long as the third. Toes various. Habits gregarious and migratory. Colours black varied with white and red. The fissirostral type (America only).

Sub-genera:—*Centurus*, *Leuconerpes*, *Melanerpes*, *Tripsurus*. Sub-family: *Buccoinæ*, Barbets [BARBETS]. Bill surrounded with long bristles. Tail short, soft.

Yunx. [YUNX.]

The *Picidæ*, in Mr. Swainson's arrangement, are placed between the *Psittacidæ* and the *Certhiadæ*.

Picus martius, Linn. (genus *Dryocopus*, Boie; *Dryotomus*, Sw.). This is the Pic Noir of the French; Picchio Grande, Picchio Nero, and Picchio Corvo of the Italians; Schwartz Specht and Fichten- und Nordischer-Baumhacker of the Germans; Swarte Specht of the Netherlanders; Great Black Woodpecker of the English.

The whole plumage deep black, except that, in the male, all the upper part of the head is of a lively red; the female, on the contrary, has only a small space of that colour on the occiput. Very old males have the belly and abdomen tinged with reddish; part of the tarsus

feathered; iris yellowish-white; naked circle which surrounds the eye and feet black; bill bluish-white, black at the point. Length from 16 to 17 inches.

Young males have the upper part of the head marked with red and blackish spots; iris whitish-ash colour. The older the male grows the more vivid does the red on the head become.

This bird is found in the north of Europe and Siberia principally: Norway, Sweden, Poland, and Russia possess it, and it inhabits the Swiss mountains and those of Savoy and the Tyrol. It is rare in France and Germany. There is no record of its appearance in Holland. Prince Bonaparte mentions it as occurring very rarely in the neighbourhood of Rome, in the winter only, in the deep sub-Apennine woods. Sir W. Jardine, in the 'Naturalist's Library' (1839), says Mr. Jenyns, the latest writer on our British Fauna, in 1835 writes thus:—"No specimens however known to have been certainly killed in this country exists in any of our museums, and there is strong reason to doubt the reality of its claims to a place in the British Fauna." The authority previous to this rests with the works of Drs. Latham and Pulteney.

Great Black Woodpecker (*Picus* (*Dryocopus*) *martius*).
Upper figure, female; lower, male. (Gould.)

Mr. Yarrell, in his interesting 'British Birds,' states, that the Great Black Woodpecker was added to the catalogue of the birds of these islands by Dr. Latham, who said that he had been informed that the species had occasionally been seen in Devonshire and the southern parts of the kingdom. Mr. Yarrell refers also to Dr. Pulteney's catalogue of the Dorsetshire birds, where the Great Black Woodpecker is noticed as having been more than once killed in that county—one in particular said to have been shot in a nursery at Blandford, and another at Whitchurch; and he then quotes Montagu's supplement for the following passage:—"Lord Stanley assures us that he shot a *Picus martius* in Lancashire; and we have heard that another was shot in the winter of 1805 on the trunk of a tree in Battersea Fields." Mr. Yarrell then goes on to state that the specimen of the Black Woodpecker, formerly in the collection of Mr. Donovan (who was well known to give very high prices for rare British-killed birds, for his own use in his 'History of British Ornithology'), was affirmed to have been shot in this country; and, at the sale of Mr. Donovan's collection, this specimen was purchased by the Earl of Derby, and is now at Knowsley. Mr. Yarrell further states that he has been told of two instances of the Black Woodpecker having been killed in Yorkshire, and that it is also recorded to have been killed in Lincolnshire. "A few years since," says Mr. Yarrell in continuation, "a communication was made to the Zoological Society of London, that two examples of the Great Black Woodpecker had been at that time killed in a small wood, near Scole Inn in Norfolk; and, still more recently, a pair were frequently seen in a small preserved wood, near Christchurch in Hampshire. It was hoped that they would have remained to go to nest; but the birds, disturbed by being too frequently watched, left the wood. Lastly, I may add, that Sir Robert Sibbald, in his 'Scotia Illustrata,' claims *Picus martius* as a bird of Scotland, including it in his 'Historia Animalium in Scotia.'" ('British Birds.')

Mr. Gould thus describes the habits of the Great Black Woodpecker:—"We need hardly say that it is on the bark of trees more exclusively that the Woodpecker finds its food, and to this end are its powers and organs adapted. If we examine the toes of the present species, which are to be taken as illustrative of form in the whole of the family (with the exception of a single limited group), we find them long and powerful, furnished with strong claws, admirably adapted for grasping or clinging to the rough inequalities of the bark; besides this they are placed in pairs, so as in some measures to antagonize; but not, as generally stated, two before and two behind, for one pair is lateral and diverges from the other at an acute angle, so as to be applied to the convexity of the tree, and thus render the grasp close and firm. The tail is composed of stiff feathers; the shafts of which taper gradually from the base of the extremities, which, curving inward when pressed against a tree, not only form a fulcrum for the support of the body, but by their elasticity tend to propel it forwards. This provision, the more needed from the posterior situation of the legs, is admirably calculated for ascending; and having explored the bark by a spiral course, the woodpecker flies off to the next tree to repeat the same process. The flight of the present species is undulating, seldom protracted to any extent, but limited to a transit from tree to tree in the seclusion of its native woods. Its food consists of the larvæ of wasps, bees, and other insects; in addition however it devours fruits, berries, and nuts with avidity. The female selects the hollows of old trees, in which she deposits two or three eggs of an ivory whiteness."

Mr. Hewitson saw this species in two instances only in Norway, and at a distance. The birds were so wild that to approach them was impossible. The same observing ornithologist says that on the wing the Black Woodpecker looks like a crow, and that its notes resemble a loud hoarse laugh.

P. viridis (Genus *Gecinus*, Boie; *Brachylophus*, Swainson). This is the Pic Verd and Pic Vert of the French; Pico Verde, Picchio Verde, and Picchio Pollastro, of the Italians; Grün Specht, and Fichten-, Laub-, Grüner- und Grünlicher-Baumhacker, of the Germans; Wedknar, Gronspik, and Grongjoling of the Swedes; Groenspet of the Danes and Norwegians; Deteu and Detela of Scopoli; Green Woodpecker or Woodspite, Rain-Bird, Rain-Fowl, High-Hoe, Hewhole, Awl-Bird, Pick-a-Tree, Yappingale, Yaffil, Yaffle, Yaffler, Woodwall (?), Whet-Ile, Popinjay, and Poppinjay, of the English; Cnocell y Coed and Delor y Derw of the Welsh.

Male.—Top of the head, occiput, and moustaches brilliant red; face black, upper parts a beautiful green; rump tinged with yellowish; quills regularly marked with whitish on their external barbs; tail shaded with brown and striped transversely; base of the lower mandible yellowish; iris white, feet greenish-brown. Total length about 13 inches.

Female with less red on the head and less black round the eyes; the moustaches black.

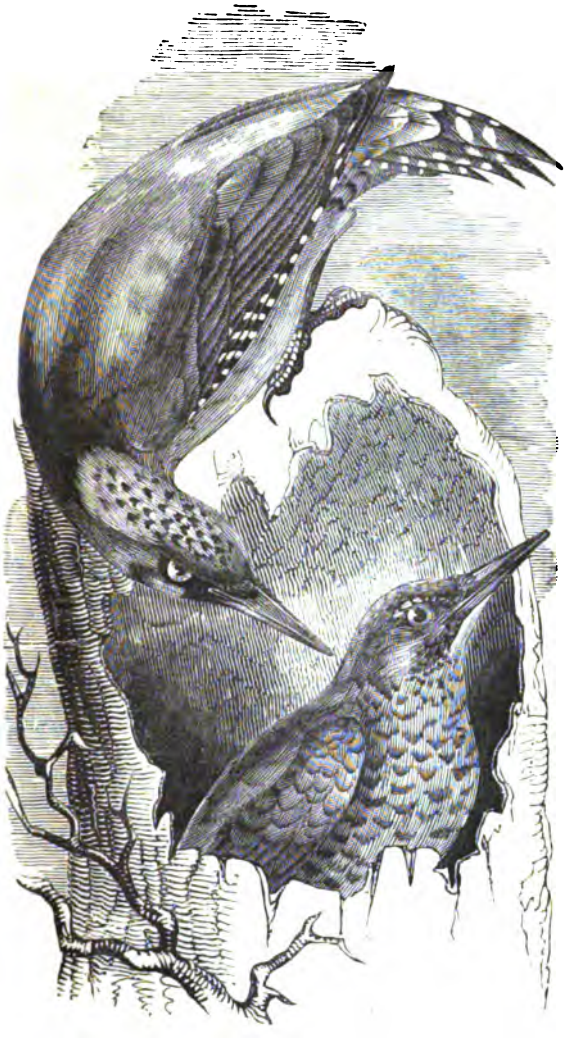
The young at their departure from the nest have a little red upon the head, the rest yellowish ash-colour; all the green paler, and marked on the back with ashy spots; the moustaches formed by some black and whitish spots; the rest of the lower parts greenish-white with transverse brown bands; iris blackish-ash.

Varieties.—Pure white with the head yellowish; the plumage whitish, with the ordinary colours weakly developed; often more or less variegated with white.

Belon seems to confound the Great Black Woodpecker and the Green Woodpecker: his description and figure indicate the latter, but over the cut in 'L'Histoire de la Nature des Oyseaux' (folio, 1555), he writes, "Dryocolaptos, Pipra, Pipo, Chloreus en Grec, Picus martius major, Picus arborarius et Arborum Cavator en Latin, Pic mart, Pic verd, ou Pic iaulne en Françoys;" and below he gives the description of the Δρυοκολάπτης from the ninth chapter of the ninth book of Aristotle ('Hist. Anim.), where the Greek zoologist states that the Δρυοκολάπτης does not perch on the ground, but strikes the oaks to make the worms and insects (σκνῖπες) come forth. Now the Green Woodpecker frequently alights on the ground for the purpose of feeding on emmets. In the 'Portraits des Oyseaux,' &c. (4to, 1557), over the same figure, is printed "Grec., Δρυοκολάπτης; Latin, *Picus*

maximus, Picus martius, arborarius; Italien, Pico, Pichio; François, Pic, Picmart, Pic verd, Pic iaulne, Picumart;" and below it:—

"Le Pic verd iaulne à la Turtrelle a guerre,
Et au Corbeau et au rouge Pic verd.
De plume iaulne il a le corps couvert,
Et ses petits en un trou d'arbe enserre."



Green Woodpecker (*Picus* (*Gecinus*) *viridis*).
Upper figure, adult male; lower, young bird, (Gould.)

This bird is found on the European continent, but not common in Holland, from Scandinavia and Russia to Spain, Provence, and Italy; the wooded districts of Greece; England generally, where there are woods. Not recorded as having been found in Ireland.

This species obtains its food both upon trees and on the ground; its flight is short, undulating, and rather laborious. "When seen moving upon a tree," says Mr. Yarrell, "the bird is mostly ascending in a direction more or less oblique, and is believed to be incapable of descending unless this action is performed backwards. On flying to a tree to make a new search, the bird settles low down on the bole or body of the tree, but a few feet above the ground, and generally below the lowest large branch, as if to have all its work above it, and proceeds from thence upwards, alternately tapping to induce any hidden insect to change its place, pecking holes in a decayed branch, that it may be able to reach any insects that are lodged within, or protruding its long extensible tongue to take up any insect on the surface; but the summit of the tree once obtained, the bird does not descend over the examined part, but flies off to another tree, or to another part of the same tree, to recommence its search lower down nearer the ground."

A very large proportion of the food of this species is derived from ants and their eggs. Every person who has lived in the country must frequently have seen this gay-coloured woodpecker on its feed at some ant-hill. Mr. Yarrell states that he has seldom had an opportunity of examining a recently-killed specimen, the beak of which did not indicate by the earth adhering to the base, and to the feathers about the nostrils, that the bird had been so at work. Bechstein says that in the winter it will take bees from the hive, and that in the house it is fed on nuts, ants' eggs, and meat. Of its manners in captivity the German ornithologist says that the beauty of its plumage is all that can be said of it; for it is so fierce, quick, and stubborn, that it can only be kept chained. It is curious, he adds, to see it crack nuts.

Buffon laments over the hard lot of this bird, always condemned to labour for its existence; and hears in its wild laughing cry exclamations of wretchedness. An animal can hardly be unhappy while obeying an instinct which is associated with enjoyment; and so differently has the sound fallen upon other ears, that it has conveyed the idea of mirth. But Buffon had strange fancies about the happiness and unhappiness of animals.

The nest is generally formed in an elm or ash tree; and when the birds are excavating the hole on which they have pitched for its place, they are said to carry their chips to a distance, for fear their presence on the spot should lead to discovery. The eggs, which are smooth, shining, pure white, are deposited on the bare loose decayed wood, and are from five to seven in number.

Besides the laughing note, which is repeated more frequently and loudly before rain, a low jarring sound is uttered by the adults, and is supposed to be a sexual call. Mr. Yarrell states that the young are fledged in June, and creep about at a short distance from the hole where they were hatched before they are able to fly, and that he has known the young birds taken from the tree and brought up by hand to become very tame and utter a low note not unlike that of a young gosling.

P. major (Genus *Dryobates*, Boie; *Dendrocopus*, Swainson).—This is the Grand Pic Varié and Pic Varié ou Epeiche of the French; Picchio Cardinale Maggiore, Picchio Varia Maggiore, and Picchio Rosso Maggiore of the Italians; Der Bunt Specht, Fichten-, Kieffern-, Laubholz- und Bergbunt-Specht, and Grosser Baumhacker, of the Germans; Gyllenrenna of the Swedes; Hakke-Spect of the Danes; Great Black and White Woodpecker, Greater Spotted Woodpecker, Witwall, Whitwall, Wood Pie, and French Pie (the last in Gloucestershire), of the English: Delor Fraith of the Welsh.

Male.—A transverse whitish band on the forehead; top of the head black; on the occiput a red space; a large black band originates at the angle of the bill, surrounds the temples, and forms a junction with itself upon the nape in one direction, whilst in another it advances, enlarging as it proceeds, upon the breast; back and wings deep black; temples, a patch on the side of the neck, scapulars, middle wing-coverts, and lower parts, pure white; white spots on the two barbs of the quills; abdomen and tail-coverts crimson; lateral tail-feathers terminated with white, with some black spots; four middle tail-feathers black; iris red. Length about 9½ inches.

The female has no red on the occiput.

Young before the Moult.—Forehead gray; all the top of the head of a fainter red than in the adults, interspersed occasionally with a few black feathers; occiput black; black of the plumage generally tinged with brown; white of the lower parts tarnished, and interspersed with small blackish points.

After the first moult the red on the top of the head disappears, to give place to the black; and the occiput, which is black in the young, becomes red in the adult males. By this peculiarity in the change of the livery the young of this species may infallibly be distinguished from those of *P. leuconotus* and *P. medius*.

The distribution of this bird is extensive, more so perhaps than that of any other European Woodpecker. Denmark, Norway, Sweden, and Russia; Europe generally to Italy inclusive; common in Smyrna (Strickland); England (rarer northward), Scotland, and Ireland.

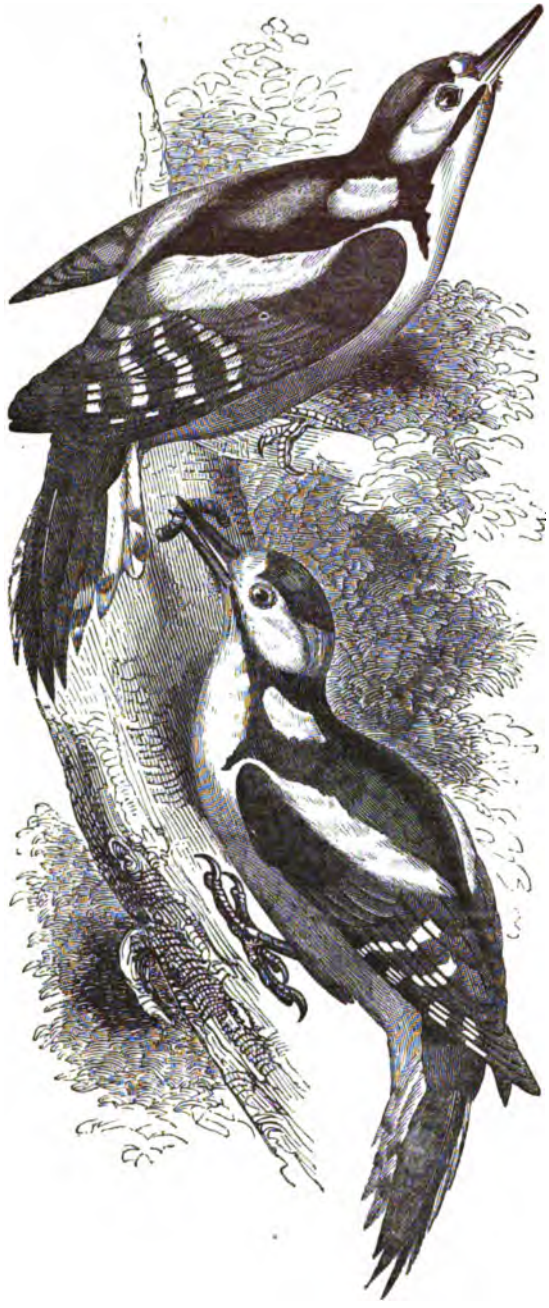
Mr. Gould observes that the group to which this species belongs, although they occasionally descend to the ground, are far more arboreal in their habits and manners than the Green Woodpeckers represented by the *P. viridis*, *P. canicepa*, and several others from the Himalaya Mountains. "They exhibit," says Mr. Gould in continuation, "great dexterity in traversing the trunks of trees and the larger decayed limbs in quest of larvæ and coleopterous insects which lurk beneath the bark, and to obtain which they labour with great assiduity, disengaging large masses of bark, or so disturbing it by repeated blows as to dislodge the objects of their search. Besides searching trees of the highest growth, they are observed to alight upon rails, old posts, and decayed pollards, where among the moss and vegetable matter they find a plentiful harvest of spiders, ants, and other insects; nor are they free from the charge of plundering the fruit-trees of the garden, and in fact commit great havoc among cherries, plums, and wall-fruit in general. Their flight is rapid and short, passing from tree to tree, or from one wood to another, by a series of undulations. In their habits they are shy and recluse; and so great is their activity among the branches of trees, that they seldom suffer themselves to be wholly seen, dodging so as to keep the branch or stem between themselves and the observer." ('Birds of Europe.')

The editor of Pennant's 'British Zoology' states that this species puts the point of its bill into a crack or the limb of a large tree, and makes a quick tremulous motion with its head, thereby occasioning a sound as if the tree was splitting, which alarms the insects, and induces them to quit their recesses: this, the editor says, it repeats during the spring in the same spot every minute or two for half an hour, and will then fly to another tree, generally fixing itself near the top for the same purpose. The noise, he adds, may be distinctly heard for

half a mile; and he remarks that the bird will also keep its head in very quick motion while moving about the tree for food, jarring the bark, and shaking it at the time it is seeking for insects. Bechstein says that the food of this species consists of insects, beech-mast, acorns, nuts, and the seed of pines and firs; and that, in order to crack nuts, it fixes them in the clefts of the trees. Temminck makes the food to consist of "hannetons (*Melolonthæ*), bees, grasshoppers, ants, perforating and other larvæ."

The eggs, which are glossy-white, and from four to six in number, are deposited at the bottom of a hole in a tree upon the decayed wood.

The favourite localities of the Greater Spotted Woodpecker are large woods and well-timbered parks. It has been seen, but not so abundantly as the next species, in Kensington Gardens.



Greater Spotted Woodpecker (*Picus* (*Dryobates*) *major*).
Upper figure, male; lower, female. (Gould.)

Pennant and others have placed the Middle Spotted Woodpecker, *P. medius*, among the British birds; but there is no safe record of its having been ever seen in this country. The mistake has arisen from the captors supposing the crimson-headed young of the Greater Spotted Woodpecker to be the Middle Spotted Woodpecker, which when in perfect plumage has the top of the head red. The last-named species is now withdrawn from the British catalogue.

P. minor, Linn. This is Le Petit Epeiche and Le Petit Pic of the French; Picchio Sarto Minore, Picchio Piccolo, Picchio Cardinale Minore, and Picchietto Cardinale, of the Italians; Gras-Specht, Garten und Gras Bunt-Specht, Kleiner Bunt-Specht, and Kleiner Baumhacker, of the Germans; Kleinste Bonte Specht of the Netherlanders; Lilla Hackspetten of Nilsson's Scandinavian Fauna; Lesser Spotted Woodpecker, Lesser Spotted Woodspite, Hickwall, and Crank-Bird, of the English; Delor Fraith Beiaf of the Welsh.

Old Male.—The whole of the forehead, region of the eyes, sides of the neck, and under parts, tarnished white; five longitudinal black lines on the breast and flanks; top of the head red; occiput, nape, upper part of the back and wings, black; on the rest of the upper parts black and white bands; a black band goes from the angle of the bill on the sides of the neck; lateral tail-feathers terminated with white and streaked with black; iris red. Length 5¾ inches.

Female.—No red; white of the plumage clouded with brown, with a greater number of spots and black stripes than in the male; the black of the upper parts is also less perfect.

Lesser Spotted Woodpecker (*Picus minor*).
Lower figure, male; upper, female. (Gould.)

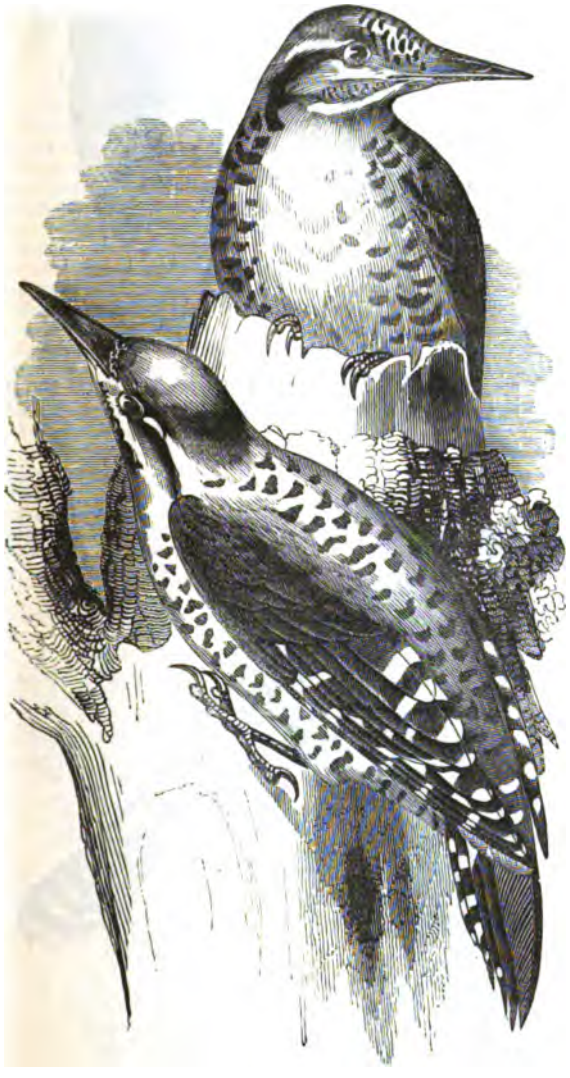
This, the least of the European Woodpeckers, but by no means the smallest of the family, is pretty generally distributed over Europe from Scandinavia, and as far east as Siberia, to Italy. It is common in England, and Sir Robert Sibbald claims it as a Scotch bird under the name of *Picus varius minor*, a designation by which it was known to Ray and the earlier writers. In Ireland it does not seem to have been noticed.

Woods, orchards, nursery gardens, and well-timbered parks, are the haunts of this pretty little bird. "In England," says Mr. Gould, "it is far more abundant than is generally supposed; we have seldom sought for it in vain wherever large trees, particularly the elm, grow in sufficient numbers to invite its abode: its security from sight is to be attributed more to its habit of frequenting the topmost branches than to its rarity. Near London it is very common, and may be seen by an attentive observer in Kensington Gardens, and in any of the parks in the neighbourhood. Like many other birds whose habits are of an arboreal character, the Lesser Spotted Woodpecker appears to perform a certain daily round, traversing a given extent of district, and returning to the same spot whence it began its route. Besides

the elm, to which it is especially partial, it not unfrequently visits orchard-trees of large growth, running over their moss-grown branches in quest of the larvæ of insects which abound in such situations. In its actions it is very lively and alert. Unlike the Large Woodpecker, which prefers the trunks of trees, it naturally frequents the smaller and more elevated branches, which it traverses with the utmost ease and celerity. Should it perceive itself noticed it becomes shy, and retires from observation by concealing itself behind the branch on which it rests; if however earnestly engaged in the extraction of its food, its attention appears to be so absorbed that it will allow itself to be closely approached without suspending its operations. When spring commences it becomes clamorous and noisy, its call being an oft-repeated note so closely resembling that of the Wryneck as to be scarcely distinguishable from it. At other times of the year it is mute, and its presence is only betrayed by the reiterated strokes which it makes against the bark of trees." ('Birds of Europe.')

The four or five eggs are deposited in a hole in a tree generally suited to the size of the bird (whereby larger intruders are excluded), and sometimes very deep. They are of a delicate flesh-colour before they are blown, being so transparent that the colour imparted by the yolk is visible; when blown they are of a shining white.

P. tridactylus (Genus, *Picoides*, Lacép.; *Tridactylia*, Stephens; *Dendrocopus*, Koch; *Apternus*, Sw.). This is the Northern Three-Toed Woodpecker of Edwards; *P. hirsutus* of Vieillot; Dreizehiger Specht and Berg und Alpen Dreizehiger Specht of the Germans; Tretaig Hackspette of Nilsson's Scandinavian Fauna; Picchio a Tre-Dita of the Italians.



Three-Toed Woodpecker (*Picus tridactylus*).
Lower figure, male. (Gould.)

Male.—Forehead variegated with black and white; top of the head golden-yellow; occiput and cheeks lustrous black; a black moustache is prolonged upon the breast; behind the eyes a narrow white stripe, and a larger one below; front of the neck and breast pure white; upper part of the back, sides of the breast, flanks, and abdomen transversely streaked with black and white; wings tarnished black, with some white spots on the quills; part of the upper part of the tarsus covered with feathers; upper mandible brown, lower whitish to the point; iris blue. Length nine inches.

The old male has the yellow of the head more vivid and more white on the lower parts, but the white is always transversely striped with black.

Female.—Top of the head lustrous or silvery-white, variegated with fine black streaks.

This bird inhabits the vast forests in the mountains of the north of Europe, Asia, and America. It is very abundant in Siberia, and common in the Swiss Alps, but rare in France and Germany, where it only passes accidentally; it is never seen in Holland. Such is M. Temminck's account, who adds, in the fourth part of his 'Manual,' that it is never or very rarely found on the summits of the Alps, and that it never passes the elevation of 4000 feet above the level of the sea. It inhabits, he adds, exclusively the forests and valleys at the foot of the Alps, and is very common in Switzerland. Mr. Gould states that it is by no means uncommon in the northern parts of the European continent, the vast forests of the mountainous parts of Norway, Sweden, Russia, and Siberia, forming its principal habitat; that it is also found among the Alps of Switzerland, is but an accidental visitor in France and Germany, and has never been taken, he believes, in the British Islands. Sir John Richardson says that this bird exists in all the forests of spruce-fir lying between Lake Superior and the Arctic Sea, and that it is the most common woodpecker north of the Great Slave Lake.

Insects and their larvæ and wild fruits form the food of this species, which lays four or five pure white eggs in the hole of a tree.

Two other European Woodpeckers (four-toed), namely, *P. canus* and *P. leuconotus*—the first a good deal resembling the Green Woodpecker, and the second not unlike the Greater Spotted Woodpecker—are unknown as inhabitants of the British Islands.

The European Woodpecker seems to have been known to the ancients. Aristotle ('Hist. Anim.,' viii. 3), after treating of insectivorous birds, says that there are other insect-eaters (*σκνιποφάγα*), as the Greater and Lesser *Pipra* (*Pipo* in Bekker's text), and that some call both these *δρυοκολάπτης*, that is, tree-pecker or piercer. These birds, he adds, resemble each other, and have the same voice, but the greater has the loudest. They both obtain their food by flying to the trees. The *Κολιός*, or *Κελεός* (Bekker, whose text is the only good one), also, which is the size of the turtle-dove, but whose colour is green entirely. This, Aristotle says, is a great excavator of trees, on which it gets its living, and its voice is very loud. This bird occurs especially in the Peloponnesus. Aristotle then mentions another insectivorous bird, which is called *κνιπολόγος* (gnat or insect catcher), and hollows trees; but this, from its small size and colour, can hardly have been any known woodpecker. In the ninth chapter of the ninth book, Aristotle states that the *Dryocolaptes* does not sit on the ground, but pecks the oaks to make the worms and insects come forth, which it afterwards catches with its tongue, which is broad and large. It runs very quickly upon the trees.

Aristotle mentions three of these *Dryocolaptes*, one smaller than a *Cottyphus* (Blackbird probably), which has red spots; a second of the same size as a *Cottyphus;* and a third not much less than a hen. It has its nest on trees, especially on the olive-tree, and feeds on emmets and worms which come out of the trees. To get at the worms he hollows out the tree so much, they say, as to cause it to fall. A tame one having adjusted an almond in a chink of wood, broke it at the third stroke and ate the kernel.

Aristotle also mentions the strong and compact bill of the *Dryocopus* in the first chapter of the third book ('De Partibus Anim.').

Pliny appears to use the term *Picus martius* as a general name for all woodpeckers. ('Nat. Hist.,' x. 33; xi. 37; xxvi. 4; xxvii. 10; xxx. 16).

P. squamatus. Top of the head and occiput scarlet; above and below the eye a yellowish-white streak; a black line extending from the base of the lower mandible along the sides of the neck; the upper surface of a bright green; quill-feathers and tail dull olive-black, barred with white; throat and breast grayish-green; abdomen and under surface of a still lighter tint, marked with black scales closely and regularly disposed; bill yellowish-white, horn-brown at the base; tarsi brown. Length 12¾ inches.

It is found in Asia, in the Himalaya Mountains.

Mr. Gould, from whom the above description is taken, observes, in his 'Century,' that there appears to be a natural group of the Woodpeckers, intermediate between the genus *Colaptes*, whose habits confine them entirely to the ground, and the typical *Picidæ*, who gain their subsistence almost wholly from the bark of trees. In this intermediate division—of which, he remarks, our own *P. viridis* and the *P. canus* of the continent may be considered as the types, and which are the only species found in Europe—the present species, as well as *P. occipitalis*, also a Himalayan bird, may be classed; all these birds being found, like the typical Woodpeckers, to frequent trees as a resort for food, while at the same time they equally subsist, like the ground-feeding species, on ants and other insects which they obtain on the surface of the ground.

Mr. Gould further states that the locality of *P. squamatus*, as well

as *P. occipitalis*, is believed to be confined solely to the higher parts of the mountains.

Picus squamatus. (Gould.)

P. Shorii. Upper part of the head and elongated crest of the head and rump rich scarlet; a white line, extending from the base of the upper mandible to the occiput, edges the scarlet of the head; a black band originates behind the eye below this white line, passes through the ear-coverts to the back of the neck, and there spreads as far as to the back; cheeks and sides of the neck white, separated from the throat and forehead by a wavy black line passing from the gape to the sides of the chest; base of the lower mandible bordered by a brownish mark; throat white; back orange passing into various tints of scarlet on the shoulders and wing-coverts, and on the rump into bright scarlet; quills, tail, and upper tail-coverts black; under surface dirty brownish-white, with black scale-like marks; bill and tarsi black. Length 12 inches.

It is also found in the Himalaya Mountains.

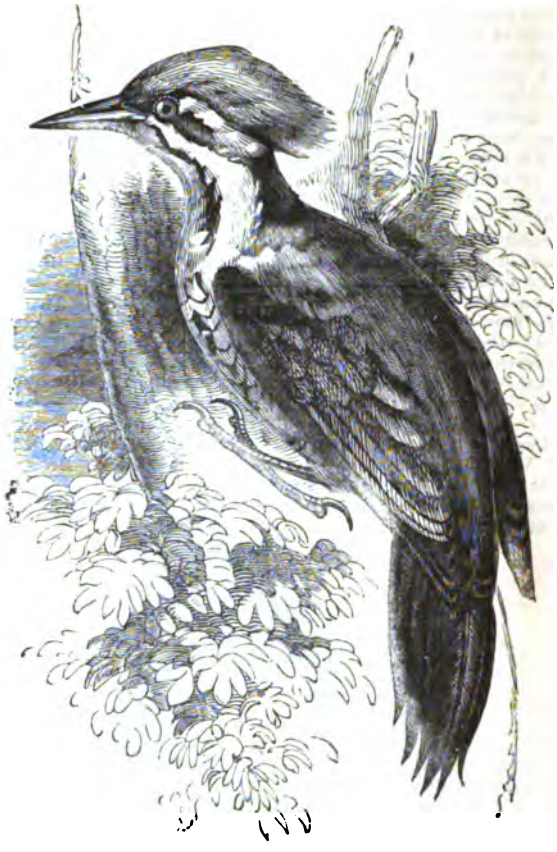
This three-toed woodpecker exhibits a close affinity with *P. tiga* (Horsf.), an inhabitant of the Indian Archipelago, as well in colouring as in the absence of the hinder toe, which in both birds is represented only by a rudimentary tubercle. Few, if any, of the tribe surpass it in brilliancy of plumage.

P. Cafer (Genus *Trachyphonus*, Ranz; *Cucupicus*, Less.; *Polysticte*, Smith). This is the Promepic of Le Vaillant; *Trachyphonus Vaillantii*, Ranz; *Micropogon sulphuratus*, Latreille.; and *Polysticte quopopa*, Smith. This form has been arranged by Mr. G. R. Gray as the last of the sub-family *Bucconinæ*.

The generic characters of *Trachyphonus*, are as follows:—Bill of the length of the head, convex above, pointed, recurved or arched longitudinally, upper mandible thicker than the lower; nostrils oval, basal, furnished with bristles; tarsi slender; third quill longest; tail rounded.

The birds of this genus are Woodpeckers which seek their food on the ground, and under the bark and in the moss which grows on trees, and indeed the old zoologists termed the species which we have selected as an example a *Picus*. It differs however considerably from the typical Woodpeckers, which has led to its separation, and the generic names applied to it by modern zoologists.

P. Cafer (*T. Cafer*), has the head, belly, and rump yellow; upper coverts of the tail orange; fore-head black; two black scanty pointed aigrettes; a large black collar variegated with white, bordered above with a small narrow white edging varied a little with brown below; back of the neck and back brown, each feather terminated with white. Tail rounded, brown, striped with grayish-white; bill black at the point. It inhabits Caffraria.



Picus Shorii. (Gould.)

This species inhabits the forests, and lives on insects and their larvæ which harbour in the moss that grows on trees and under their bark.

Picus (Trachyphonus) Cafer.

P. pileatus (Genus *Dryotomus*, Sw.). This is the Larger Red-Crested Woodpecker of Catesby; Pileated Woodpecker of Pennant and others; Pileated Woodpecker, or Log-Cock of the Anglo-Americans; Mohkeechæ Cannæshees of the Cree Indians; Thedè-Dilleh of the Chipewyans.

Male.—Top of the head, occipital crest, and maxillary stripe bright

scarlet. Line bounding the crest laterally from the eye, a band from the nostrils to the side of the nape, thence along the neck to the sides of the breast, the concealed bases of all the quill-feathers, a spot covered by the spurious wing, the chin, throat, and inner wing-coverts pure white. A bar across the orbit and to the middle of the nape, and the rest of the plumage, pitch-black, purest on the quills and tail. Some of the ventral feathers are fringed with gray, and two or three of the greater quills are tipped exteriorly with brownish-white. Bill blackish-gray above, pale horn-colour beneath. Irides golden-yellow. Legs bluish-black.

The female has a yellowish-brown forehead, with darker shafts and a blackish maxillary stripe. Length of a male killed in the winter, 57° N. lat., near the Rocky Mountains, 20 inches.

This bird is not unfrequent in well-timbered forests, from Mexico to Canada, at least to 50° N. lat. (Nuttall.)

Catesby says that these birds (besides insects which they get from rotten trees, their usual food) are destructive to maize by pecking holes through the husks that inclose the grain, and letting in the wet. Sir John Richardson states that the stillness of the primeval shades which it frequents is often invaded by the stroke of its powerful bill, which excels the woodman's axe in the loudness of its sound, and still more in the rapidity with which its blows are urged; nor does it, he adds, fall far short in the quantity of chips it produces. Like other Woodpeckers, it is, he says, extremely industrious, seemingly never a moment idle, flying from tree to tree, and plying its head like a hammer the instant that it alights.

"From the tall trees which cast their giant arms over all the uncleared river lands may often be heard his loud, echoing, and incessant cackle, as he flies restlessly from tree to tree, presaging the approach of rainy weather. These notes resemble ekerek rek rek rek, rek, rek, rek, uttered in a loud cadence, which gradually rises and falls. The marks of his industry are also abundantly visible on the decaying trees, which he probes and chisels with great dexterity, stripping off wide flakes of loosened bark, to come at the burrowing insects which chiefly compose his food. In whatever engaged, haste and wildness seem to govern all his motions; and by dodging and flying from place to place as soon as observed, he continues to escape every appearance of danger. Even in the event of a fatal wound, he still struggles with unconquerable resolution to maintain his grasp on the trunk to which he trusts for his safety, to the very instant of death. When caught by a disabling wound, he still holds his ground against a tree, and strikes with bitterness the suspicious hand which attempts to grasp him, and, resolute for his native liberty, rarely submits to live in confinement." Nuttall further states that this species is without much foundation charged at times with tasting maize, but in winter he observed the bird in South Carolina occasionally making a hearty repast on holly and similar berries.

The female lays about six snow-white eggs in the cavity of a tree. Two broods are said to be produced in a season.

P. principalis. This is the Largest White-Bill Woodpecker of Catesby; Ivory-Billed Woodpecker and Large Log-Cock of the Anglo-Americans.

Black with a gloss of green. Fore part of the head black, the rest of the crest crimson, with some white at the base. A stripe of white proceeding from a little below the eye, down each side of the neck, and along the back (where the two are about an inch apart) nearly to the rump. Tail black, tapering from the two exterior feathers, which are three inches shorter than the middle ones, the feathers concave below. Legs lead-colour. Bill an inch broad at the base, of the colour and consistence of ivory, and channelled. Tongue also white. Iris vivid yellow. Length about 20 inches; alar extent about 30 inches. (Nuttall.)

It is found in Brazil, Mexico, the Southern States, seldom seen to the north of Virginia, and but rarely in that state.

Catesby says that these birds "subsist chiefly on ants, wood-worms, and other insects, which they hew out of rotten trees, nature having so formed their bills, that in an hour or two they will raise a bushel of chips, for which the Spaniards call them 'Carpenteros.' He adds that their bills are much valued by the Canada Indians, who make coronets of them for their princes and great warriors by fixing them round a wreath, with their points outward. The Northern Indians, he tells us, having none of these birds in their cold country, purchase them of the southern people at the price of two and sometimes three buck-skins a bill.

Nuttall states that it is a constant resident in the countries where it is found, in the warmer regions, breeding in the rainy season, and that the pair are believed to be united for life.

Wilson, whose 'American Ornithology' is known to every lover of the subject and of nature, wounded one of these birds. His narrative is painful. The Woodpecker did not survive his captivity more than three days, during which he manifested an unconquerable spirit, and refused all sustenance. When he was taken he uttered cries almost like those of an infant; and no sooner was he left alone for an hour, than he so worked, that he nearly made a way through the wooden house in which he was confined. He severely wounded Wilson whilst the naturalist was sketching him, and died with unabated spirit. This unconquerable courage most probably gave the head and bill of the bird so much value in the eyes of the Indians.

Largest White-Bill Woodpecker (*Picus principalis*).

Picus Chilensis. (Coquille.)

The four or five white eggs are generally deposited in a hole in the trunk of a cypress tree at a considerable height, at which both the male and the female have laboured, to enlarge and fit it for the purposes of incubation, till it is some two or more feet in depth. About the middle of June the young are seen abroad. Besides the usual arboreal insects, this woodpecker, it is said, is fond of grapes and other berries; but Indian corn, other grain, or any orchard fruit, it does not touch, according to good authorities.

P. Chilensis. Sombre with little bars of brown and whitish except on the lower part of the back and rump, where a single colour predominates, forming a large patch of pure white; bill black; a gray hood, pencilled with very bright gray, covers the head; cheeks rusty, and throat whitish; all the upper part of the body, wings, and even the great quills, rusty brown barred with small whitish bands; shafts of the quills golden yellow, and their internal part fulvous brown, with a white border or a single spot of the same colour towards the middle; breast, abdomen, and flanks whitish, dotted with brown; colour of each feather yellowish-white, while the middle is occupied by a circle of brown deepest upon the breast. Tail-feathers stiff and wedge-shaped, brown above with a slight fulvous tint brightest below; the two external and the two internal ones are pencilled with whitish sinuous bands upon their edges. Colour of the tarsi greenish; that of the claws approaching reddish. Total length more than eleven inches. (Lesson.)

It is found in the woods of the province of Concepcion in Chili. M. Lesson killed many individuals upon the peninsula of Talcaguano.

The Chilians call this bird Carpentero, a name generally applied by the Spaniards to the Woodpeckers, both in Europe and America.

PICKERINGITE, a name given in America to the Magnesia Alum occurring near Iquique, South America.

PICRIS, a genus of Plants belonging to the natural order *Compositæ*, and the sub-order *Cichoraceæ*. It has an involucre of one row of equal scales, with unequal, linear, often spreading scales at the base; the receptacle is dotted; the fruit terete, transversely striated, constricted, or slightly beaked above; the pappus in two rows, feathery, external row subpilose.

P. hieracioides, the only British species, has rough leaves, with forked and hooked bristles, lanceolate leaves, dentate or sinuated, the upper leaves somewhat clasping; the head solitary, terminating the stem and branches; the outer involucral scales lax, oblong, bristly on the keel, glabrous on the margin. The fruit constricted just below the pappus. The flowers are a bright yellow colour. This species is found on dry banks in Great Britain.

(Babington, *Manual of British Botany.*)

PICROLITE, a Mineral which occurs massive, with a thin fibrous radiated structure. Colour leek- or yellowish-green. Fracture splintery. Hardness 3·5 to 4. Opaque, or translucent on the edges. Lustre slight, but somewhat pearly. Before the blow-pipe it colours borax green, the colour disappearing on cooling. This mineral is found at Taberg and Nordmorken in Sweden, traversing beds of magnetic iron-ore. It is stated also to have occurred at Reichenstein in Silesia. The following is its analysis by Klaproth:—

Silica	40·04
Carbonic Acid	4·70
Magnesia	38·80
Protoxide of Iron	8·28
Water	9·08
	100·90

PICROSMINE, a Mineral which occurs crystallised and also massive. Its primary form is a right rhombic prism. Fracture indistinct, uneven. Hardness 2·5 to 3. Nearly opaque. Lustre dull, vitreous. Colour greenish-white, or sometimes dark green or even blackish. Streak white and dull. Specific gravity 2·58 to 2·66. Before the blow-pipe it gives out water, but does not melt; it becomes black, and then white and opaque, and acquires a hardness = 5.

The massive varieties have a thin and fibrous structure; fracture splintery, granular to compact.

It is found in the iron-mine of Engelsburg near Presnitz in Bohemia. According to Magnus it consists of—

Silica	54·88
Magnesia	33·34
Protoxide of Iron	1·39
Protoxide of Manganese	0·42
Water	7·30
	97·33

PICTITE, synonymous with *Turnerite*. [TURNERITE.]

PICUMNUS. [PICIDÆ.]

PICUS. [PICIDÆ.]

PIG. [SUIDÆ.]

PIG-NUT. [BUNIUM.]

PIGEON. [COLUMBIDÆ.]

PIGEON PEA is the seed of the plant called by Linnæus *Cytisus Cajan*, and by De Candolle *Cajanus bicolor* and *Cajanus flavus*. It is a kind of pulse highly esteemed by all classes of the natives of India, and is by them regarded as holding the third rank among such articles of food.

PIGMENT. In certain parts of the animal organism we meet with definite and well-marked colorations, not dependent on any peculiar arrangement of fibres, &c., but on the presence of pigment-granules of various colours. These granules are usually inclosed in cells, termed pigment-cells. In all races of men we find a most remarkable development of these cells on the inner surface of the choroid coat of the eye, where they form several layers known as the Pigmentum Nigrum. They are probably always mingled with the epidermic cells, giving rise in the dark races to the deep colour of the skin; and presenting themselves in the white races in the form of freckles, the areola round the nipple, &c. The pigment-cells are usually flat and laterally compressed into the polygonal form. The granules in their interior are extremely minute, retain their dark colour under high magnifying powers, but exhibit various forms. In the choroid membrane of the human eye their form is very regular (*fig.* 1); in the adult no nucleus can be

Fig. 1.

Cells from the choroid coat of an adult.

seen, a structure which is obvious in corresponding cells from the fœtus (*fig.* 2). [EYE.] The pigment-cells have not always a simple

Fig. 2.

Similar cells from a fœtus at the third month.

rounded or polygonal form; they sometimes present remarkable stellate prolongations and other singular shapes, which we have attempted to depict in *fig.* 3, representing pigment-cells from a frog: *a*, *b*, *c*, *d*, *e*,

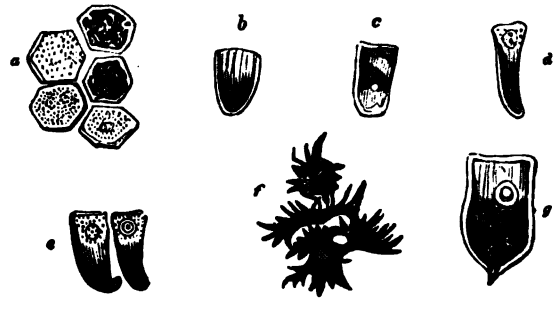


Fig. 3.

and *g* (*fig.* 3), are representations of various pigment-cells from its choroid coat, while *f* is intended to exhibit the stellar shape in which these cells occur on the skin of that animal. The nucleus is sufficiently obvious in one of the cells in *a*, *c*, *d*, *e*, and *g*.

Little is known of the chemistry of the animal pigments. Scherer has made three analyses of the black pigment from the eye of the ox, from which he concludes that it consists of—

Carbon	58·284
Hydrogen	5·918
Nitrogen	13·768
Oxygen	22·030
	100

From these analyses it appears probable that the black pigment contains a larger amount of carbon than any other constituent of the animal body. The absence of these cells in the tissues produce those varieties of animals called Albinos. [ALBINOS.]

PIGOTITE, a Mineral consisting of an organic acid called mudeous acid and ammonia.

PIKE. [ESOX.]

PIKE, SEA. [CENTROPOMUS.]

PILCHARD. [CLUPEIDÆ.]

PILE-WORT. [RANUNCULUS.]

PILE'OLUS. [NERITIDÆ.]

PILEO'PSIS, Lamarck's name for a genus of *Mollusca* (*Capulus* of De Montfort), which name has the priority, whose place in the system was long doubtful.

The form was arranged by Linnæus under his genus *Patella*, with the name of *Patella Ungarica*.

Lamarck divided his genus *Pileopsis* into two sections: the first consisting of those species whose shell was without any known support (*Pileopsis*, Lam., *Capulus*, Montf.); the second consisting of those species whose shell had a known support (*Hipponyx*, Defrance).

Hipponyx (Defrance).—Animal oval or subcircular, conical, or depressed; head globular, carried at the extremity of a sort of neck, on each side of which is a tentacle convex at its base, and terminated by a small conical point; eyes placed on the tentacular convexity; mouth with two small labial tentacles; foot very delicate, thickened towards its borders, which lessen and enlarge like those of the mantle, to which it bears a complete resemblance; branchiæ situated above the origin of the back; anus at the right side of the cervical cavity; oviduct terminated in a large tubercle at the root of the right tentacle.

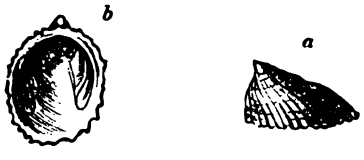
Shell conoid or depressed, the apex not spiral; aperture with irregular edges; cavity deep, with a muscular impression in the form of a horse-shoe; a rounded lamellar support, or an impression on the body serving as the resting-place of the animal, presenting also a muscular impression of a horse-shoe shape. (Rang.)

The number of living species given by M. Deshayes in his tables is six; in the last edition of Lamarck the number is three:—*H. acuta*, *H. foliacea*, and *H. suturalis* of M. Quoy; the first from the seas of Australia, and the last two from the island of Guam in the archipelago of the Marianne Islands. To these, according to his own showing, *Patella Australis* should be added; and also the *Patella mitrata* of Linnæus.

The genus is marine, and has been found attached to stones and shells at depths varying from the surface to 16 fathoms.

H. acuta has the shell solid, ovate, thickly striated longitudinally, the margin crenulated, violascescent; the vertex long, acute, and straight; white internally.

It is found in the seas of Australia.



Hipponyx acuta.

a, the upper valve in situ; *b*, inside view of the same.

Hipponyx acuta, var.

a, the animal; *b*, the shell in situ.

Pileopsis (Lam., *Capulus*, Montf.).—Animal conical, slightly spiral at the summit, furnished with a distinct head which has a proboscis terminating the mouth; in front of the anterior border of the foot is a double membrane forming numerous folds; the tentacles are nearly cylindrical, stout, obtuse, and carry the eyes on small convexities a little above their external base; foot large, but very anterior and delicate; mantle simple and without ornament; branchial cavity open anteriorly; branchiæ composed of many narrow and longitudinal laminæ, which adhere by a single transversal line to the roof; orifice of the anus towards the right side of that cavity.

Shell irregular, conical, with the apex more or less inclined or spiral, directed backwards; aperture rounded, with simple, irregular, and continuous borders; cavity deep, offering a muscular impression in form of a horse-shoe, open anteriorly. (Rang.)

This genus, like *Hipponyx*, is entirely marine, and has been taken adhering to shells and stones at depths ranging from the surface to 20 fathoms. The Pacific, the East and West Indies, and the coasts of Europe, are the localities principally known.

The number of living species recorded by M. Deshayes in his tables is seven, and of these one, *Pileopsis Ungarica*, is noted as recent and fossil (tertiary): the number given in the last edition of Lamarck is six, to which, as we have seen, *Patella Galathea* and *P. tricostata* are to be added.

P. Ungarica has the shell conico-acuminate, striated; the vertex

Pileopsis Ungarica.

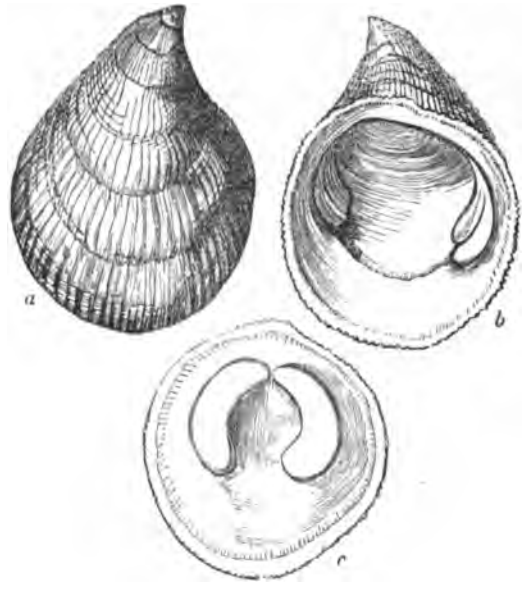
a, the shell in situ; *b*, inside view of the same.

uncinate and revolute; aperture rather wider transversely; rosy within. The epidermis is somewhat horny, thick, and velvety.

It is a native of the Mediterranean and the shores of the Atlantic. Abundant on our own coasts. One of the best figures we know is given by Mr. G. B. Sowerby in his 'Genera' (No. xxxviii.)

Fossil Hipponyces and Pileopsides.—Lamarck has described some fossil species among the *Patellæ* under the name of *P. Cornucopia* and *P. dilatata;* and Mr. G. B. Sowerby ('Genera') states that all the species known are from the Calcaire Grossier: (but see below).

The number of fossil species (tertiary) recorded by M. Deshayes in his tables is 12, and a 'new species' is noted as both living and fossil (tertiary). The localities for these fossils are Sicily, Italy (Sub-Ap.), Bordeaux, Dax, Touraine, and Turin. Paris is given as the locality for eight. In the last edition of Lamarck six is the number recorded, including *Hipponyx Cornucopia.*



Hipponyx Cornucopia.

a, external view of the upper valve; *b*, internal view of the same; *c*, inside of lower valve.

Pileopsis.—Mr. G. B. Sowerby states that he is not acquainted with many recent species, but that several are common among the fossils of the tertiary beds. M. Deshayes, in his tables, gives the number of fossil species (tertiary) as six, *P. Ungarica* being both recent and fossil (tertiary, Baden); the other localities being Sicily, Italy (Sub-Ap.), the English Crag, Bordeaux and Dax, and Touraine.

Professor Phillips records *Pileopsis* (?) *trilobus*.* *P. tubifer*, *P. striatus*, *P. neritoides*, *P. vetustus* (?), and *P. angustus*, from the Mountain-Limestone Formation of Yorkshire and other districts. ('Illustrations of the Geology of Yorkshire,' part ii.)

Mr. Murchison, in his catalogue of the shells of the Middle Ludlow Rock, records the only imperfect specimen yet obtained from the Aymestry Limestone: the aperture appears less expanded than in the *Pileopsis vetusta* of the Carboniferous Limestone. ('Silurian System.')

PILL-BEETLE. [Byrrhus.]

PILL-WORT. [Pilularia.]

PILOT-FISH. [Centronotus.]

PILULA'RIA, a genus of Plants belonging to the natural order *Marsileaceæ*. *Marsileaceæ* are creeping plants with alternate erect leaves, having a circinate vernation; the fructification consisting of globular, nearly sessile, coriaceous bodies, with three or four cells, and containing sacs including either other bodies that germinate or loose granules. [Marsiliaceæ; Sporocarpium.] According to this definition it embraces only the genera *Pilularia* and *Marsilea*. The genus *Pilularia* has solitary involucres, nearly sessile, globose, coriaceous, 4-celled; the cells containing bodies of two kinds, granules and membranes containing minute grains. Of this genus there is but one species, *P. globulifera*, which on account of the form of its fruit is called Pill-Wort or Pepper-Grass. This plant is a native of Europe, and is found in Great Britain on the extreme margin of ponds or on swampy ground covered with water during the winter and comparatively dry in the summer. It is interesting to the systematic botanist, as affording a high development in the organs of reproduction in the class of Acrogens to which it belongs. The granules contained in the cells ultimately become seeds, and have a very definite form of germination.

(Jussieu, *Mémoires de l'Académie Royale des Sciences;* Valentine, in the *Transactions of the Linnean Society*, vol. xviii.)

* Pileopsis is generally considered to be feminine.

PILUMNUS (Leach), a genus of Brachyurous *Crustacea*. This genus very much resembles the Crabs properly so called; but differs from them principally in the number of pieces in the abdomen of the male, and is removed from them still further by the mode of insertion of the external antennæ.

Pilumnus hirtellus, Leach (*Cancer hirtellus*, Linn.), is found on the coasts of England and France; generally found under stones.

(Leach, *Malac. Brit.*, t. 12; Penn., *Brit. Zool.*, vol. iv. pl. 6, lower figure.)

PIMELITE. [NICKEL.]

PIMENTA, or PIMENTO. [EUGENIA.]

PIMPERNEL. [ANAGALLIS.]

PIMPINELLA, a genus of Umbelliferous Plants inhabiting the meadows and mountains of Europe principally, is chiefly interesting on account of its comprehending among its species the Anise of the shops. This plant is an annual, with a smooth stem one to one and a half foot high; the lower leaves roundish, cordate, lobed, and both serrated and cut; those of the stems pinnated with wedge-shaped lanceolate segments, and the upper trifid, with the lobes undivided and linear. The flowers are small and white. The fruit is narrow, slender, rather hairy, with five filiform ridges to each mericarp. The latter is employed extensively as a carminative medicine, and for the purpose of flavouring liqueurs. The plant inhabits Egypt and the islands of the Grecian Archipelago, especially Scio.

PINACEÆ. [CONIFERÆ.]

PINE. [PINUS.]

PINE-APPLE. [ANANASSA; BROMELIACEÆ.]

PINGUI'CULA, a genus of Plants belonging to the natural order *Lentibulariaceæ*. It has a 2-lipped calyx, the lower lip bifid, the upper one of three segments. The corolla ringent and spurred.

P. vulgaris has a subulate spur shorter than the link of the corolla, whose segments are very unequal, oblong, obovate, rounded, separated, entire. The leaves are all radical, fleshy, and covered with minute crystalline points, pale-green; and when the plant is gathered, they curve back so as to hide the root. The flowers are purple. It is found in bogs in England.

P. grandiflora has a spur whose segments are very unequal, broadly obovate, rounded, contiguous; the middle one of the lower lip notched. This is much larger than the former species: the flowers are large, of a deep purple colour. It is found in Ireland about Kerry and Cork.

P. alpina is known by its conical spur being shorter than the unequal limb of the corolla, and curved upwards. The flower is small and yellowish. It is found in Skye and Ross.

P. Lusitanica has a cylindrical spur, obtuse, decurved, shorter than the nearly equal limb of the corolla; the capsules globose, scape downy. It is found in the western parts of this country. These species derive their common name (Butterworts) from the greasy appearance of their foliage. Like other marshy plants they have been said to produce flukes in the sheep that feed upon them. This however is attributable rather to the larvæ of the fluke, which adhere to the leaves of plants in marshy districts, and are thus taken in by the animal, than to any peculiarity in the *Pinguiculæ*. When mixed with cow's milk, the juice of this plant acts like rennet and produces a curd; but Linnæus says that when rein-deer's milk is poured on the leaves warm, and allowed to stand for a day or two, it becomes acescent, acquires consistence, neither the cream nor serum separates, and it is much esteemed by the Swedes and Norwegians.

(Burnett, *Outlines of Botany;* Babington, *Manual of British Botany.*)

PINGUITE. [IRON.]

PINITE, a Mineral which occurs in imbedded crystals. Primary form a rhomboid, but generally found in hexagonal prisms. Cleavage parallel to the lateral faces of the prism. Fracture indistinct, uneven. Hardness, scratches gypsum, is scratched by fluor-spar. Colour reddish, grayish, and grayish-red. Lustre slightly resinous. Opaque. Specific gravity 2·78 to 2·98.

Before the blow-pipe on charcoal it whitens, fuses on the edges, and yields a white glass with bubbles; with borax it fuses with difficulty into a transparent glass, coloured by iron. The Saxon variety is infusible.

It is found in Saxony, France, England, in some other parts of Europe, and in North America.

According to Gmelin, the Pinite of St.-Pardoux in France consists of—

Silica	55·964
Alumina	25·480
Potash	7·894
Soda	0·386
Peroxide of Iron	5·512
Magnesia, with Manganese	3·760
Water, with Animal Matter	1·410
	100·406

PINK. [CARNATION; CARYOPHYLLACEÆ; DIANTHUS.]

PINK, a name for the Minnow. [LEUCISCUS.]

PINK-UNDERWING. [CALLIMORPHA.]

PINNA. [MYTILIDÆ.]

PINNOTHE'RIIDÆ, a family of the Brachyurous *Crustacea* (*Catametopes*), called Pinnotherians by M. Milne-Edwards, and known by the common name of Pea-Crabs.

They are small crustaceans whose carapace is nearly circular, and whose teguments exhibit considerable softness. Their eyes are in general very small, and the disposition of their front and their antennæ varies, as also their external jaw-feet, which present remarkable anomalies. Their feet are short or of moderate length, and are in general very weak. The abdomen of the male is much narrower at its base than the corresponding part of the sternal plastron.

But it is the singular habits of these crustaceans which especially demand attention; for they ordinarily are housed between the mantle-lobes of certain *Conchifera—Mytilus, Pinna, Mactra*, &c., for example.

M. Milne-Edwards arranges in this small group the genera *Pinnotheres, Doto, Mictyris, Hymenosoma*, and *Elamena;* but he acknowledges that this tribe is not so natural as might be desired, and that hereafter perhaps the necessity for subdividing it may arise.

Pinnotheres (Latreille).—Body circular and rounded above; front not soldered to the epistome; eyes very small, orbits nearly circular; internal antennæ of the ordinary form, and the fossets which lodge them scarcely separated from each other; external antennæ short, occupying the internal angle of the orbit. Buccal frame very wide backwards, and describing a semicircle forwards. External jaw-feet placed very obliquely; their enlarged and valvular portion is formed entirely by their third joint, which is very large, whilst the second is rudimentary; the fourth joint is inserted at the summit of the preceding, and the fifth, which is tolerably developed, is articulated with the sixth by the middle of its internal border, so that it is placed nearly like the thumb of the didactylous claws. The sternal plastron is very wide, and in the male the apertures of the organs of generation occupy its last segment. The feet are moderate. The abdomen of the male is small, whilst that of the female is ordinarily very convex, and much larger than the sternal plastron. (M. Milne-Edwards.)

View of the under side of the upper part of *Pinnotheres*, eyes, jaw-feet, &c., seen from below and magnified. (Milne-Edwards.)

Mr. J. V. Thompson was the first who pointed out the interesting fact that the species, in the early stages of their existence, have a very elongated abdomen which is terminated by a fin, the carapace armed with three spiniform prolongations, very large eyes, and natatory feet; in short that it then bears the greatest resemblance to *Zoea*.

These curious animals were known to the ancients, who were not ignorant of their connection with the *Pinnæ*. The Greeks named them Πιννοτῆρας and Πιννοφύλακ. (Arist., 'Hist. Anim.' v. xv.) Oppian ('Halieut.,' ii. line 186, et seq.) treats the connection as a sort of partnership for obtaining prey. The *Pinnoteres* of Pliny ('Nat. Hist.,' ix. xxxi.), described as harbouring in the empty shells of oysters, and as migrating to others when it increased in growth, appears to have been more applicable to the *Pagurus* of the moderns; but the same author, in the 42nd chapter of the same book, "De Pinna, et Pinnotere, et aquatilium sensu," uses the terms Pinnoteres and Pinnophylax to designate the Crab which resides in the shell of the *Pinna*.

Among the moderns Hasselquist has given one of the best accounts of the habits of the genus. In a letter to Linnæus, dated "Smyrna, December 16, 1749," he says, "The *Pinna muricata*, or Great Silk Muscle, is here found in the bottom of the sea in large quantities, being a foot long. The Ὀκτωπόδια, or Cuttle-Fish with eight arms, watches the opportunity, when the muscle opens her shell, to creep in it and devour her; but a little crab, which has scarcely any shell, or has at least only a very thin one, lodges constantly in this shell-fish; she pays a good rent by saving the life of her landlady, for she keeps a constant look-out through the aperture of the shell, and on seeing the enemy approach, she begins to stir, when the Πίνα (for so the Greeks call the shell) shuts up her house, and the rapacious animal is excluded. I saw this shell-fish first at the island of Milo, and found such a little crab in all I opened: I wondered not a little what was her business there; but when I came here, I was first informed of it by the secretary of our consul, Mr. Justi, a curious and ingenious man, who has travelled much, and lived long in this place. This was afterwards confirmed by several Greeks, who daily catch and eat both these animals."

M. Milne-Edwards remarks that the distinction of the species of this genus is difficult, inasmuch as that the principal differences to be remarked in the greater part of them do not exist in both sexes, and are often of the nature of those which are modified by age.

P. Pisum, the Pea-Crab. Carapace soft; front projecting in the male, not reaching beyond the curved line formed by the anterior part of the carapace in the female. Inferior border of the hands ciliated. Length: female, 4 lines; male, 2 lines.

This species is very common in *Mytilus edulis* on the coasts of England and France. Leach, 'Malac. Brit.,' t. 14, f. 2, 3 (female); *P. varians* of the same work, t. 14, f. 10 and 11 (male); *P. Latreillii* of the same work, t. 14, f. 7 and 8 (young female.) (M. Edwards.)

M. Milne-Edwards is of opinion that *P. Cranchii*, Leach ('Malac.,' t. 14, f. 4, 5), does not differ specifically from *P. Pisum*.

P. veterum is found in *Pinnæ* on the coasts of Italy, &c.

Pinnotheres veterum.

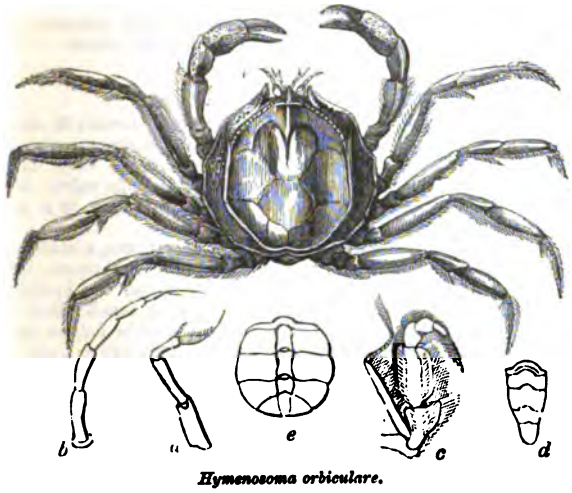
Elamena (M. Edwards) is founded on *Hymenosoma Mathæi*, figured by M. Rüppell, in his work on the 'Crustacea of the Red Sea,' and separated from that genus by M. Milne-Edwards, who thinks that it seems to establish the passage between the *Hymenosomata*, the *Oxystomes*, and the *Oxyrhynchi*.

E. Mathæi (Rüppell, 'Krabben,' pl. v., f. 1), is found in the island of Mauritius and the Red Sea.

Hymenosoma (Leach).—Carapace very much flattened above, and nearly circular; the front very narrow and inclined. Orbits very small, and nearly circular, and the eyes must be bent back downwards rather than outwards to be hidden in them.

M. Milne-Edwards remarks that hitherto this genus has been arranged in the neighbourhood of the *Inachi*, principally on account of its narrow and pointed front; but its natural position appears to him to be in the family of the *Catametopes*, for it is to this type that it approaches in all the important points of its organisation.

H. orbiculare is found at the Cape of Good Hope.



Hymenosoma orbiculare.

a, internal antenna; *b*, external antenna; *c*, right external jaw-foot; *d*, abdomen of the male; *e*, abdomen of the female.

Mycteris (Latreille).—Carapace extremely delicate, nearly circular, and very convex above. Front disposed nearly as in the *Ocypodes* [Ocypodidæ]; but the eyes, which are short and stout, have no orbitary cavity for concealment, and always remain projecting.

M. longicarpis has the carapace smooth and divided by furrows into three longitudinal portions; a small spine at the spot where the external orbitary angle is ordinarily found; anterior border of the carapace very much projecting, and furnished with hairs.

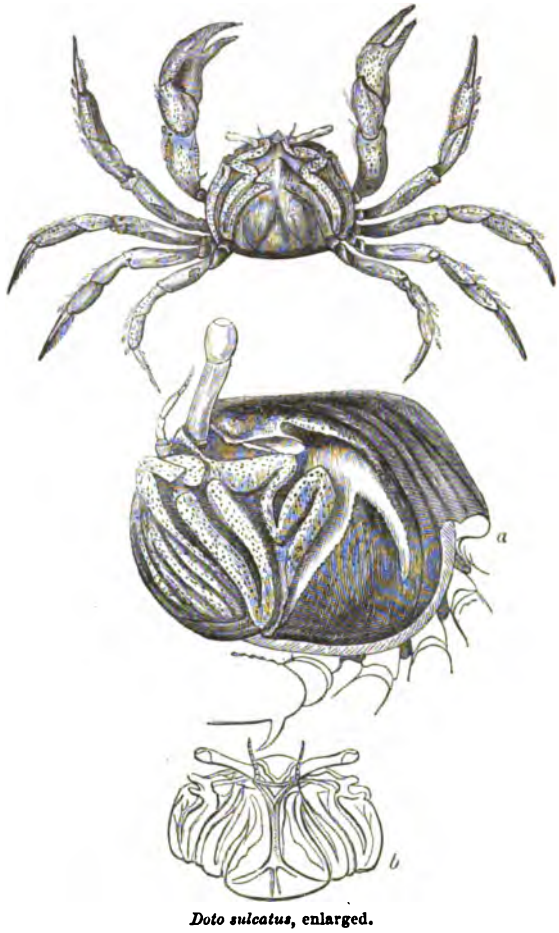
Mycteris longicarpis.

It is a native of Australia.

Doto (M. Edwards).—M. Milne-Edwards remarks that he here places, not without doubt, a small and very remarkable crustacean which Savigny has figured in the great work on Egypt, and which M. Audouin has referred to the genus *Mycteris*. It approximates to the *Ocypodes* much in the general form of the body, in that of the feet, and in the disposition of the front, the antennæ, and the eyes; but it is distinguished from all the preceding *Catametopes* by the conformation of the external jaw-feet and the form of the buccal frame.

D. sulcatus (*Cancer sulcatus*, Forsk.; *Mycteris sulcatus*, Audouin), has the carapace nearly square, and furrowed above; the front orbital border occupying nearly the whole of its width. Length about six lines.

It inhabits the Red Sea.



Doto sulcatus, enlarged.

a, profile view, still more enlarged, without the legs, to show the grooves *b*, detail of under part of carapace.

PINNULARIA, a genus of Fossil Plants.

PINTADO. [Pavonidæ.]

PINTAIL DUCK. [Ducks.]

PINUS, a genus of Gymnospermous Exogenous Plants, consisting for the most part of timber trees, inhabiting various temperate countries in the northern hemisphere. They are commonly called Pine-Trees, and are distinguished from the Firs by their leaves, always evergreen, and needle-shaped, growing in pairs, threes, fours, or fives, surrounded by a membranous sheath at their base. In reality each parcel of leaves indicates a small branch axillary to a membranous, deciduous, withering leaf. The species are generally of great beauty as objects of ornament, or of much value on account of their timber, and are in much request by the planter: on which account we give a very brief enumeration of the best known species.

Div. I. Scales of Cones truncate at apex.

a. Leaves in pairs.

* Scales of Cones spineless at apex.

1. *P. sylvestris*, the Scotch Pine. Trunk erect. Leaves 2, short, glaucous. Cones ovate, stalked, and recurved, with rugged, truncated, depressed scales. This is the most hardy and valuable of all the pines. Its timber furnishes the red deal of the carpenters, and in Scotland,

the climate of which country is particularly suited to it, the trees often acquire a great size, and highly picturesque appearance. It is however asserted that the quality of its timber is much deteriorated by being grown in warm districts. In England it is chiefly valued as a nurse to other trees, for which its hardiness and rapid growth render it well adapted. It forms an excellent screen in exposed sandy situations, where no other tree will thrive. Many varieties are known, of which an account will be found in Loudon's 'Arboretum Britannicum;' of these the Pine of Haguenau, a village on the Rhine, is said to be the most important.

2. *P. Pumilio*, the Dwarf Pine. Trunk prostrate, dwarfish. Leaves 2, short, stiff, glaucous. Cones ovate, spreading, sessile, with depressed truncated scales. A small mountain species from the midland parts of Europe. Its timber is of no importance; in fact, from its small size, it can scarcely be said to yield any. It is probably an alpine form of *P. sylvestris*.

3. *P. uncinata*, the Hooked Pine. Trunk erect. Leaves 2, short, dark green. Cones oval, recurved, sessile, with pyramidal, recurved, truncated, or mucronated scales. A fine alpine tree, from the Pyrenees, and other European mountains, on the upper zone of vegetation, above *P. sylvestris*. It is extremely valuable for its hardness and the great durability of its timber. The *P. Mughus* is apparently the same plant.

4. *P. resinosa*, the Red Pine. Trunk erect, lofty. Leaves 2, long, of a light somewhat glaucous green colour. Cones ovate-oblong, very obtuse, shorter than the leaves, pendulous, with rugged, rounded, truncated scales. A red-barked tree of large size from the northern parts of North America. The wood is fine-grained and of close texture, and is highly esteemed in Canada for strength and durability. In appearance the species bear some resemblance to *P. Laricio*.

5. *P. Halepensis*, the Aleppo Pine. Trunk slender, erect. Leaves 2, long, slender, light green. Cones ovate, stalked, solitary, very regular in form, with depressed truncated scales. A beautiful species, found wild in the western parts of Europe, from Genoa to Constantinople, and also throughout Syria. It grows fast, and is at once known by its fine light-green foliage; but its wood is not of much value, and it bears the climate of England with impatience.

6. *P. Bruttia*, the Calabrian Pine. Trunk erect. Leaves 2, slender, lax, pale green, very long. Cones sessile, in dense clusters, ovate, acute, very regular and even, with depressed truncated scales. A very handsome tree, inhabiting Calabria, and said to yield timber of excellent quality. It is very like the Aleppo Pine, but its cones are sessile and clustered, and it is much more hardy.

7. *P. Banksiana*, the Banks Pine. Trunk low, scrubby and straggling. Leaves 2, divaricating, oblique. Cones ovate, acuminate, horn-like, curved, erect, in pairs, gray, with rounded depressed truncated scales. An ugly tree, from the most southern parts of North America, where it is called the Scrub Pine and the Gray Pine. Its timber seems to be of little value, except for the construction of canoes, for which its lightness and toughness render it well adapted.

8. *P. Pyrenaica*, the Pyrenean Pine. Trunk erect. Leaves 2, long, fine, bright green, clustered at the end of the branches. Cones ovate, drooping, shorter than the leaves, with roundish truncated scales. A Spanish plant, inhabiting the Sierra de Segura, above the limits of the Aleppo Pine, on the Pyrenees, and elsewhere. Its timber is said to be of excellent quality and to have been used largely in the Spanish marine. It is reported to be a majestic species, and to be called by the Pyrenean peasants Pin Nazaron. It is the *P. Hispanica* of some collections.

9. *P. Pallasiana*, the Pallas Pine. Trunk erect, with horizontal branches when old. Leaves 2, dark green, very long, and stiff. Cones curved, horizontal, ovate-oblong, as long as the leaves, with roundish truncated scales. A fine tree from the central parts of the Crimea, with the habits of the Pinaster. Wood resinous and durable, but difficult to form into good planks on account of being unusually knotty. The resin is stated to be very pleasant to the smell.

10. *P. Pinea*, the Stone Pine. Trunk erect; when old, flat-headed. Leaves 2, long, stiff, dark-green; when the plant is very young, small and glaucous. Cones roundish, polished, with rounded truncate scales. Seeds large, oblong, with a very short wing. An inhabitant of the southern parts of Europe and the Levant, where the wood is often used in ship-building, and the seeds, which are large and like nuts, are eaten.

11. *P. Austriaca*, the Black Pine. Trunk erect, with horizontal branches when old. Leaves 2, dark-green, glossy, straight, stiff, from 3 to 5 inches long. Cones conical, horizontal, shorter than the leaves, polished, and pale-brown. It is found among the rocks and precipices of Southern Germany, and derives its name from the peculiarly dark colour of the foliage. The most sterile soil is said to suit it. The timber is reported to be valuable, but coarse; and to resist alternate dryness and moisture better than the larch.

12. *P. Laricio*, the Corsican Pine. Trunk very erect and tall. Leaves in pairs, long, deep green, distant, rather loose. Cones ovate, horizontal, shorter than the leaves, with roundish rugged truncated scales. A noble tree, from the mountains of Corsica, Greece, Turkey, and Spain. It grows faster than any other known species, and produces excellent timber, similar in quality to red deal, but more brittle and less elastic. The French use it extensively in ship-building. The tree is now becoming common in this country.

** Scales of Cones spiny at apex.

13. *P. Pinaster*, the Cluster Pine. Trunk lofty, erect. Leaves 2, long, stiff, dark green. Cones clustered, recurved, conical, shorter than the leaves, with pyramidal scales terminated by a small rigid spine. A noble species, inhabiting the most sterile sandy plains of France and Southern Europe, especially along the coast. Its timber is soft, light, coarse, and only fit for very common purposes; but it affords a large quantity of resin and tar, and is much consumed in the manufacture of lampblack. It is this species that has been so successfully employed in fixing the loose drifting sand of the barren plains of some parts of France.

14. *P. pungens*, the Prickly Pine. A large tree. Leaves 2, short, compact, pale green. Cones ovate, clustered, drooping, longer than the leaves, with hard pyramidal scales terminated by a stiff strong spine. A native of Virginia and North Carolina. The timber seems of no value. The aspect of the tree is something like that of the Scotch Pine, but it is paler. Its cones hang on the branches for many years.

15. *P. mitis*, the Yellow Pine. A fine tree. Leaves 2, long, slender, dark green. Cones ovate, pendulous, shorter than the leaves, with depressed roundish scales, armed with a small spine. Young shoots violet. A common inhabitant of the pine-forests of North America, as far north as Connecticut and Massachusetts. Its timber is of great value for domestic and naval architecture, provided the sapwood, which is very perishable, is first removed. It is regarded as a most durable timber in this country. In America it ranks next in quality to the *P. Australis*, or Southern Pine. *P. variabilis* is one of its garden names.

16. *P. inops*, the Jersey Pine. A low gnarled tree. Leaves 2, dark-green, from 2 to 3 inches long. Cones recurved, ovate-oblong, straight, longer than the leaves, with spiny spreading scales. Young shoots violet. A native of the more southern states of the American union. Its timber is of little use except for fuel. In this country it is usually a miserable-looking species, evidently unsuited to the climate. Like the Banks Pine, it is called Scrub Pine in the United States.

b. Leaves in threes.

* Scales of Cones spineless at apex.

17. *P. sinensis*, the Chinese Pine. A large tree. Leaves 3, slender, deep green, serrulated. Cones ovate, brownish, on short stalks, with flattened truncate unarmed scales. Native of China. Very little is known of it, except from Chinese drawings. It only exists in the garden of Mr. Wells, of Redleaf, near Tunbridge, where it is found to be 'tolerably hardy.'

18. *P. insignis*, the Noble Pine. Leaves 3, grass-green, a little wavy, irregularly arranged, longer than the cones. Cones ovate, bright brown, obtuse, with rounded depressed obtuse scales, the lowermost of which are longer than the others, and more or less hooked back. A beautiful species, native of California, remarkable for its bright dense grass-green foliage. Nothing is known of its native habit. It is rather too tender for the latitude of London.

19. *P. Canariensis*, the Canary Pine. Trunk stout, erect. Leaves 3, very long, rough-edged, wavy, grass-green. Cones oblong, woody, 5 or 6 inches long, with prominent large pyramidal straight-scales, terminated by a hard blunt callosity. A native of the mountains of Teneriffe and Canary, where it forms large forests, and often acquires an enormous size. The timber is said to be very resinous and durable. The species is too tender for England.

20. *P. Ocote*, or *Teocote*, the Ocote Pine. Leaves 3, wavy, rough, light-green. Cones obtuse at the base, ovate, smooth, with pyramidal-angular blunt scales. A Mexican plant, of which little is known. It is found on Monte Orizaba, and near Real del Monte, and forms a tree 100 feet high.

21. *P. patula*, the Spreading-Leaved Pine. Leaves 3, very slender, spreading. Cones ovate, oblong, polished, with small angular truncated prominent scales. Native of Mexico. A lofty tree, with leaves 8 or 9 inches long. It occurs in the northern provinces of Mexico.

** Scales of Cones spiny at the apex.

22. *P. australis*, or *P. palustris*, the Southern Pine. Trunk erect, very cylindrical, and stiff. Leaves 3, very long, grass-green, clustered at the ends of the branches. Cones ovate-oblong, 7 or 8 inches long, with depressed scales, armed in the middle with a small prickle. A native of Virginia and the neighbouring states of America to the south, where it acquires the height of from 60 to 70 feet. Its timber is of excellent quality.

23. *P. Tæda*, the Frankincense Pine. Trunk lofty, straight. Leaves 3, pale-green, stout, straight. Cones curved, oblong, the length of the leaves, with compressed woody prominent scales, armed with a sharp point. A tree said to acquire the height of 80 feet, in the barrens of Florida and Virginia, but not much known in England, where it seldom thrives.

24. *P. rigida*, the Pitch Pine. Trunk lofty, straight, much branched. Leaves 3, of variable lengths. Cones clustered, sessile, ovate, with rugged compressed pyramidal scales, terminated by a small hooked spine. Found in poor soil in most parts of the United States, and even inhabiting salt-marshes overflowed by the sea.

25. *P. serotina*, the Pond Pine. Trunk much branched. Leaves 3,

very long (5 or 6 inches). Cones roundish-ovate, in pairs, with prominent rounded scales, armed with a firm short brittle prickle. An obscure species. Found in America.

26. *P. ponderosa*, the Heavy-Wooded Pine. Trunk very rugged, and irregularly branched. Leaves 3, very long and strong. Cones small, oblong, with strong pyramidal scales terminated by a small recurved prickle. A large tree, with the habit of the Corsican Pine. Found in North-West America.

27. *P. Sabiniana*, the Sabine Pine. Trunk straight, erect; the young shoots covered by a glaucous bloom. Leaves 3, very long and lax, glaucous, and serrated. Cones very large, roundish ovate, with large pyramidal hooked scales. A noble Californian tree. The wood is white, soft, and not durable.

28. *P. Coulteri*, the Coulter Pine. Trunk straight, erect; the young shoots covered with a glaucous bloom. Leaves 3, very long and stiff, glaucous, and serrated. Cones very large, oblong, with long wedge-shaped rigid woody horned scales. A fine tree, from California.

29. *P. longifolia*, the Long-Leaved Pine. Trunk erect, with a coarse rugged bark, and whorled branches. Leaves very long, drooping, slender, bright-green, channelled, and serrated. Cones shorter than the leaves, oblong-ovate, woody, and rugged, with pyramidal obtuse mucronate corky recurved scales. Seeds large, eatable. An Indian species, inhabiting the valley and lower hills of Nepaul.

30. *P. Gerardiana*, the Neoza Pine. Trunk lofty, with a conical head. Leaves 3, short, stiff, glaucous, obsoletely serrated, with deciduous sheaths. Cones very like those of *P. longifolia*. Seeds large, eatable. A native of the coldest forests of the Himalayas.

c. Leaves in fives.

* Scales of Cones spineless at apex.

31. *P. ovocarpa*, the Egg-Fruited Pine. Leaves 5, slender, from 8 to 11 inches long. Cones roundish, ovate, polished, hard, with truncated scales. Found in the pine-region of Mexico.

32. *P. leiophylla*, the Smooth-Leaved Pine. Leaves 5, very slender, 3 or 4 inches long, rough-edged, light green. Cones ovate, 2 inches long, on a short stalk, with truncate depressed scales, a little hollowed. An inhabitant of the cold regions of Mexico.

33. *P. Montezumæ*, the Montezuma Pine. Leaves 5, rather rigid, rough-edged, about 6 inches long. Cones ovate, oblong, bright-brown, about as long as the leaves, with elevated rugged truncated scales. A native of the mountains of Mexico.

34. *P. filifolia*, the Thread-Leaved Pine. Leaves 5, from 12 to 15 inches long, acutely triangular. Cones sessile, ovate-acuminate, woody, hard, curved, 9 inches long, 3 inches in diameter at the base, with lozenge-shaped pyramidal depressed scales, and a hard woody compressed callous mucro in the middle. A noble pine, found in Guatemala by Mr. Hartweg.

35. *P. Acapulcensis*, the Acapulco Pine. Leaves 5, thin, short, very glaucous, as well as the shoots. Cones pendulous, ovate, acute, whorled, with pyramidal erect tapering scales, often contracted in the middle. Found in Mexico.

36. *P. Pseudostrobus*, the False Weymouth Pine. Leaves 5, very fine, and glaucous. Cones ovate, whorled, horizontal, about 4 inches long, by an inch and a half in breadth over the middle, with pyramidal erect scales. A Mexican pine.

37. *P. Russelliana*, the Bedford Pine. Leaves 5, very long. Cones tapering, horizontal, a little drooping, nearly straight, from 7 to 8 inches long, about 2 inches wide near the base, and almost acute at the upper end, with pyramidal straight obtuse scales. A native of Mexico near Real del Monte.

38. *P. Devoniana*, the Devonshire Pine. Leaves 5, very long. Cones pendulous, solitary, horn-shaped, from 9 to 10 inches long, about 3 inches in diameter near the base, and tapering to 1½ inches, with rounded obtuse polished scales. It is called in Mexico *Pino blanco* or *P. real*, forming a high tree 60 or 80 feet high, between Real del Monte and Regla.

39. *P. Hartwegii*, the Hartweg Pine. Leaves 4, very slender, about 6 inches long. Cones pendulous, oblong, obtuse, clustered, about 4 inches long, with depressed truncated scales, having a projecting callosity in the middle. It is a Mexican tree, 40 or 50 feet high. The cones are of a clear grayish-brown, and of nearly the same diameter throughout.

** Scales of Cones spiny at apex.

40. *P. occidentalis*, the West Indian Pine. Leaves 5, pale green, slender, much longer than the cones. Cones ovate-oblong, obtuse, stalked, with rounded angular prominent scales, tipped by a sharp prickle. It is a native of St. Domingo.

41. *P. macrophylla*, the Long-Leaved Pine. Leaves 5, from 14 to 15 inches long. Cones straight, horizontal, ovate, tapering, solitary; 6 or 7 inches long, and about 3 inches broad at the base, with the ends of the scales strongly hooked backwards. It is a small tree from the north of Mexico.

Div. II. Scales of Cones flat, and compressed at the apex.

42. *P. Cembroides*, or *P. Llaveana*, the Mexican Cembra. Leaves 3, short, tufted, glaucous, and twisted. Cones small, roundish-ovate, hard, with elevated roundish obtuse scales. Seeds large, eatable. It is a small Mexican tree, occurring in large forests, and producing seeds similar to those of the Stone and Neoza Pines.

43. *P. Cembra*, the Cembra Pine. Tree erect, conical. Leaves 5, with no sheath, short, stiff, glaucous-green. Cones ascending, oblong, about the length of the leaves, with thin callous-pointed scales. Seeds large, without wings. It is a tree of considerable size, inhabiting the sides of mountains in Siberia, Tartary, Switzerland, and Italy.

44. *P. Strobus*, the Weymouth Pine. Trunk erect, very long. Leaves 5, slender, bright green, without sheaths. Cones narrow, long, pendulous, from 5 to 6 inches long, with thin ovate callous-pointed scales. It is a native of Canada.

45. *P. excelsa*, the Lofty Pine. Trunk erect, very lofty. Leaves 5, bright green, distinctly glaucous on one side, with no sheath; leaves narrow, long, pendulous, stalked, from 6 to 7 inches long, with thin lax ovate callous-pointed scales. It is a fine Himalayan tree, bearing the climate of England without protection.

46. *P. Lambertiana*, the Lambert Pine. Trunk erect, very lofty. Leaves 5, rather stiff, bright green, roughish, with no sheaths. Cones very large, pendulous, from 14 to 18 inches long, with broad rounded scales. Seeds large, eatable. It is an enormous tree, found by Douglas in New Albion.

47. *P. Ayacahuite*, the Ayacahuite Pine. Leaves 5, with deciduous sheaths, slender, very glaucous on one side, sharp-pointed, from 2 to 4 inches long. Cones drooping, a foot or more long, very slender, with distant oblong-lanceolate obtuse spreading scales. It is a gigantic tree, resembling the Weymouth Pine in habit; found by Ehrenberg near Omitlan in Mexico, and by Hartweg in Guatemala.

The following species of Pine are mentioned in books:—*P. Californiana* or *P. Montereyensis*, *P. Timoriensis*, *P. muricata*, *P. tuberculata*, *P. radiata*, *P. contorta*, *P. squamosa*, and *P. turbinata*.

(Loudon, *Arboretum et Fruticetum Britannicum*, vol. iv.; Lambert, *Monograph of the genus Pinus*.)

PIPA. [AMPHIBIA.]

PIPE-CLAY. [CLAY.]

PIPE-FISH. [SYNGNATHIDÆ.]

PIPE-MOUTH, a Fish, the species of *Fistularia*. [FISTULARIA.]

PIPER, a genus of Plants belonging to the natural order *Piperaceæ*. It has stamens varying in number from 1 to 10; stigma 3-lobed; fruit baccate.

P. Cubeba, Linn., is generally regarded as the source of the officinal Cubebs; but, according to Blume, *P. canicum*, Rumph., which is the *P. Cubeba* of Roxburgh, yields the greater portion of the cubebs of commerce. The fruits of both are stalked, but that of the former is larger and has more pungency than the latter. Both are common in Java, where, as in other parts of India, they are used as a grateful condiment, as common pepper is in Europe. They are also employed medicinally in the same complaints as give them repute in Europe.

The berry is small, about the size of black pepper-corns (but with a little foot-stalk, from one-third to half an inch long, hence called sometimes *P. caudatum* or *P. pedicellosum*), more or less round, of a blackish-gray or grayish-brown colour, with a thin vascular reticulated husk, which incloses a hard round oily seed. The husk has a pleasant taste; the seed a bitterish, acrid, peppery, aromatic, and camphor-like flavour.

Those which come from the islands of the Indian Archipelago are the best. A sort from the Mauritius, small, or about the size of a millet-seed, are from some unknown species. The Guinea or African cubebs is the produce of *P. Afzelii*.

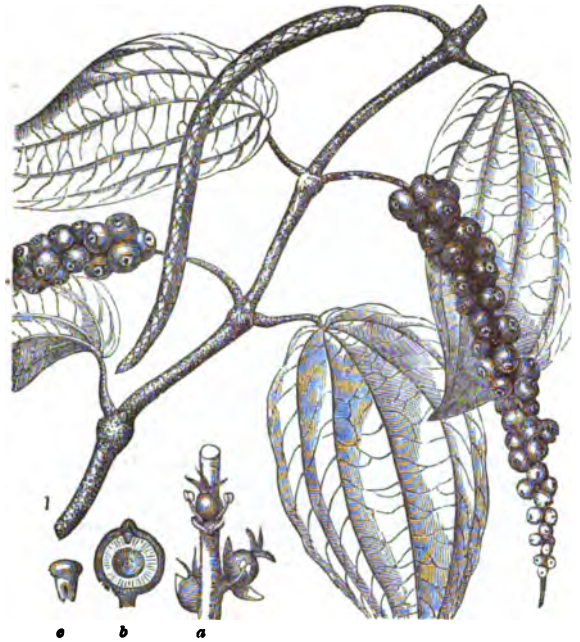
Indian cubebs are frequently adulterated with black pepper, pimento berries, or the fruits of the *Rhamnus catharticus*. Genuine cubebs consist of waxy matter, two kinds of volatile oil, a peculiar resin (cubebin), balsamic resin, &c.

The volatile oil by rest deposits a camphor, which crystallizes in four-sided plates. The resin is analogous to that of copaiva, and has, like it, a peculiar influence over mucous membranes, especially those of the urino-genital organs.

P. longum, Long Pepper, a native of the East Indies, the female spike of which having attached to it the dried half-ripe berries (resembling the catkin, of the birch), is used in medicine. It has nearly the same chemical composition and properties as black pepper, though feebler. It is said to contain piperin. The root is employed by the Hindoos, but it is still weaker than the fruit.

P. nigrum, Linn., Black Pepper, a climbing plant of the East Indies, and very extensively cultivated there, the plantations stretching from 96° to 115° E. long., 5° S. lat. to 12° N. lat., which limits comprise Sumatra, Borneo, the Malay Peninsula, and all countries to the east of the Gulf of Siam. The best pepper comes from Malabar, the least esteemed from Java and Sumatra. The plant is allowed to grow, trained to the stem of the *Areca Catechu*, and other trees, especially the Jack (*Artocarpus*) and *Hyperanthera Moringa* (or Horse-Radish-Tree), four years before the fruit can be collected. The berries are gathered when yet green, before they are perfectly ripe, and quickly dried on mats, by which they turn black. When plucked too young, they speedily fall into a state of powder. These are separated from the others by sieves and winnowing. In this condition it is termed black pepper. White pepper is the same fruit freed from the outer rind: for this purpose, the ripe berries are allowed to macerate in water, and the husk is removed. These are smaller, smooth, of a

grayish-white colour, varying to yellow, with a less powerful odour and taste than the black.



c *b* *a*

1, *Piper nigrum*. *a*, portion of the spike of *Piper aromaticum*; *b*, a section of its fruit; *c*, its embryo.

P. Betle, Linn., and *P. Siriboa*, Linn. The leaves of these two species are extensively used by the natives of the East Indies, and lately of the West, to chew along with the nut of the *Areca Catechu* and quicklime, as a restorative of the powers of the stomach and promoter of digestion. It is capable however of producing, like some other species of *Piper*, intoxicating effects, and should be used in moderation.

(Curtis, *Botanical Magazine*, t. 3132.)

PIPER, a Fish. [TRIGLA.]

PIPERA'CEÆ, a small natural order of incomplete Exogenous Plants, composed of climbing or creeping plants with alternate or opposite exstipulate leaves, jointed stems, and spiked naked flowers consisting of an ovary containing a single erect ovule, and of from two to an indefinite number of stamens. The fruit, when ripe, is more or less fleshy, indehiscent, and contains a single seed filled with albumen, on the outside of which, inclosed in a vitellus, is a minute embryo. Jussieu originally regarded these plants as members of the Urticaceous order; but afterwards separated them, in which he has been followed by all botanists. There is however some difference of opinion as to their class, some regarding them as Exogens, and others as Endogens. The general properties of the order are aromatic, as in the peppers of the shops. [PIPER.]

PIPILLO. [TANAGRINÆ.]

PIPING CROW. [BARITA.]

PIPIT. [ANTHUS.]

PIPPUL-TREE. [FICUS.]

PIPRA. [PIPRINÆ.]

PI'PRIDÆ, the name given to a family of *Dentirostres*, by Mr. Vigors.

M. Lesson, who adopts Mr. Vigors's family, makes the *Pipridæ* consist of the genera *Rupicola* and *Calyptomena* [RUPICOLINÆ], *Pipra*, *Pardalotus*, and *Pachycephala*.

Mr. Swainson does not admit the family *Pipridæ*, but he makes the *Piprinæ* a sub-family of the *Ampelidæ*. [PIPRINÆ.]

PIPRI'NÆ, Mr. Swainson's name for the Manakins, which he makes a sub-family of the family *Ampelidæ*, Fruit-Eaters, or Chatterers, and thus characterises:—Size small. Feet lengthened, slender, weak. Bill very short: the upper mandible much curved.

Mr. Swainson is of opinion that the *Piprinæ*, called Manakins from their diminutive size, which is seldom larger than that of a tom-tit, constitute the sub-typical group of this family.

Phœnicircus, *Pipra* (with its sub-genus *Metopia*), *Calyptura*, and *Pardalotus*, are the genera arranged by Mr. Swainson under this sub-family.

Phœnicircus (Sw.).—Size and habit of *Ampelis*. Bill small, rather weak. Wings very short, convex, rounded: the three first quills narrow, and of equal length; the fourth much shorter, and ending in a point. Tail broad, even. Feet short, strong; toes syndactyle; tarsi feathered, on their inner side only, as far as the toes; claws strong, curved. (Sw.)

P. carnifex (*Ampelis carnifex*, Linn.) is fire-red, with a bright red cap; back red-brown; breast blood-red; tail-feathers purple, terminated by ruddy-black. Female reddish; abdomen ochraceous; front reddish.

The Caraibs designate this magnificent bird by the names Arara and Apira. It is a native of Brazil, Guyana, and Surinam.

Phœnicircus carnifex.

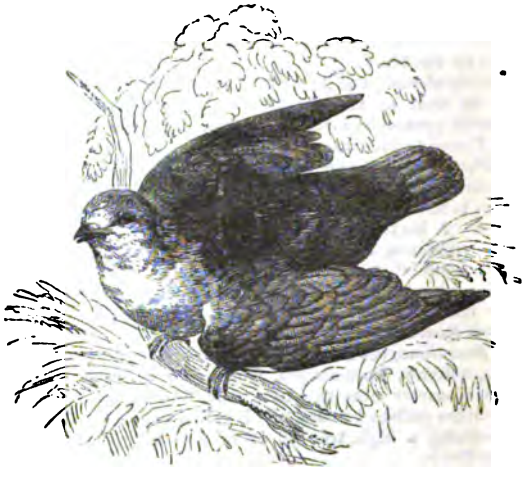
Pipra (Linn.).—Size very small. Bill weak; the upper mandible bent over the lower, which is flattened and nearly straight; notch small. Wings more or less rounded. Tail short, even. Toes syndactyle.

P. strigilata. Male the size of a wren; a patch or cap of fire-colour covers the head; all the upper part of the body uniform grass-green; all the lower parts yellow striated with brown; bill brownish; feet yellowish.

Female.—Not differing from the male, except in the absence of the red cap on the head.

It is found in Brazil.

P. aureola. Red; back, wings, and tail, black; throat yellow. It is found in Guyana.



Pipra aureola.

Metopia (Sw.).—Front with an elevated compressed crest. Wings lengthened, very broad. Tail broad, lengthened, rounded. (Sw.)

M. galeata (*Pipra galeata*, Licht.). Black. Frontal crest, directed forwards over the culmen of the bill, rich crimson, which colour is also continued over the head and back of the neck; feet and legs reddish-brown. It is a native of Brazil.

Calyptura (Sw.).—Bill short, strong, robust, shrike-like; the sides somewhat gibbous; the notch deep and tooth-like. Under mandible strong. Wings short, rounded. Tail remarkably small, almost concealed. Feet lengthened, slender, toes syndactyle. (Sw.)

C. cristata. Crown red; upper parts brownish or olivaceous green; rump yellow; throat and breast yellowish; abdomen brighter yellow; feet and legs black. It is a native of Brazil.

Pardalotus (Vieill.).—Bill as in *Calyptura*. Wings long, pointed; the first three quills of equal length. Tail short, even. Feet strong; lateral toes free and equal. (Sw.)

P. punctatus. Male gray above, undulated with yellow; head and wings black, dotted with white; a white line above the eye; rump

Metopia galeata.

Calyptura cristata.

Pardalotus punctatus.

fire-red; abdomen whitish; throat yellow. The female has the head dotted with yellow points.

It is a native of Australia.

Mr. Caley states that this species is called Diamond Bird by the settlers, from the spots on its body. He adds that it is reckoned a valuable bird on account of its skin, that it is not very plentifully met with, and that it inhabits both forest-land and brushes, at least he had seen it in both. ('Description of the Australian Birds in the Collection of the Linnean Society,' Vigors and Horsfield, in 'Linn. Trans.,' vol. xv.)

Mr. G. R. Gray makes the *Piprinæ* the second sub-family of the *Ampelidæ*, *Pachycephalinæ* being the first; and he arranges under it the following genera:—1. *Phœnicircus*, Sw. (*Pipra*, Wagl., *Ampelis*, Linn., *Querula*, Cuv.). 2. *Metopia*, Sw. (*Pipra*, Licht.). 3. *Piprcola*, Sw. 4. *Pipra*, Linn. (*Manacus*, Briss.). 5. *Pipracidea*, Sw. 6. *Iodopleura*, Sw. (*Pardalotus*, Less.). 7. *Calyptura*, Sw. (*Pardalotus*, Vieill., *Regulus*, Licht.).

PIRE'NA. [MELANIA; MELANOPSIS.]

PIRIME'LA (Leach), a genus of Brachyurous *Crustacea*. It is placed by M. Milne-Edwards among the Canceriens Arqués, or those crabs which have no clypeiform prolongation on the sides of the carapace, which is much wider than it is long, arched in front, and strongly truncated on each side posteriorly.

Carapace regularly arched on its anterior moiety, and strongly truncated on each side of its posterior moiety; much wider than it is long; convex, and strongly bossed. The front narrow, and armed with three pointed teeth. The latero-anterior borders are directed very obliquely backwards and outwards, and are armed with four compressed and triangular teeth. The orbits present two teeth and two fissures above, a sharp tooth at the external angle, and a fourth at the internal and inferior angle.

P. denticulata is found on the coasts of Europe, England, and France.

Pirimela denticulata.

PISA. [MAIDÆ.]

PISCI'COLA, a name for the *Hirudo Piscium*. [ANNELIDA.]

PISCICULUS, a generic name for the Sticklebacks. [GASTEROSTEUS.]

PISCI'DIA (from 'piscis,' a fish, and 'cædo,' to kill or destroy), a genus of Plants belonging to the natural order *Leguminosæ*. It has a campanulate 5-cleft calyx, an obtuse keel, and a papilionaceous corolla. The stamens are monadelphous, with the tenth one free at the base. The style is filiform and smooth, the legume pedicellate linear, furnished with four membranous wings, the seeds separated by a spongy substance. The species are West Indian trees, with broad unequally pinnate leaves and terminal panicles of white and red flowers mixed.

P. erythrina, Dogwood, is a tree about twenty feet high. The leaflets are in pairs, from 3 to 4 together; they are oblong or obovate, rounded at the base, downy on both sides when young, but smooth when old. The racemes are compound, axillary, staminal. The flowers whitish tinged with purple. This plant possesses the peculiar property of intoxicating fish; the bark of the root is the part used. Dr. Hamilton, in a paper read before the Medico-Botanical Society of London, gives a lengthened account of this process and of the properties and uses of this plant. He says that a preparation of the root is infused into the water containing the fish, which soon rise to the top. They float perfectly insensible along, and are easily taken by the hand; they recover on being thrown into pure sea-water, and neither their flavour nor wholesomeness is in any degree impaired. The same gentleman made a series of experiments on himself as to the effect of a tincture of this plant. Labouring under an attack of severe toothache, he took a powerful dose of the tincture, which was succeeded by a profound sleep and entire relief from pain on awaking. As a topical application to carious teeth he found it equally successful, and came to the conclusion that the tincture of the Dogwood is more powerful than that of opium. The root-juice is used to poison the arrows with which birds are shot in the Antilles. It is said to be an effectual remedy for mange in dogs: it is also reputed to possess tanning qualities. It is one of the best timber-trees in Jamaica; the wood is coarse, heavy, resinous, and almost imperishable, lasting equally well in or out of water; hence it makes excellent piles for docks and wharfs.

P. Carthaginensis is a native of Jamaica, Guadaloupe, and Carthagena, on the mountains. It closely resembles the former species, and is scarcely distinguishable from it.

(Don, *Dichlamydeous Plants;* Lindley, *Flora Medica;* Burnett, *Outlines of Botany.*)

PISCIS. [FISH.]

PISI'DIA. [PORCELLANIDÆ.]

PISI'DIUM. [CYCLADIDÆ.]

PI'SODUS, a genus of Fossil Fishes.

PISOLITE, or *Pea-Stone*, a variety of carbonate of lime, which occurs in globules from one-eighth to half an inch in diameter, imbedded in a calcareous cement; they usually consist of concentric lamellæ, in the midst of which is generally a grain of sand.

PISSODES. [CURCULIO.]

PISSOPHANE, a Mineral occurring amorphous. Colour pistachio, asparagus, or olive green. Fracture conchoidal. Hardness 1·5. Very fragile. Lustre vitreous. Transparent. Specific gravity 1·93 to 1·98. It is found at Garnsdorf, near Saalfeld. Its analysis, by Erdmann, gives:—

Sulphuric Acid	12·593
Alumina	35·228
Peroxide of Iron	9·769
Water	41·695
	99·285

PISTACIA, a genus of Plants belonging to the natural order *Anacardiaceæ*. It has dicœcious, apetalous flowers. The male flowers with the raceme amentaceous, with 1-flowered bracts; calyx 5-cleft; stamens 5; anthers subsessile, 4-cornered. Female flowers with the raceme more lax; calyx 3-4-cleft; ovary 1-3-celled; stigmas 3, rather thick. Drupe dry, ovate, with a somewhat bony nut, usually 1-seeded and 1-celled. Seeds solitary, each without albumen.

P. vera, a small tree, or large bush, from 15 to 20 feet high; its leaves are alternate, unequally pinnated, without stipules, and consist of from 3 to 5 oval blunt leathery smooth leaflets. The flowers are small, and arranged in short branched racemes from the old wood; some are male and others female; the latter are succeeded by dry drupes about the size of an olive, of a reddish colour, with a very thin rind, a brittle 2-valved shell, and contain a single almond-like seed with a green embryo. The tree is originally from Asia Minor, but is now naturalised all over the South of Europe, where the fruit is in request for confectionary and for the dessert, under the name of Pistachio Nuts.

Pistacia vera.

1, a male flower; 2, a female; 3, a ripe fruit; 4, a seed cut transversely.

P. Terebinthus is a native of Syria and the Greek Archipelago, a smaller plant than the last, but much like it.

P. Lentiscus is a bush found on the coasts of the Mediterranean. The leaves are evergreen, equally pinnate; leaflets 8 to 12, usually alternate, with the exception of the two upper, which are opposite, oval, lanceolate, obtuse, often mucronate, entire, and perfectly smooth. Flowers very small, in axillary panicles, similar to those of the other species; fruits very small, pea-shaped, reddish when ripe. The sweet fragrant stimulant resin called *Mastich* is obtained from the trunk by incisions made in the month of August. It is used to strengthen and preserve the teeth and in diarrhœa. [MASTICH, in ARTS AND SC. DIV.]

PISTIACEÆ, *Lemnads*, or Duck Weeds, a natural order of Endogenous Plants. The species are floating or land plants with very cellular, lenticular, or lobed fronds or leaves, some of them wholly destitute of spiral vessels, except perhaps in the pistil. The flowers appearing from the margin of the fronds 2 or 3, naked, inclosed in a spathe, but without a spadix. In the male flowers the stamens are definite, often monadelphous: in the female flowers the ovary is 1-celled, with one or more erect ovules; style short, stigma simple, ovules anatropal, hemianatropal, or atropal. Fruit membranous or capsular, not opening, one or more seeded; seeds with a fungous testa and a thickened indurated foramen; embryo either in the axis of fleshy albumen and having a lateral cleft for the emission of the plumule, or at the apex of the nucleus, covered in by a hardened endostome.

The common Duck-Weed *Lemna* may be regarded as the most simple of all Phænogamous Plants. It inhabits the ditches of the cooler parts of the world. [LEMNA.] *Pistia* is found in the tropics; *Ambrosinia* in the basin of the Mediterranean.

P. stratiotes grows in water-tanks in Jamaica, where, according to Brown, it is acrid, and in hot dry weather impregnates the water with its particles so as to become injurious. There are 6 genera and 20 species in this order.

(Lindley, *Vegetable Kingdom.*)

PISTIL, the name applied to the changed leaves called Carpels, which are found in the centre of the flower. This part ultimately becomes the Fruit. [FRUIT.] The term pistil is applied to these organs, whether there is but one or many of them, or whether they are united or separate. The carpel consists of three parts: the Ovary or germen, generally of a spherical form, and hollow, containing the ovules; the Style, an elongated organ, formed of a continuation of the tissue of the ovary, possessing a canal in communication with the interior of the ovary; and the Stigma, which is the point or summit of the style. The carpels, like all other parts of the flower, are modifications of the leaf, and examples of their reversion to their normal form are not unfrequent. This is well seen in the double cherry, in which the pistil often appears as a little leaf in the centre of the flower. The blade of the leaf corresponds to the ovary of the carpel; the midrib, which is elongated, to the style; and the stigma is nothing more than a secreting surface at the point of the style, communicating with the interior of the ovarial leaf. The carpel presents two sutures, called dorsal and ventral. The first of these corresponds with the midrib of the leaf, and the latter with the folded margins. The ventral suture is always opposite the axis of the plant, and is the point from which the Placenta is developed, to which the young ovules are attached.

When there is only one carpel in the flower, it is called a simple pistil; but when there are several carpels, they are called a compound pistil. The carpels of a compound pistil may be either united or separate. When they are united, they are called by Lindley Syncarpous. This union may occur between the ovaries only, leaving the styles distinct, as in *Nigella damascena;* or the ovaries, styles, stigmas, and all may be united, forming one body, as in the tulip. When the carpels are all separate, as is seen in *Caltha*, *Ranunculus*, &c., the pistil is said to be apocarpous.

The Pistil is either superior or inferior. When it is placed on the receptacle on the same plane or above the other organs of the flower it is called superior. It frequently however contracts a union with the parts of the calyx, or it sinks into the receptacle, and the calyx and corolla are placed above it; it is then called inferior.

The structure of the pistil differs according to the modes of its origin. Like every newly forming part of a plant, it consists originally of uniform delicate parenchyma, in which an epithelium on both the outer and inner surfaces is distinguishable. Gradually, but sometimes not till a late period, or in certain cases not at all, the vascular bundles are organised from the parenchyma; in the single carpel there is usually one main bundle, corresponding with the central rib of the leaf, and two others at the edges of the leaf; in many-membered 1-celled germens, the latter are frequently wanting. In rare cases the vascular bundles are ramified in the same way as in the leaf, which indeed is the natural consequence of their morphological import, since germen and style correspond to the sheath and petioles which are supplied with only a few vascular bundles. The stamen on the other hand corresponds to the lamina, and is so imperfectly developed that in most instances it contains no vascular bundles. In a few cases, interesting modifications of cellular tissue are presented in the interior of the germen; yet oil-passages or vittæ [UMBELLIFERÆ], milk-vessels, and cells containing crystals, &c., occur here and there. The external epithelium of the outer surface is commonly soon changed into epidermis, which often exhibits stomates, and under this the parenchyma is somewhat lax and almost spongy. The surface of the germen exhibits all the various appendages of young epidermis, hairs, prickles, glands, &c. The formation of the epithelium of the inner surface is more important; it is sometimes developed with the next subsequent layers into a true epidermis, but only in the cavity of the germen, as in *Passiflora* and some *Cruciferæ*. On the stigma it is converted, either partially or entirely, into papillæ, as it also is sometimes in the canal of the style, if this is distinctly hollow; and in the cavity of the germen along the placentæ, as far as the ovules, where the papillæ frequently become long hairs. All these papillæ commonly secrete at the time of the perfecting of the pistil an adhesive substance, containing gum or sugar, the stigmatic fluid. A similar substance is frequently secreted in the intercellular spaces of the cellular layers lying immediately beneath the epithelium of the stigma and the styles, and often so copiously that the cells are loosened from their union with one another, and lie loosely imbedded in this mucilaginous semi-fluid matter. The process may be easily followed in the *Orchidaceæ* and the *Onagraceæ*.

The Style is not at all essential to the existence of the carpel, and is frequently absent. When present, it is composed of just the same tissues as the ovary, which in most cases consist of vascular surrounded by cellular tissue. The style varies in form and size; sometimes it is flat, as in the *Iris* and *Canna*, but is mostly cylindrical and filiform. It generally proceeds from the apex of the ovary, but in some cases, from an alteration in the position of the ovary, it proceeds from other parts besides the apparent apex, as from the side in *Alchemilla*, and from the base in *Lamiaceæ* and *Boraginaceæ*. The length of the

style varies very much; in some plants, as in *Colchicum*, it is 7 or 8 inches long, whilst in the *Nymphæaceæ* and *Papaveraceæ* it can hardly be said to exist at all. The canal of the style was first discovered by Malpighi. It is a continuation of the cavity of the ovary, and terminates in the surface of the stigma. This canal varies in extent in different places, in some being very narrow, and in others very wide. It is lined with a peculiar kind of cellular tissue, having a papillary character, and is covered with a viscous secretion. It is called by Brongniart 'tissu conducteur,' or conducting tissue, on account of its supposed office in conducting the pollen tubes from the stigma to the ovule.

The style is often covered with hairs, which, on account of their supposed office of clearing the pollen from the cells of the anthers, have been called collectors. Sometimes these hairs are united together into a kind of cup around the stigma, as in *Goodeniaceæ*, when they form what is called an Indusium.

The Stigma is composed of the same kind of tissue as the interior of the canal of the style, but has a more spongy appearance. Its papillary character also is more evident, and the little swellings on its surface are often called papillæ. These papillæ become less evident as the canal of the style approaches the ovary. The stigma assumes a variety of forms, the distinction of which is often of importance in systematic botany. These forms depend principally upon the tissue of which its surface is composed. Sometimes the papillæ are developed into little hairs, as is seen in the stigma of *Urtica urens*. In other cases it is perfectly smooth, as in *Nymphæaceæ*. In rhubarb it is composed of three flat orbicular discs. In grasses it is in the form of a tufted hairy body like a little brush. In *Mimulus* it has two lips which have the power of contracting, and in *Clarkia* it consists of four broad lobes. In *Orchidaceæ* it has a structure in accordance with the anomalous character of all the parts of the flower in these plants; it consists of on oval humid space which occupies the middle of the central column, and is covered with a thick viscous secretion. In some cases however the stigma is not distinguishable from the style, as in *Asclepias* and *Tupistra*.

The position of the stigma is sometimes anomalous. As it forms the apex or point of the carpellary leaf, it ought always to be alternate with the placentæ, which are formed at the margins of the leaf, but in *Cruciferæ* the stigmata are opposite the placentæ. This may be explained in two ways. Dr. Lindley supposes that in this order there are originally four carpels, two of which being abortive, the stigmata are left opposite the placentæ. Brown on the contrary supposes that the stigmata are originally 2-lobed, and that the lobes have united on each side, and thus obtained their abnormal position. [Seed; Reproduction in Plants.]

PISTACITE. [Epidote.]

PISUM, a genus of Plants belonging to the natural order *Leguminosæ*, and the tribe *Viciæ*. It has a calyx with foliaceous segments, the two upper ones being shortest; the vexillum ample, reflexed; the style compressed, carinated, villous above; the legume oblong, rather compressed, but not winged; the seeds globose, numerous, with a roundish hilum.

P. sativum has two or many-flowered peduncles, with red or white flowers, and is the common pea of our fields and gardens.

P. arvense has 1-flowered peduncles and always red flowers, and yields the gray peas of the fields. [Peas, in Arts and Sc. Div.]

P. maritimum, the Sea-Pea, has an angled stem, the petiole flattened on the upper side; the stipules broad, sub-sagittate; the peduncles many-flowered, shorter than the leaves. This plant is a native of France, Denmark, and other parts of Europe, and also of Kamtchatka. In Great Britain it is found on the pebbly beach of Lincolnshire, Sussex, Kent, and Suffolk. It is said to have been first observed in Great Britain, at Orford in Suffolk, in the year 1555, when during a great scarcity of food the poor people of that district were almost entirely supported for some time by its seeds. There is a tradition that it sprung up after the wreck of a vessel loaded with peas on the coast, but this could not be the case, as the Sea-Pea is a very different species from any other. The seeds are bitter, and cattle are fond of the herb. There are three or four other species of pea, affording edible seeds, but not so valuable as the first.

PISUM (Zoology), Megerle's name for a genus of Conchiferous *Mollusca* (*Pisidium*, Leach), separated from *Cyclas*.

PITCHBLENDE. [Uranium.]

PITCHER-PLANTS. [Leaf; Nepenthaceæ.]

PITCHSTONE, a Mineral occurring massive. Structure compact, sometimes slaty, occasionally curved. Fracture imperfectly conchoidal. Hardness 5·0 to 6·0. Colour brown, black, gray, red, &c., and variously mixed. It is generally dull, but has sometimes a resino-vitreous lustre. Translucent. Opaque. Specific gravity 2·3 to 2·7. It occurs at Meissen in Saxony, at Newry in Ireland, and in the island of Arran, and other places.

Analysis of Irish Pitchstone by Knox:—

Silica	72·80
Alumina	11·50
Soda	2·85
Lime	1·20
Protoxide of Iron	3·03
Water	8·50
	99·88

Pitchstone is also applied to a Siliceous Rock of igneous origin, generally occurring in dykes which traverse the strata, or in overlying columnar masses. Among recent volcanic rocks its analogue is Obsidian. M'Culloch gives the characters of Pitchstone in the following leading divisions:—

1. Simple: *a*, amorphous, massive; *b*, concretionary.
2. Porphyritic: Pitchstone-Porphyry of mineralogists.
3. Concretionary spheroidal: Pearlstone of mineralogists.
4. Amygdaloidal: containing imbedded zeolites, &c.

The colours are extremely various; the texture varies from almost glassy to granular, and thus allows of passage into Hornstone.

PITH is a cellular substance found in the centre of the branches, but not the roots, of Exogenous Plants. [Exogens.]

PITHE'CIA. [Sakis.]

PITHE'CUS. [Ape; Chimpanzee; Orang-Utan.]

PITHYS. [Merulidæ.]

PITONNELLUS, De Montfort's name for a genus of Turbinated Testaceous Gastropods, *Rotella* of authors. [Turbinidæ.]

PITPIT. [Dacnis.]

PITTA, M. Vieillot's name for a genus of remarkable birds, placed by Mr. Swainson among the *Myiotherinæ*, or Ant-Thrushes. [Merulidæ.]

Pitta (Vieill., Temm.).—M. Lesson remarks that, under the name of *Myiothera*, Illiger and Cuvier united the Brèves of Buffon and the Ant-Thrushes properly so called. These Brèves are remarkable, he observes, for the livid colours of their plumage, their long legs, and their very short tail. They are only found, he adds, in the Malaisian Islands, whilst the Ant-Thrushes belong to the New Continent as well as to the Old World.

Mr. Swainson notices the genus *Pitta* as one of remarkable beauty, and observes that they have the gradually-curved bill of the true Thrushes, but much stronger.

P. gigas, Brève Geant, or Giant Pitta. Size equal to that of a magpie, but the tail is short and squared, and the wings cover it entirely. A very brilliant azure-blue covers the back, the scapulars, the rump, and tail; a less vivid tint is spread over the wings, the quills of which are black, covered with azure towards the tips; summit of the head, nape, and demi-collar of the lower part of the neck black; feathers of the front and eye-brows ashy-brown; throat whitish; an ashy-brown tint is spread over all the lower parts; the feet are very long and of a horny-ash colour. Total length 9 inches.

It is found in Sumatra. (Temminck.)

Giant Pitta (*Pitta gigas*).

Sub-Genus *Chlorisoma*. (Sw.)

C. thalassinum (*Kitta thalassina*, *Piroll Thalassin*, Temm.). Greater part of the plumage very brilliant celadon-green; a velvety black band springs at the angle of the bill, passes backwards so as to include the eye, and surrounds the occiput; tail deep tarnished green; wings reddish, but the three or four secondary feathers nearest the body are

opaline bluish-ash; iris, bill, and feet, very bright vermilion-red. Total length 11 inches 2 or 3 lines.

The male and female have nearly the same livery.

The Young of the Year differ in the colour of their bill and feet, which are black; in that of the wings, which is a tarnished rusty-red, and in the very clear blue, which is nearly whitish, of all the rest of the plumage. This blue tint is more vivid in middle age, and passes by degrees from bright azure-blue to celadon-green. Individuals during moult have the plumage varied with these two tints very vivid and pure.

It is a native of Java and Sumatra. (Temminck.)

Chloriscoma thalassinum.

Sub-genus *Grallaria.* (Vieill.)

G. Rex (Roi des Fourmilliers, Buff.; King-Thrush, Lath.; *Turdus Rex*, Gmel.). Brown, inclining to red, lighter beneath; occiput plumbeous; forehead varied with black and white.

It is a native of South America, Guyana, and Brazil especially.

King-Thrush (*Grallaria Rex*).

PITTOSPORA'CEÆ are Polypetalous Exogenous Plants with a definite number of hypogynous stamens, a superior 1- or 2-celled ovary, which in the former case has parietal placentæ, numerous ovules, a single style, and hard seeds containing a very small embryo in the region of the hilum. Their position in a natural arrangement is unsettled, but appears to be near the Vitaceous Order, rather than the Rhamnaceous or Polygalaceous. All the species contain in greater or less abundance a resinous substance, the use of which is unknown. Many of the species are pretty shrubs or bushes, sometimes extremely graceful, but they are of no known use. Most of them are natives of Australia. The names of *Sollya* and *Billardiera* recal to the mind some of the prettiest twiners of the greenhouse. [SOLLYA; BILLARDIERA.]

Pittosporum tomentosum.

1, the stamens and pistil; 2, a ripe fruit; 3, the same divided transversely; 4, a section of a seed with the minute embryo near the base.

PITTIZITE. [IRON.]

PITUS, a genus of Fossil Plants.

PI'TYLUS. [TANAGRINÆ.]

PLACENTA (Botany). [SEED.]

PLACENTA (Schumacher), a genus of *Mollusca.*

PLACENTA. [REPRODUCTION IN ANIMALS.]

PLACENTULA, a genus of *Foraminifera.*

PLACOBRANCHIA'TA, or PLACOBRA'NCHIDÆ, M. Rang's name for a family of *Mollusca*, forming his fifth family of *Gasteropoda* (Cuvier), but placed by Cuvier among his *Nudibranchiata.* [NUDIBRANCHIATA.]

PLACOBRA'NCHUS. [NUDIBRANCHIATA.]

PLACODINE (*Arseniuret of Nickel*), a Mineral which occurs in crystalline masses and crystallised. Primary form an oblique rhombic prism. Colour bronze-yellow; streak black. Fracture conchoidal, uneven. Hardness 5·0. Lustre metallic. Specific gravity 7·988 to 8·062. It is found at the Jungfer mine, Müsen. The analysis by Plattner gives—

Arsenic	39·707
Nickel	57·044
Cobalt	0·900
Copper	0·862
Sulphur	0·617
	——99·180

PLACU'NA. [PECTINIDÆ.]

PLACUNANO'MIA. [PECTINIDÆ.]

PLAGIAULAX. [*See* SUPPLEMENT.]

PLAGIODONTIA. [HYSTRICIDÆ.]

PLAGIONITE, a Mineral which occurs massive and crystallised. Primary form an oblique rhombic prism. Cleavage lateral, perfect, but seldom affording smooth surfaces. Colour blackish lead-gray. Fracture imperfectly conchoidal. Hardness 2·5. Brittle. Lustre metallic. Opaque. Specific gravity 5·4. It is found at Wolfsberg in the Harz. The analysis by Rose and Kudernatsch gives—

Sulphur	21·53
Lead	40·52
Antimony	37·94
	——99·99

PLAGU'SIA. [GRAPSIDÆ.]

PLAICE. [PLEURONECTIDÆ.]

PLANA'RIA (Brown), a genus of Fossil Shells which are discoid, and much resemble *Planorbis;* but the outer lip is reflected, and the form is considered to have been marine. Dr. Lea notes a species, *P. nitens*, from the Claiborne Beds, Alabama. *Planaria* had been used by Müller, Lamarck, and others, to designate a genus of animals placed by Cuvier among his Intestinaux Parenchymateux, but they do not live in other animals, and are only found in fresh or salt waters.

PLANAXIS. [ENTOMOSTOMATA.]

PLANE. [PLATANACEÆ.]

PLANIPENNES. [NEUROPTERA.]

PLANORBIS. [LIMNÆADÆ.]

PLANORBULI'NA, a genus of *Foraminifera*.

PLANTA GENISTA. [GENISTA.]

PLANTAGINA'CEÆ, a small natural order of Plants belonging to the Monopetalous Exogenous series, principally characterised by having a superior 1-celled simple ovary, terminated by a simple linear stigma, many seeds, with a minute embryo in the midst of much albumen, and stamens with extremely weak filaments. They consist of herbaceous or suffrutescent plants, of which the Common Ribgrass, or *Plantago lanceolata*, may be taken as the type, and are of no material importance to man. The mucilage surrounding the seeds of some is occasionally used in the stiffening of muslins by the manufacturers, and the *P. lanceolata* is sown on sandy bad lands as a material for sheep food. In structure, *Plantago* possesses the rare peculiarity of having the cavity of its simple carpel divided into two by a vertical additional plate. [PLANTAGO.]

Great Plantain (*Plantago major*).

1, a flower; 2, a corolla cut open; 3, a seed-vessel, with the upper half of the pyxis removed.

PLANTA'GO, a genus of Plants, the type of the natural order *Plantaginaceæ*. It has a 4-cleft calyx, a corolla with an ovate tube, and a 4-parted reflexed limb. The capsules burst transversely; they are 2-4-celled, and have from 2 to 4 seeds.

P. Coronopus, Buck's-Horn Plantain, has linear pinnatifid leaves, with a slender spike; the bracts are subulate from an ovate base, erect; the midrib of the lateral sepals with a ciliated membranous wing; the placenta 4-winged, with one seed in each cell. This species is found in gavelly and sandy places, both near the sea and inland. It is a native of Great Britain. It has been eaten as a salad, but it is too bitter and astringent to be palatable, and these qualities have given it some reputation as an expectorant and vulnerary. Strange accounts are given of its efficacy in medicine, and some very improbable cures attributed to its use.

P. maritima has linear grooved fleshy leaves, convex on the back; the sepals not winged; the capsules 2-seeded; the tube of the corolla pubescent; the spike cylindrical; the bracts ovate acuminate. It is found on the sea-coast and on high mountains in Great Britain.

P. lanceolata is distinguished by its leaves being lanceolate, attenuated at both ends, and 5-nerved; the scape furrowed, the spike ovate or oblong; cylindrical bracts, ovate-acute or cuspidate; the capsules 2-celled, the cells 1-seeded; the tube of the corolla glabrous. The root produces long fibres; the neck is clothed with dense wool, and the scape and leaves with silky hairs. This species was once cultivated as an agricultural plant, but was found to be unprofitable, and has long ceased to be sown.

P. media is known by its ovate leaves, with short broad pubescent stalks; the sepals are not keeled; the capsules 2-celled, and each cell contains one seed. It is found in meadows and pastures in England. The leaves and root have been used in decoction as an astringent lotion.

P. major, Great Plantain, has broadly ovate leaves on a long channelled stalk; terete scapes; an elongated spike; ovate-obtuse keeled bracts; the sepals with a prominent dorsal nerve; the capsules 2-celled, each cell containing many seeds. It is found in Great Britain, and has been called Way-Bred, from its prevalence on the way-side. This plant has a peculiar tendency to grow in the neighbourhood of the abodes of men, and seems as though it followed the migrations of the human species. Thus, although not intentionally conveyed, it has accompanied our colonists to every part of the world, and is known in some of our settlements to the natives under the name of 'The Englishman's Foot'; for, with a strange certainty, wherever our countrymen have trod there it is to be found. Small birds are almost universally fond of the seeds of these plants, which are covered with mucus. According to De Candolle, the seeds of *P. arenaria* are exported in considerable quantities from Nismes and Montpellier to the north of Europe, and are supposed to be consumed in the completion of the manufacture of muslins. The seeds of *P. Ispaghula* are of a very cooling nature, and with boiling water form a rich mucilage, which is much used in India in catarrh, gonorrhœa, and nephritic affections. Soda is obtained in Egypt from the ashes of *P. squarrosa*.

(Babington, *Manual of British Botany*; Lindley, *Vegetable Kingdom*; Lindley, *Flora Medica*; Burnett, *Outlines of Botany*.)

PLANTAIN. [PLANTAGINACEÆ; PLANTAGO; MUSA.]

PLANTAIN-EATER. [MUSOPHAGIDÆ.]

PLANTAIN, WATER. [ALISMACEÆ.]

PLANTI'GRADA. [CARNIVORA.]

PLANTS, FOSSIL. Those plants which are found embedded in the various strata of the earth are called Fossil. The nature and general character of such remains are referred to in the article ORGANIC REMAINS. The greatest development of vegetable life occurred during the deposit of the Coal Measures. The characters of that vegetation, with a list of the species, will be found in the article COAL-PLANTS. Lists of the genera of plants found in formations above and below the Coal will be found in the accounts of those formations. [GEOLOGY.]

PLANTS, REPRODUCTION IN. [REPRODUCTION IN PLANTS.]

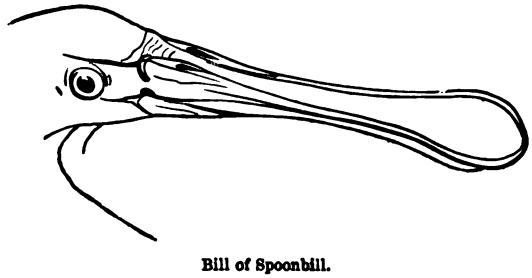
PLANULATI. [AMMONITES.]

PLASMA. [AGATE.]

PLASTER OF PARIS. [GYPSUM.]

PLASTIC CLAY. The lower part of the Tertiary Series of England and France yields, with greensands and pebbles, beds of red, white, or mottled clay, often of excellent quality for the potter. [LONDON CLAY.]

PLATALEA, a genus of Birds belonging to the family *Ardeidæ*. The peculiar form of the bill in this genus has gained for these birds the common name of Spoonbill. It has the following generic characters:—Bill very long, strong, very much flattened, point dilated and rounded into the form of a spoon or spatula; upper mandible channelled, transversely furrowed at its base; nostrils at the surface of the bill, approximated, oblong, open, bordered by a membrane; face and head partially or entirely naked. Feet long, strong; three toes anteriorly united up to the second joint by membranes or webs; posterior toe touching the ground. Wings moderate, ample; the first quill nearly as long as the second, which is the longest.



Bill of Spoonbill.

The Spoonbills live in society in wooded marshes, generally not far from the mouths of rivers, and are rarely seen on the sea-shore. Their food consists of small fishes, spawn, and small fluviatile testaceous molluscs, as well as small reptiles and aquatic insects. According to circumstances they build their nests either in high trees, in bushes, or among rushes. Their moult is simple and ordinary, but the young bird does not take the confirmed livery of the adult till the third year; the bill is gradually developed, and appears covered with a membrane. The crest makes its appearance at the second year. The sexes have external distinctions, but the characters are but slightly marked. (Temminck.)

P. leucorodia, Linn., the Common White Spoonbill. This species is, there can be little doubt, the Λευκερωδίος of Aristotle ('Hist. Anim.,' book viii. c. 3), of which he says that it haunts περὶ τὰς λίμνας καὶ τοὺς ποταμούς ("about the lakes and rivers"); and which he thus describes:—"In size it is less than the other," the Ἐρωδιός (one of the Herons, perhaps *Ardea cinerea*), "and has a broad and long bill;" a description which, when coupled with the white colour indicated by the name, can hardly be deemed inapplicable; nor can the term 'broad' be with any propriety referred to the bill of any of the true Herons. It is the Becquaroueglia (Belon) and Cucchiarone (Bonaparte) of the modern

Italians; Pale, Poche, Cueiller, Truble (Belon), and Spatule of the French; Weisser Löffeler and Löffel Gans of the Germans; Lepelaar of the Netherlanders; Y Llydon Big of the Welsh; and Spoonbill and White Spoonbill of the English.

This bird has a very full long occipital crest, formed of loose and subulate feathers.

Very old males have all the plumage pure white, with the exception of that of the breast, where there is a large patch of reddish yellow; the extremities of this patch lessen into bands which unite on the upper part of the back. Naked skin about the eyes and throat pale-yellow, but slightly tinged with red on the lower part of the throat. Bill black, but bluish in the hollow of the furrows, apex ochreous yellow; iris red; feet black. Total length 2 feet 6 inches; length of bill 8 inches 6 lines.

Old females are rather less than those of the male; the crest is less full and shorter, and the sternal patch is only very feebly indicated.

Young of the Year.—White on leaving the nest, with the exception of the external quills, which are black along the shafts and at their ends; all the shafts are also of a deep black. Head covered with short rounded feathers; the bill, 4 inches 6 lines long at most, is of a deep ash-colour, soft, very flexible, and covered by a smooth skin; iris ash-coloured; naked parts tarnished white. The yellow sternal patch does not begin to appear till the second or third year. (Temminck.)

Mr. Selby observes that in its anatomy it shows an affinity to the Cranes in the form of the windpipe, which, previous to entering the thorax, undergoes a double flexure to the extent of about two inches, and forms a convolution similar to the figure 8. The flexures touch, but do not cross each other, the points of contact being united by fine membranes. This double flexure, according to Willughby and Temminck, was supposed peculiar to the males, but Mr. Selby remarks that Montagu disproves that idea, as the specimen he dissected was a female, and yet possessed the flexure to the extent above described; and this indiscriminate characteristic was corroborated by the dissection of the specimens which Mr. Selby obtained.

It feeds on very small fish, spawn, testaceous molluscs, insects and aquatic worms, small reptiles, and the roots of some weeds and grasses.

The Common Spoonbill haunts the mouths of rivers. Its nest is built sometimes on lofty trees, sometimes in rushes and reeds, according to circumstances, and the eggs are from two to four in number, generally three, sometimes entirely white, but most frequently white marked with obscure red spots. They bred annually in the time of Ray in a wood at Sevenhuys, not far from Leyden, but the wood has been long destroyed.

Common White Spoonbill (*Platalea leucorodia*).

They are generally distributed throughout Europe. Holland appears to be a principal place for their summer meetings; and Temminck states that it has two periods of passage along the maritime coasts, and that it journeys with the storks. As winter approaches it migrates to more southern regions till the milder weather recals it. Mr. Bennett states that in winter it takes up its quarters in various parts of Africa, extending southwards even to the Cape of Good Hope. It is, he observes, rarely met with in inland countries except on the banks of the larger rivers; but it is by no means uncommon during the season on the coasts of the great extent of country which it embraces in its visits. In England it only appears occasionally; Pennant mentions a large flight which arrived in the marshes near Yarmouth in April 1774. Montagu records it as having been sometimes seen during winter on the coast of South Devon, and mentions the receipt of two specimens from that part of the country, one in November 1804, and a second in 1807. Mr. Yarrell records two specimens which were shot in Lincolnshire in 1826, and Mr. Selby, when in London in 1830, obtained a male and female, in fine adult plumage, from Norfolk. Dr. Latham states an instance of its occurrence on the Kentish coast. The old quatrain in the 'Portraits d'Oyseaux,' speaks of the Spoonbill under the name of Pale, as living "es marches de Bretagne."

The flesh of the Spoonbill, when well fed and fat, is said nearly to resemble that of the goose in flavour.

PLATANACEÆ, *Planes*, a natural order of Exogenous Plants. The species are amentiferous trees or shrubs, with alternate deciduous palmate or toothed stipulate leaves, and unisexual naked flowers in globose catkins. The barren flowers with stamens single, mixed with scales. Fertile flowers with ovary 1-celled, style thick and subulate. Ovules 1-2, orthotropal; suspended. Nuts clavate, with a persistent style. Seeds usually solitary and albuminous; radicle inferior. They are natives of the Levant and North America chiefly. They are fine trees, but their timber is not durable.

Platanus orientalis, Oriental Plane, has palmate leaves resembling those of the common Sycamore. It grows in the western parts of Asia, and extends as far east as Cashmere. Its wood is fine-grained and hard, and when old it acquires dark veins so as to resemble walnut-wood. The tree was valued for its shade by the Greeks and Romans, and it was held sacred in the East. *P. occidentalis* is found in most parts of North America, from Mexico as far as Canada. The timber is of a reddish colour, and will not bear exposure to the weather. There is but this one genus in the order and six species. The family resembles *Artocarpaceæ* and *Altingiaceæ*.

(Lindley, *Vegetable Kingdom*; Balfour, *Class-Book of Botany*.)

PLATANISTA, [CETACEA.]

PLATANTHE'RA, a genus of Orchidaceous Plants, struck off *Habenaria* on account of the stigmatic processes of the column being small and inconspicuous, or altogether obsolete, instead of being lengthened into horn-like projections below the arms of the anther. The species are numerous, and inhabit the temperate parts of the Old World, but are rarely ornamental, and never of any known use. The British Flora comprehends two species, *P. bifolia* and *P. chlorantha*, both white-flowered, and called Butterfly-Orchis. [HABENARIA.]

PLATANUS. [PLATANACEÆ.]

PLATAX. [CHÆTODON.]

PLATEMYS. [CHELONIA.]

PLATESSA. [PLEURONECTIDÆ.]

PLATIN-IRIDIUM. [PLATINUM.]

PLATINA. [PLATINUM.]

PLA'TINUM, or PLA'TINA, an important metal, although it was not known earlier than about the middle of the last century. It was first made known in Europe by Mr. Wood, assay-master in Jamaica, who met with its ore in 1741. In 1750 he published a paper upon it in the 'Philosophical Transactions.'

The name of this metal is the diminutive of 'plata,' silver, given to it on account of its colour, and it was originally called Platina del Pinto, because it was found in the auriferous sand of the river Pinto. It has since been found in Brazil, Colombia, St. Domingo, and in the Ural Mountains.

Platinum is separated from the sand and other matters with which it is mixed, by washing with a great quantity of water, from which the heavier parts of course subside, and these contain the ore in question.

The ore of platinum is composed of irregular rounded grains, which are sometimes flattened; they are of various sizes, often very small, and occasionally they exhibit traces of crystallisation; but these are probably derived from the presence of some other metal. These grains possess no cleavage. Fracture hackly. Hardness 4·0 to 4·5. Specific gravity 17·332. Opaque. Lustre metallic. Colour steel-gray.

Berzelius has analysed many varieties of this ore, from which we select two examples: (1) the ore of Barbacoas, in the province of Antioquia, Colombia, and (2) that of Goroblagodat in Siberia:—

	(1.)	(2.)
Platinum	84·30	86·5
Palladium	1·06	1·0
Rhodium	3·46	1·1
Iridium	1·46	
Osmium	1·03	
Iron	5·31	8·32
Copper	·74	·45
Gangue	·60	1·40
	97·96	98·82

The following are the properties of pure Platinum:—Its colour is grayish-white, intermediate between silver and tin. When it free from iridium, it is so very ductile, that it may be drawn into very fine wire, not exceeding the 2000th part of an inch in diameter. It is also very malleable, and may be beaten into thin leaves. According to Berzelius, when perfectly pure, it is softer than silver, and it is susceptible of receiving a fine polish. Of all metals it is the least expansible. Its density varies: when fused, it is 19·50; when forged, it is as high as 21·4 to 21·5.

Platinum suffers no change by exposure to the air, nor is it oxidised when heated in it. It does not under any circumstances decompose water. It is infusible in the strongest heat of a smith's forge, but it may be melted by voltaic electricity or by the oxyhydrogen blowpipe. Of all metals, except iron and copper, it is the most tenacious; a wire of the diameter of 0·787th of a line is capable of sustaining a weight

of about 274 lbs. Like iron, Platinum possesses the very valuable property of welding at a high temperature, and this enables us to form it into chemical vessels of great and daily use.

The metals iridium, osmium, and palladium, occur in conjunction with Platinum.

Platin-Iridium consists of 76·8 Iridium and 19·64 Platinum, with some palladium and copper. It is obtained at Nischnei Tagilsk, and also at Ava in the East Indies. Another variety is found in Brazil.

Iridosmine is a compound of Iridium and Osmium from the platinum mines of Russia, South America, and the East Indies. Its composition varies. One variety contains—

Iridium	46·8
Osmium	49·3
Rhodium	3·2
Iron	0·7
	——100

Iridium and Rhodium are very hard, and are used as nibs for gold pens.

Native Palladium.—Its form is supposed to be the regular octahedron. It occurs mostly in grains, apparently composed of divergent fibres. Colour steel-gray, inclining to silver-white. Ductile and malleable. Hardness above 4·5. Specific gravity 11·8—12·2. This ore consists of palladium, with some platinum and iridium. It fuses with sulphur, but not alone. It is found in Brazil with gold, and is distinguished from platinum, with which it is associated, by the divergent structure of its grains. *Selenpalladite* is nothing but the native palladium; and *Eugenesite* is a similar compound.

This metal is malleable, and when polished has a splendid steel-like lustre which does not tarnish. A cup weighing 3¼ lbs. was made by M. Breant in the mint at Paris, and is now in the Garde-Meuble of the French crown. In hardness it is equal to fine steel. One part fused with six of gold forms a white alloy; and this compound was employed, at the suggestion of Dr. Wollaston, for the graduated part of the mural circle, constructed by Troughton for the Royal Observatory at Greenwich. Palladium has been employed also for certain surgical instruments. Large masses of the metal Palladium are brought from Brazil.

PLATYCA'RCINUS (Latreille), a genus of *Crustacea*. [CANCER.]

PLATYCERCUS. [PSITTACIDÆ.]

PLATYCRINI'TES. [ENCRINITES.]

PLATYDA'CTYLUS. [GECKOTIDÆ.]

PLATY'LEPAS. [CIRRIPEDIA.]

PLATY'LOPHUS (Swainson), a sub-genus of *Barita*.

PLATY'MERA. [OXYSTOMA.]

PLATYONYX, a genus of extinct *Mammalia* belonging to the family *Megatheriidæ*.

PLATYPEZIDÆ, a family of Insects belonging to the order *Diptera*, the sub-order *Proboscidea*, and the tribe *Nemocera*.

PLA'TYPUS. [ORNITHORHYNCHUS.]

PLATYRHOPALUS. [PAUSSIDÆ.]

PLATYRHYNCHUS. [PHOCIDÆ.]

PLATYRHYNCHUS. [MUSCICAPIDÆ.]

PLATY'STERA. [MUSCICAPIDÆ.]

PLATYSTERNON. [CHELONIA.]

PLATY'STOMA and PLATY'STOMUS. [MUSCICAPIDÆ.]

PLATYU'RUS. [GECKOTIDÆ.]

PLECO'TUS. [CHEIROPTERA.]

PLECTOGNATHI. [FISH.]

PLECTRANTHUS (from πλῆκτρον, a cock's spur, and ἄνθος, a flower, in reference to the corolla being spurred or gibbous above the base), a genus of Plants belonging to the natural order *Labiatæ*. It has a campanulate 5-toothed calyx in the floriferous state; the teeth equal or the upper one largest. The corolla with an exserted tube; the upper lip from 3-4-cleft, the lower one entire, usually longer and concave. There are 4 stamens, declinate, didynamous, the lower ones longest; free toothless filaments; ovate uniform anthers. The species are herbs, sub-shrubs, and shrubs. There are 45 species of this genus described, which are of easy culture and propagation.

P. crassifolius is esteemed in India both as a perfume and a spice, being equally valued in the toilet and the kitchen. The Patchouly, so inimical to vermin and so efficacious in preserving cloths from moths, is said to be the leaves of *P. graveolens*, which have a very powerful odour, but the comminuted state in which it is imported renders this uncertain.

(Don, *Dichlamydeous Plants*; Burnett, *Outlines of Botany*.)

PLECTRIS. [MELOLONTHIDÆ.]

PLECTRO'PHANES. [EMBERIZIDÆ.]

PLECTRO'PTERUS. [DUCKS.]

PLEIOCENE, or PLIOCENE. By this title (derived from πλεῖον, more, and καινός, new) Sir Charles Lyell characterises the upper part of the Tertiary Strata. There are in his view Older and Newer Pleiocene Formations, and some have used for the latter class the expression Pleistocene, or 'most new.' [TERTIARY SYSTEM.]

PLEI'ODON, synonymous with *Iridina*. [NAIADÆ.]

PLEI'ONE (Savigny), a genus of Dorsibranchiate (*Amphinome*, Blainv.) *Annelidæ*, which, with the same tentacles as *Chloeia*, Sav., have branchiæ in the form of tufts. The species are natives of the Indian seas, where some of them grow to a large size.

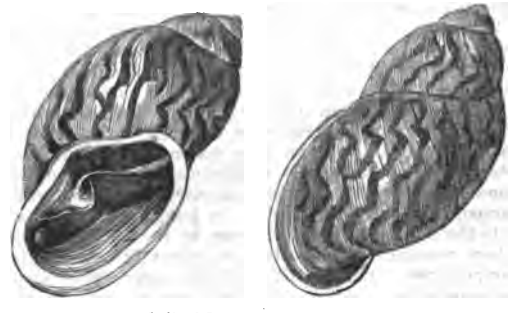
PLEKOCHE'ILUS, the Rev. Lansdown Guilding's name for a genus of *Pupadæ* (Guild.), *Bulimus* of authors.

Animal hermaphrodite. Body corrugate, heliciform; head bilobate; tentacles four, the two longer ones with oculiferous terminations; mandible very lunate, the ossicula transverse, the triangular appendage cutaneous. Intromittent organ retractile, at the root of the right greater tentacle. Mantle perforated by a common foramen. Ova few, large, with a calcareous shell or crust.

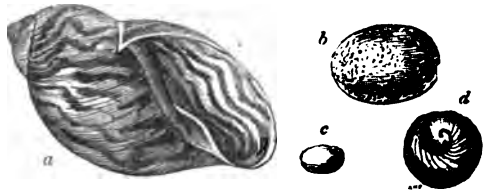
Shell barely umbilicate, dextral, oval, spiral; the spire elevated, but obtuse, the two last whorls largest, ventricose. Aperture entire, elongated. Columella with a single plait, which is cavernoso-inflex. Lip thickened, marginate. (Guild.)

P. undulatus has the body olivaceous-black, foot pallid beneath; tentacles white at the apex; eyes black. The shell is stout, turgid, plaited longitudinally, indistinctly striated transversely, ferruginous chestnut, with oblique brown undulated bands; whorls five.

Plekocheilus undulatus, animal and shell. (Swainson, from Guilding's drawing.)



Shell of *Plekocheilus undulatus*.



a, young shell of same; *b*, egg magnified; *c*, natural size; *d*, apex of nucleus, enlarged.

Mr. Guilding states that this fine species occurs in immense numbers in the forests of the island of St. Vincent, generally withdrawn in the daytime. The ova are agglutinated to the vaginating leaves of the *Tillandsiæ*, which, from holding water, secure a damp atmosphere at all times.

PLEODONTS, the name assigned by Messrs. Duméril and Bibron to their first sub-family of Lézards Lacertiens (Lacertian Lizards), or Sauriens Autosaures (Autosaurian Saurians).

The Pleodonts are divided into two great groups: the first with a

compressed tail, surmounted with crests, as in the Crocodiles; the other with the tail perfectly conical, or very slightly flattened on its four surfaces, so that it still appears rounded.

PLEONASTE. [SPINEL.]

PLESIOSAU'RUS (Conybeare), a genus of the extinct family of Enaliosaurians. This genus was first described by Mr. Conybeare, with the assistance of Sir Henry de la Beche, in the 'Transactions of the Geological Society of London,' in 1821. A restoration of the skeleton, together with that of *Ichthyosaurus*, was given by Mr. Conybeare in a subsequent volume of the same 'Transactions' (1824), from an almost perfect specimen of *Plesiosaurus dolichodeirus*, and the accuracy of this restoration is still universally acknowledged. This genus is the *Halidracon* of Wagler.

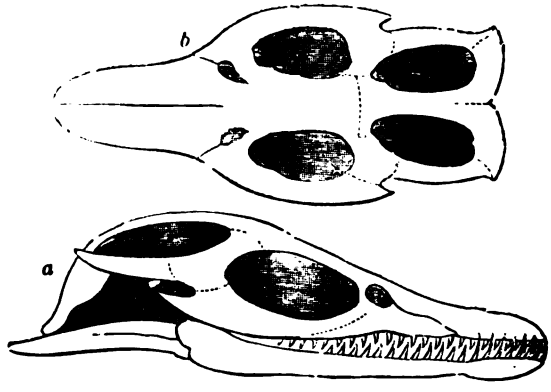
The distinguishing features of the Enaliosaurians consist in the absence of the ball and socket articulations of the bodies of the vertebræ, the position of the nostrils at or near the summit of the head; their separated hæmapophyses; the numerous short and flat digital bones, which must have been enveloped in a simple undivided tegumentary sheath, forming in both the fore and hind extremities a fin resembling in external appearance the paddles of the *Cetacea*.

The characters of the genera *Plesiosaurus* and *Ichthyosaurus*, the types of the two principal modifications of anatomical structure offered by the Enaliosaurians, are mainly derived from modifications of the vertebral column, as well with regard to the form and configuration of the individual bones, as to the relative groups of the cervical, dorsal, and caudal vertebræ. [ICHTHYOSAURUS.] Professor Owen has also found that the vertebræ afford the best characters for the distinction of species as well as of genera.

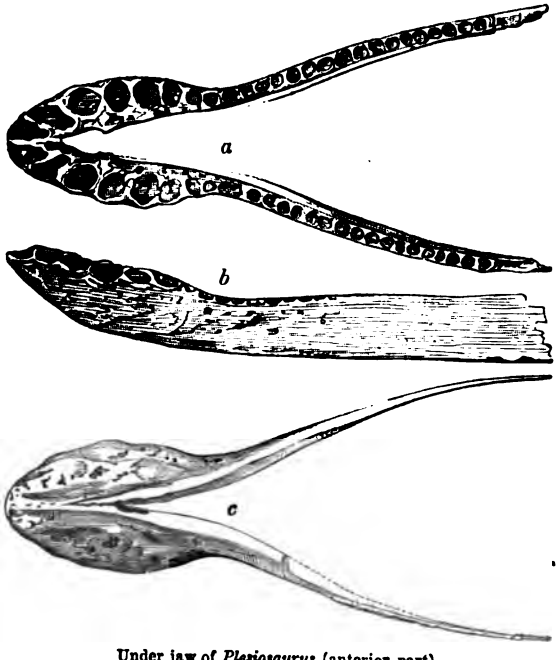
The most conspicuous and remarkable character of the vertebræ in *Plesiosaurus* is the extraordinary length of the cervical portion, including from twenty to forty vertebræ. The articular surfaces of their bodies are either flat or slightly convex in the centre, and most frequently concave at the periphery. Two pits are generally presented at the under part of the bodies, but this character is not constant. The cervical vertebræ of the *Plesiosauri* generally present the centrum, the neurapophyses, and the ribs in a separate or unanchylosed state, and although in general no transverse processes are developed in this region, an analogy with the structure characteristic of this part of the spine in the Crocodile is maintained in the division of the articular surface for the cervical rib into an upper and lower portion by a horizontal fissure—a structure which, Professor Owen observes, is well described and figured by Conybeare in the *Plesiosaurus dolichodeirus*: as these vertebræ of the neck approach the dorsal, the inferior part of the costal articulation becomes smaller, and a corresponding increase of surface is afforded by the superior facet, which also gradually rises from the centrum to the neurapophyses, and in the dorsal vertebræ stands boldly out as a true transverse process from the upper side of the base of each neurapophysis. The transverse processes of the sacral vertebræ subside to the level of the neurapophyses; and as the caudal vertebræ recede from the trunk, the articular surface, which, as in the neck, represents or takes the place of the transverse process, gradually descends, and passes from the neurapophyses to the side of the centrum, but is not divided by the longitudinal groove which characterises the costal surface in the neck; but it must be borne in mind that this groove is more marked in some species of *Plesiosaurus* than others; and indeed Professor Owen has seen Plesiosaurian cervical vertebræ in which no trace of it was visible. "The neurapophyses," he says, "are commonly unanchylosed with the vertebral centres in any part of the spine, and in some instances throughout the cervical and at the anterior part of the dorsal region the neurapophyses have appeared to be joined each by an articular surface to the spine above, as they are to the centrum below—the spines here remaining apparently throughout life unanchylosed to the neurapophyses. This condition of the upper vertebral elements is rarely seen in any cold-blooded vertebrate animals, and never in the warm-blooded classes. In those parts of the spine where the vertebræ enjoyed less mobility upon each other than in the neck, the spines become anchylosed to the neurapophyses at an earlier period. The hæmapophyses co-exist with the ribs or paravertebral elements in the caudal region of the spine, but they continue throughout life to be unattached by bone either to the centrum above or to each other below; and here also their spine is not developed, and consequently no true chevron bone is formed in the *Plesiosauri*. The hæmapophyses are also continued along the inferior surface of a great part of the abdomen, forming there the sternal or abdominal ribs; and just as the neurapophyses are developed in the transverse direction to protect the expanded cerebral masses in the cranial region, so here the hæmapophyses are in like manner elongated transversely, and their spine is introduced and modified to form a third mesial rib-like bar, connecting however, as usual, the lower or distal extremities of the hæmapophyses, and completing the osseous cincture of the abdominal viscera. The tail in the *Plesiosauri* is relatively much shorter than in the *Ichthyosauri*, and there is an obvious reason for the curtailment of this part of the animal; for in the *Plesiosauri*, the length and mobility of the neck renders a special development of the tail for producing the lateral movements of the head unnecessary. The bodies of the vertebræ, in most species of *Plesiosaurus*, are traversed vertically by two vascular canals, which lead from the medullary or spinal canal to the inferior surface of the centrum, where they terminate each by an orifice, and sometimes by two orifices on each side of the middle line. These orifices are not however a constant character of the genus *Plesiosaurus*, neither are they peculiar to this genus, being present in the vertebræ of the *Cetacea*, as well as in those of other *Sauria*. In a section of the vertebral centrum of a *Plesiosaurus*, the osseous texture for some lines near the anterior and posterior articular surfaces is denser than in the rest of the vertebræ, and the direction of the laminæ and fibres is vertical; in the intermediate portion the laminæ are horizontal."

Though the head of the *Plesiosauri* resembles that of the crocodiles in its general form, it is, relatively much smaller in proportion to the body. The elongated form of the strong and prominent cranial bones, most of which extend from point to point, with wide interspaces like the timbers of a scaffolding, forms one of the first indications of a deviation from the Crocodilian type, and of the affinity of the *Plesiosaurus* to the Lacertian *Sauria*; and this affinity is further exemplified in the condition of many of the individual bones.

The parietal bone is strong and triradiate, consisting of a median piece corresponding with the normal parietal in the Crocodiles, and of two transverse elongated processes, formed, as it were, by a bifurcation of the posterior part of the median piece; and in a young specimen of *Plesiosaurus macrocephalus*, in the museum of the Earl of Enniskillen, Professor Owen found the median or sagittal suture dividing the two parietals still distinct; in older specimens of *P. Hawkinsii* he always found it obliterated; affording evidence to justify the description of the parietal bone as single or triradiate. The other bones of the head present many remarkable distinctions from the ordinary Crocodilean type. The general structure of the head will be seen in the accompanying cuts of the skull of the *Plesiosaurus* restored after Conybeare.



Skull of *Plesiosaurus* restored: *a*, profile; *b*, seen from above.



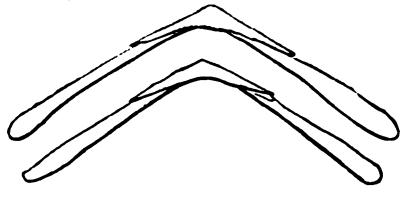
Under jaw of *Plesiosaurus* (anterior part).
a, seen from above; *b*, profile; *c*, seen from below. (Conybeare.)

The usual complicated structure observable in the Saurians appears in the Lower Jaw of the *Plesiosaurus*. The dentary piece presents

evidence of its soon becoming anchylosed to its fellow at the symphysis: it is chiefly remarkable for the expansion of its anterior extremity. No intervening vacuity separates the angular and surangular pieces as in the Crocodiles, but those pieces are joined together throughout, as in the Lacertian group. The surangular piece rises higher and forms a sharper edge for the insertion of the temporal muscles than in the Crocodiles, a structure which agrees with the greater development of these muscles, as indicated by the size of the temporal fossæ. "The articular piece presents a regular and deep concavity for the reception of the articular end of the tympanic bone; it is, as Mr. Conybeare has well remarked, more developed than in the Crocodile, and thus approximates more nearly to the corresponding part in the Lacertian type. The angular piece is prolonged backwards beyond the joint, but not quite to the same extent as in the Crocodiles." (Owen.)

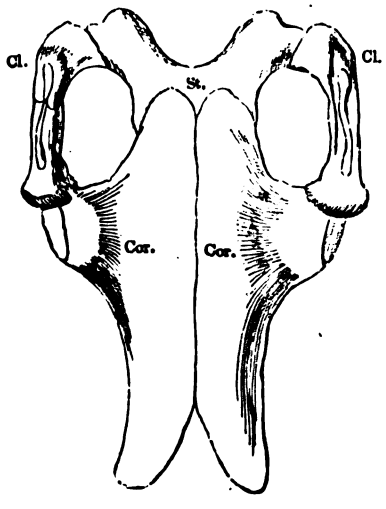
A tooth slightly magnified. (Conybeare.)

The free extremities of the Ribs are connected together, in the abdominal region, by the series of intermediate slender elongated pieces, to which Conybeare gave the approximate designation of sterno-costal arcs. Each of these sterno-costal arcs includes, in the *Plesiosaurus*, seven pieces.



Sterno-Costal Arcs of *Plesiosaurus*. (Conybeare.)

The broad coracoid bones, remarkably expanded as they are in the antero-posterior direction, are noticed by Professor Owen as the most conspicuous of those composing the Pectoral Arch: he describes their internal and anterior margins as gently convex, and meeting at the mesial plane, where they overlap the anterior thoracic ribs. Into their anterior interspace is wedged the ento-sternal piece, consisting of a short mesial process and two broad lateral expansions. A strong triradiate bone, which, in Professor Owen's opinion, seems to represent, as in the Chelonians, the scapula and clavicle united, is arched from the outer extremity of the coracoid bones, with which it combines to form the shoulder-joint, near which last point it sends upwards and obliquely backwards a branch or process representing the true scapula.

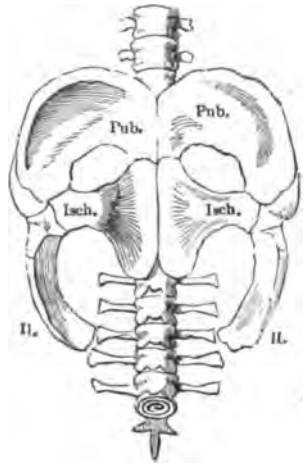


Humero-Sternal part of *Plesiosaurus*. (Conybeare.)
St., sternum; Cl., clavicle; Cor., coracoids.

The Humerus is a stout and moderately long bone, curved slightly backwards, rounded at its proximal extremity, and flattened as it approaches the elbow-joint. The Radius and Ulna are both short and flat bones, but relatively longer and more distinctly marked than in *Ichthyosaurus*. The Carpus consists of a double row of small flat

rounded ossicula, in number from six to eight. The Metacarpal Bones are elongated, slender, flattened, and slightly bent.

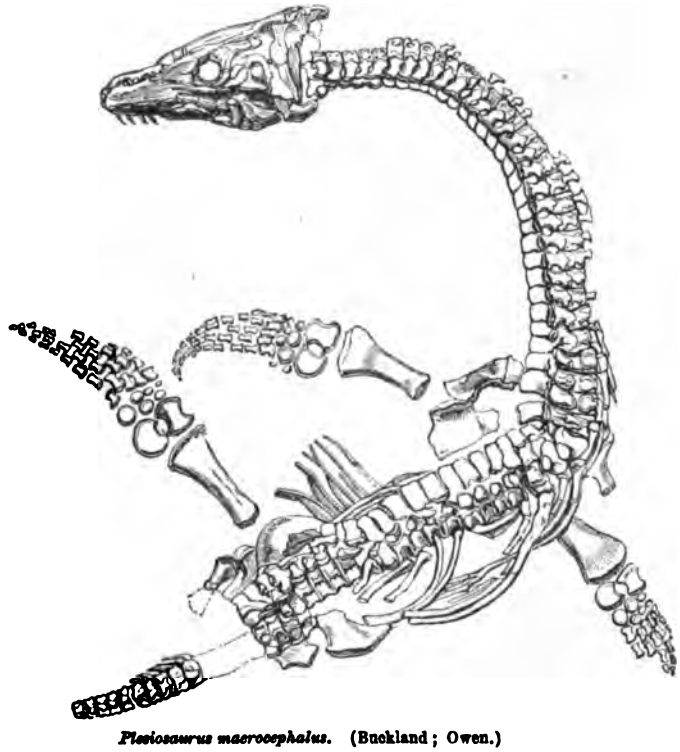
The Hinder or Pelvic Extremities are almost always equal, sometimes, as in *P. macrocephalus*, exceeding the anterior ones in size, and the Pelvic Arch consists of a strong and short Ilium, and a broad Pubis and Ischium, both of which are expanded in the antero-posterior direction analogously to the coracoid bones in the pectoral arch.



Pelvis of *Plesiosaurus*. (Conybeare.)
Pub., pubis; Isch., ischium; Il., ilium.

The radiated appendages of the pelvic arch so closely correspond with those of the pectoral arch as to require little notice. The posterior bone, or Fibula, corresponds in its curved form with the Ulna, illustrating an analogy manifested in other animals. The Tarsal Bones are principally remarkable for their small size on the tibial or anterior side of the series, indicating that the hind paddle had a freer inflection forwards, or upon the tibia, than in the opposite direction.

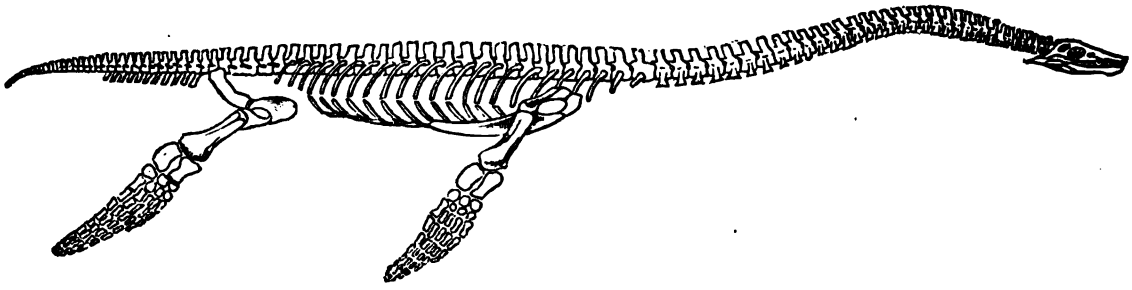
The five Metatarsals and their digits are found to correspond in structure with those of the fore paddle.



Plesiosaurus macrocephalus. (Buckland; Owen.)

For the particular variations in the skeletons of the different species the student should consult Professor Owen's report on the *Enaliosauria*, in the 'Transactions of the British Association,' from which the above general description of the osseous parts is taken.

The following species are recorded by Professor Owen:—*P. Hawkinsii*, Owen; *P. dolichodeirus*, Conybeare; *P. macrocephalus*, Conybeare; *P. brachycephalus*, Owen; *P. macromus*, Owen; *P. pachyomus*, Owen; *P arcuatus*, Owen; *P. subtrigonus*, Owen; *P. trigonus*, Cuv.;



Skeleton of *Plesiosaurus dolichodeirus* restored. (Conybeare principally.)

P. brachyspondylus, Owen; *P. costatus*, Owen; *P. dædicomus*, Owen; *P. rugosus*, Owen; *P. grandis*, Owen; *P. trochanterius*, Owen; and *P. affinis*, Owen.

Dr. Buckland truly observes that the discovery of this genus forms one of the most important additions that geology has made to comparative anatomy. "It is of the *Plesiosaurus*," he says "that Cuvier asserts the structure to have been the most heteroclite, and its characters altogether the most monstrous that have been yet found amid the ruins of a former world. To the head of a lizard it united the teeth of a crocodile; a neck of enormous length, resembling the body of a serpent; a trunk and tail having the proportions of an ordinary quadruped, the ribs of a cameleon, and the paddles of a whale. Such are the strange combinations of form and structure in the *Plesiosaurus* —a genus, the remains of which, after interment for thousands of years amidst the wreck of millions of extinct inhabitants of the ancient earth, are at length recalled to light by the researches of the geologist, and submitted to our examination in nearly as perfect a state as the bones of species that are now existing upon the earth." Conybeare thus speaks of its supposed habits:—"That it was aquatic is evident from the form of its paddles; that it was marine is almost equally so, from the remains with which it is universally associated; that it may have occasionally visited the shore, the resemblance of its extremities to those of the turtle may lead us to conjecture; its motion however must have been very awkward on land; its long neck must have impeded its progress through the water, presenting a striking contrast to the organisation which so admirably fits the *Ichthyosaurus* to cut through the waves. May it not therefore be concluded (since, in addition to these circumstances, its respiration must have required frequent access of air) that it swam upon or near the surface, arching back its long neck like the swan, and occasionally darting it down at the fish which happened to float within its reach? It may perhaps have lurked in shoal water along the coast, concealed among the sea-weed, and, raising its nostrils to the surface from a considerable depth, may have found a secure retreat from the assaults of dangerous enemies; while the length and flexibility of its neck may have compensated for the want of strength in its jaws, and its incapacity for swift motion through the water, by the suddenness and agility of the attack which they enabled it to make on every animal fitted for its prey which came within its reach." ('Geol. Trans.,' vol. i. part 2, p. 388, N. S.)

PLE'STIODON. [Scincidæ.]

PLETHODONTIDÆ. [Amphibia.]

PLEURA is the membrane which envelops the lungs and lines the cavities of the chest. On the walls of each cavity of the chest the Pleura Costalis (as it is here called) is formed by a sheet of fine and elastic cellular tissue, loosely attached to the ribs, intercostal muscles, and other subjacent parts. On the exterior of the lung the Pleura Pulmonalis is composed of a thin superficial layer of fine cellular tissue, and a deeper layer of coarser fibrous tissue, which in most of the large quadrupeds, and in the seal and some other animals, is very elastic, and affords an important assistance in the act of expiration. The surfaces of the two portions of pleura are continuous with each other at the root of the lung; each is covered with a delicate layer of epithelium; and they inclose within them a space called the sac of the pleura, into which a small quantity of serous fluid is constantly secreted, which moistens the opposite surfaces of the lung and of the wall of the chest, and permits their free motion upon each other. [Membrane.]

PLEURACANTHUS. [Fish.]

PLEUROBRANCHÆA. [Semi-Phyllidians.]

PLEUROBRANCHUS. [Semi-Phyllidians.]

PLEURODONTS. Messrs. Duméril and Bibron make their Iguaniens Pleurodontes the first sub-family of the Iguanian Lizards, or Sauriens Eunotes. [Iguanidæ.]

PLEURONE'CTIDÆ, a family of Fishes of the order *Malacopterygii* and section *Subbrachiales*. This family contains the Soles, Flounders, and Turbots, and some other fishes, all of which are readily distinguished by the flattened form of the body, and in having both the eyes on one side. This want of symmetry in the form of the head, Cuvier states, is unique amongst vertebrate animals. The side of the body which is uppermost is always coloured, and might be mistaken for the back of the fish, whilst the opposite side is white. The two sides of the mouth are unequal, and it is uncommon to find the two pectoral fins equal; the dorsal and anal fins extend the whole length of the back and abdomen respectively; the ventrals appear like a continuation of the anal; the branchiostegous membrane has six rays.

The *Pleuronectidæ* are divided into the following genera:—

Platessa, in which the jaws are each furnished with a single row of obtuse teeth; on the pharyngeans are generally some teeth like paving-stones; the dorsal fin is only extended in front to a line with the eye, and leaves, as well as the anal, an interval between it and the caudal. The form of the body is rhomboidal, and the eyes are usually on the right side.

P. vulgaris, Cuv., the Common Plaice, is usually about a foot or rather more in length; of a brown colour above, spotted with red or orange; on the eye-side of the head are some osseous tubercles; the lateral line is curved above the pectoral fin; the body is smooth, and the teeth are blunt and contiguous.

This fish is very abundant on various parts of the British coast, and is said sometimes to attain the weight of 15 lbs.

P. Flesus, the Flounder; *P. Limanda*, the Dab; and *P. microcephala*, the Lemon Dab, are also examples of the genus *Platessa*.

Hippoglossus, Cuv.—The species of this genus differ from the Plaices proper in having the body usually more elongated, and the jaws and pharyngeans armed with strong and pointed teeth.

H. vulgaris, Flem., the Holibut, is not uncommon on some parts of our coast, and is often exposed for sale in the London market. It is usually of large size. One specimen, taken in the Isle of Man, is said to have measured 7½ feet in length. In the northern parts of Britain it is called the Turbot: the Holibut however is of a much longer form than the Turbot, and by no means equal to it in flavour.

Rhombus, Cuv.—The species of this genus have the jaws and pharyngeans furnished with thickly-set small pointed teeth; the dorsal fin commences immediately above the upper lip, and this fin, as well as the anal, extends very nearly to the tail; the eyes are generally on the left side.

The Turbot, Brill, Muller's Topknot, Bloch's Topknot, the Whiff, and the Scaldfish, are British examples of the genus *Rhombus*.

R. maximus, Cuv., the Turbot, next to the Holibut, is one of the largest of the *Pleuronectidæ* found on our coast, and is the most highly esteemed for the table. The Turbot is of a short and broad form, and rather deeper than many of the flat fishes. Its prevailing colour is brown, and the whole of the coloured side is studded with hard and roundish tubercles; the lateral line is considerably arched above the pectoral fin, and thence runs straight to the tail. It is called in Scotland the Rawn Fleuk and Bannock Fleuk.

"On the coasts of Durham and Yorkshire," says Mr. Yarrell, "a considerable fishery of Turbot is carried on by the fishermen of Hartlepool and Scarborough with long lines. . . . A large portion of the Turbot produced in the English market is taken on or near the various sand-banks between the long line of our eastern shore and the coast of Holland."

R. vulgaris, Cuv., the Brill, is very similar to the Turbot in appearance, but inferior in flavour; it is common in the markets, and may at once be distinguished by its less broad form, the want of the osseous tubercles on the coloured side of the body, and the colouring, which is reddish or sandy-brown varied with darker brown, and minutely spotted with white. It is moreover a smaller fish.

Solea, Cuv., contains the Soles, which are distinguished generally by their more elongated form and the blunt and rounded shape of the muzzle. The eyes, as well as the colouring, are on the right side; the teeth are small and confined to that side of the mouth which is opposed to the eyes; the dorsal fin commences in front of the line over the eyes, and extends, as well as the anal, to the tail-fin.

Cuvier separates as a sub-genus from the Soles proper those species which have the pectoral fin on the side with the eyes very small, and that on the opposite side either rudimentary or altogether wanting. They are termed *Monochirus*.

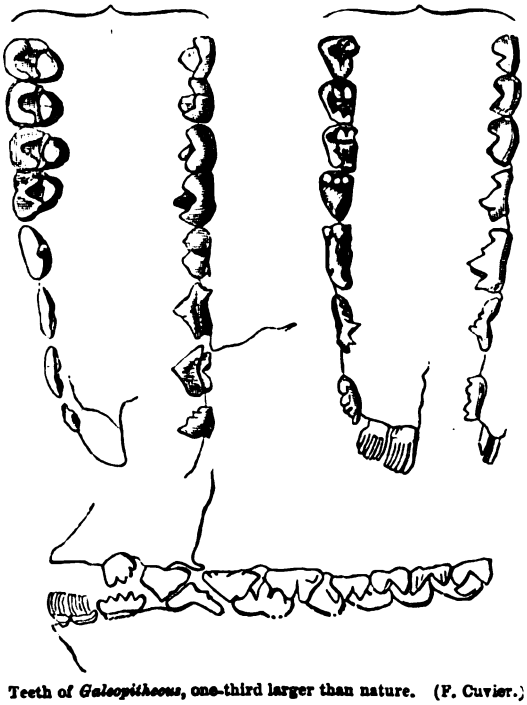
S. vulgaris, Cuv., the Common Sole, inhabits the sandy shore all round our coast, where it keeps to the bottom, and feeds upon small testaceous animals and the fry of other fishes; as they will not readily take bait, they are almost entirely caught by trawling. "Eighty-six thousand bushels of Soles were received at Billingsgate-market

only within the last twelve months." (Yarrell, 'British Fishes,' vol. ii. p. 25.)

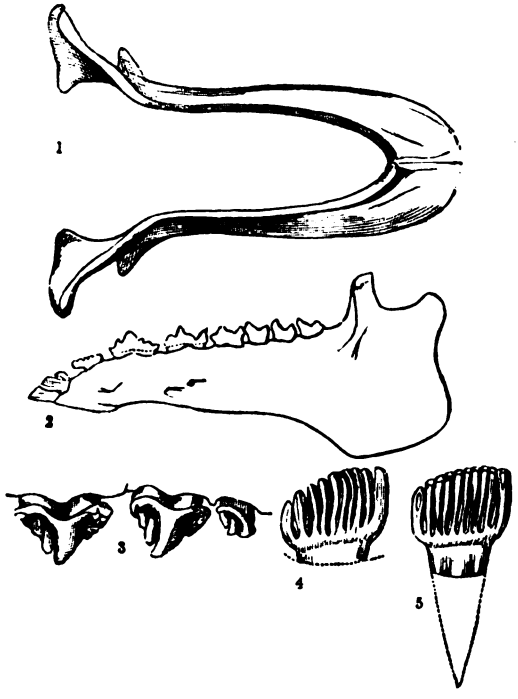
S. pegusa, Yarrell, the Lemon Sole, is occasionally taken with the common species, from which it differs in being rather broader and of a yellowish colour.

Of the sub-genus *Monochirus*, one species is found on the British coast, and is known by the names Variegated Sole, Red-Backed Flounder, &c. (*M. linguatulus*). There are moreover certain Soles in which the pectoral fins are altogether wanting; they constitute the sub-genus *Achirus* according to Lacépède.

PLEURO'PTERA, a tribe of *Mammalia* generally known as Flying Lemurs (*Galeopithecus* of Pallas; Flying Cats and Flying Foxes of



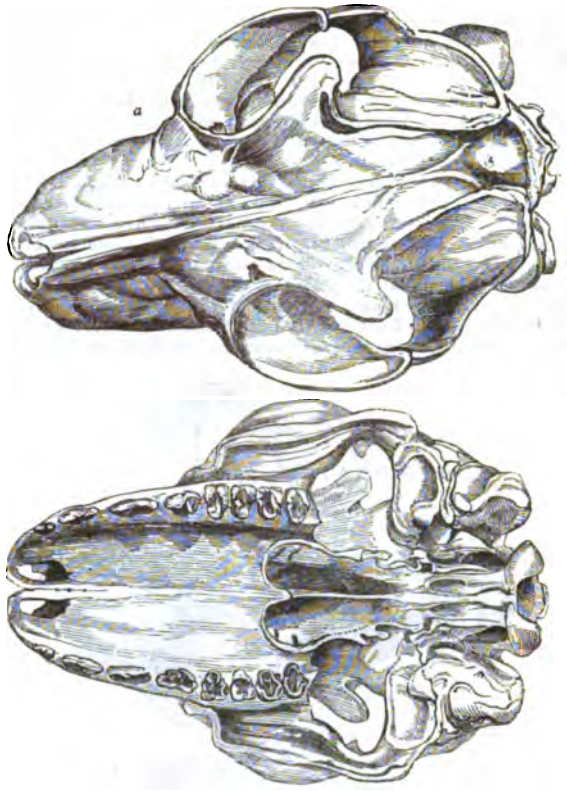
Teeth of *Galeopithecus*, one-third larger than nature. (F. Cuvier.)



Lower jaw and teeth of *Galeopithecus Temminckii*.

1, under side of the lower jaw; 2, side view of the same; 3, the three foremost teeth on either side of the upper jaw; 4, 5, outer and inner incisors of the lower jaw. (Waterhouse, 'Zool. Trans.')

voyagers). They are generally arranged under the order Carnassiers, and some authors place them in the division *Cheiroptera;* but they



Skull of *Galeopithecus Temminckii*.

a, seen from above; *b*, seen from below. (Waterhouse, 'Zool. Trans.')

Galeopithecus Temminckii.

differ from the Bats inasmuch as the toes of their anterior extremities, which are all furnished with sharp claws, are not more elongated than those of the hind feet, so that the membrane which occupies the interval between the extremities to the sides of the tail can hardly operate in executing more than the functions of a parachute.

The dentition, according to Mr. Waterhouse, is as follows:—

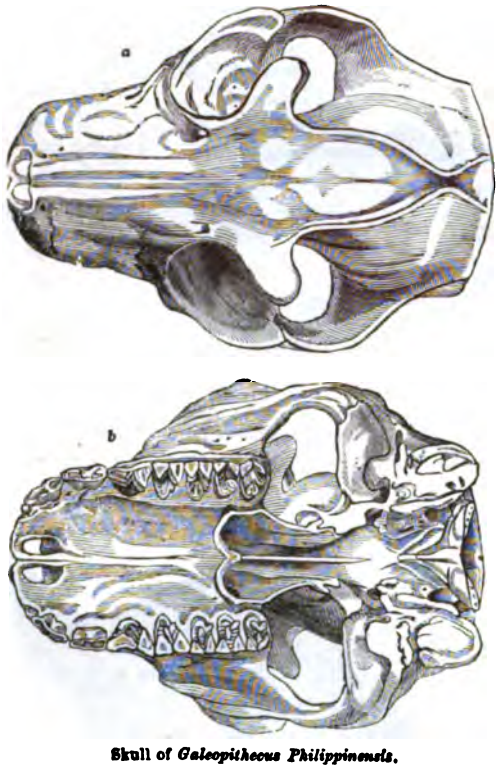
Incisors, $\frac{2-2}{4}$; Canines, $\frac{0-0}{1-1}$; False Molars, $\frac{2-2}{2-2}$; True Molars, $\frac{4-4}{4-4}$ = 34.

Cuvier states that the *Galeopitheci* live on trees in the islands of the Indian Archipelago, and there pursue insects, and perhaps birds, as their prey: judging from the detrition of the teeth with age, he thinks that they must also feed on fruits. They have a very large cæcum. In their teeth they present many analogies to the *Lemuridæ*.

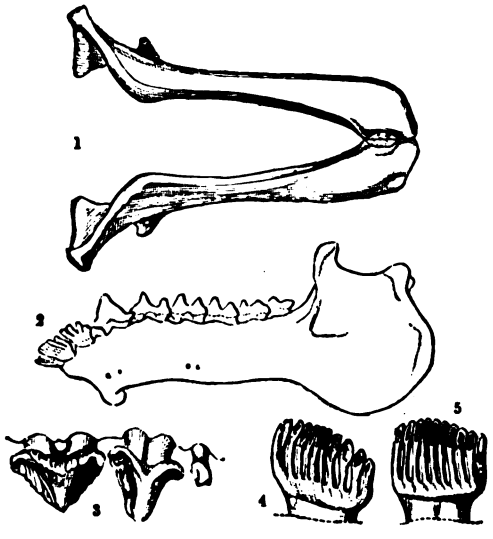
Dr. Gray makes the *Galeopithecidæ* the fourth family of the *Primates*, and places it between the *Lemuridæ* and *Vespertilionidæ*. ('Outline, &c., in Ann. of Philosophy,' 1825.)

Three species have been recorded:—1, *Galeopithecus rufus*, Geoff., Audeb. (*Lemur volans*, Linn.); 2, *G. variegatus*, Cuv., Geoff.; 3, *G. Ternatensis*, Geoff.: but the general opinion seems to have been that one only, the *Lemur volans* of Linnæus, had been satisfactorily made out. Mr. Waterhouse has however described two species, of which the following are the characters:—

G. Temminckii measures about 2 feet in total length, and its skull was 2 inches 11¼ lines in length. The anterior incisor of the upper jaw is broad, and divided by two notches into three distinct lobes; the next incisor on each side has its anterior and posterior margins notched; and the first molar (or the tooth which occupies the situation of the canine) has its porterior edge distinctly notched. This tooth is separated by a narrow space, anteriorly and posteriorly, from the second incisor in front and the second molar behind; the temporal ridges converge towards the occiput, near which however, he observed,



Skull of *Galeopithecus Philippinensis*.
a, upper side; *b*, under side.



Lower jaw and teeth of *Galeopithecus Philippinensis*.

1, under side of the lower jaw; 2, side view of the same; 3, the three foremost teeth, upper jaw; 4, 5, outer and inner incisors of lower jaw. (Waterhouse, 'Zool. Trans.')

they are separated usually by a space of about four lines. This is probably the *G. volans* of authors; but the identity cannot be said to be certain.

G. Philippinensis is described by Mr. Waterhouse as being usually about 20 inches in length, and its skull as measuring 2 inches 7 lines in length. He observes that this species may be distinguished from *G. Temminckii* by the proportionately larger ears and the greater length of the hands. The skull is narrower in proportion to its length, the muzzle as broader and more obtuse, and the orbit as smaller. The temporal ridges generally meet near the occiput, or are separated by a very narrow space. The anterior incisor of the upper jaw is narrow, and has but one notch; the next incisor on each side is considerably larger, longer, and stronger than in *G. Temminckii*, and differs moreover in having its edges even—the same remark applies to the first false molar. In this species the incisors and molars form a continuous series, each tooth being in contact with that which precedes and that which is behind it. The most important difference perhaps which exists between the two species in question consists in the much larger size of the molar teeth in the smaller skull, the five posterior molars occupying a space of 10 lines in length, whereas in *G. Temminckii*, a much larger animal, the same teeth only occupy 9 lines. ('Zool. Proc.,' 1839.)

PLEURORHYNCHUS (Phillips), a genus of fossil *Mollusca*.

PLEUROSIGMA. [DIATOMACEÆ.]

PLEUROTOMA, a genus of *Mollusca*. [SIPHONOSTOMA.]

PLICA. [IGUANIDÆ.]

PLICA'TULA. [PECTINIDÆ.]

PLICIPENNES. [NEUROPTERA.]

PLINTHITE, a variety of Bole.

PLOCARIA, a genus of Plants belonging to the alliance *Algales*, the order *Ceramiaceæ*, and the sub-order *Sphærococceæ*. One of the species, *P. Helminthocorton*, is called Corsican Moss, and has a considerable reputation as a vermifuge. It is a native of the Mediterranean.

PLOCEINÆ, a sub-family of *Fringillidæ*. [FRINGILLIDÆ.] The genus *Ploceus* (Weavers, Tisserins of the French) is thus defined by Mr. Swainson:—Size small. Bill conic, but with the culmen slightly bent, and the tip entire. Under mandible less thick than the upper. Claws large, very long. Wings pointed; but the first quill remarkably short and spurious. It inhabits the Old World only.

The following sub-genera are thus defined by the same observing author, and are arranged under the genus by him:—

Vidua.—Bill short. Wings lengthened, the second, third, and two following quills longest, and of equal length. Tail boat-shaped; males with the two middle feathers excessively elongated, generally broad and convex. (Sw.)

The Whidah-Finches, Widow-Birds, as they are familiarly termed by the British, Veuves of the French, are among the most remarkable of the section of hard-billed seed-eating birds to which they belong. These African Buntings are favourites for the cage and the aviary, where the long drooping tail-feathers, not inelegant, though out of all ordinary proportion, that adorn the males in the breeding season—for the birds are, generally, not larger in the body than canaries—immediately attract the attention. The Latin generic name and the French and English familiar ones are most probably derived from the sombre hue which prevails in their plumage, suggesting the idea of a widow's weeds.

V. paradisea. This is *Emberiza paradisea*, Linn.; Grande Veuve-d'Angola, of the French; Whidah-Bunting of English ornithologists; Widow-Bird of the English salesmen and fanciers.

The upper part of the plumage is of a faded or deep brownish-black; but this colour becomes of a paler hue on the wings and lateral tail-feathers. The whole of the head, the chin, and throat are of this faded black, which extends downwards, narrowing as it descends, to the middle of the breast. A broad rich orange-rufous collar proceeds from the upper part of the back of the neck, and unites with a tinge of the same colour on the sides of the neck and breast; this last hue passes into the pale buff of the body, abdomen, and thighs, but leaves the under tail-covers black, the colour of the upper ones.

The tail-feathers are black: the four lateral ones on each side are slightly graduated, each being a fraction of an inch, sometimes about a quarter, longer than the one above it. The next two are the long vertical externally convex feathers, so conspicuous in the male. These in fine specimens measure a foot in length from the base, and about three-quarters of an inch in width. The two middle feathers, also placed in a vertical direction, have very broad webs on their basal half (about three inches), but the remainder of the shaft becomes a plumeless hair-like process (somewhere about three inches more). Bill and feet black. Size about that of a canary.

It is a native of Senegal and South Africa.

V. erythrorhynchus, Swainson, the Red-Billed Whidah Finch, is of less size than *V. paradisea*, and is altogether an aberrant species of this group. The bill is shorter, thicker, and broader at the top. Of the four middle greatly elongated tail-feathers, two are convex, and two concave, so that when all four are closed, they form a sort of cylinder; and, but for their extremities, appear at first sight as one. It inhabits Senegal.

a, Widow-Bird (*Vidua paradisea*); *b*, Red-Billed Whidah Finch (*Vidua erythrorhynchus*).

Next to the sub-genus *Vidua*, in Mr. Swainson's arrangement, come the following:—

Euplectes (Sw.).—Bill shorter than the head. Nostrils round, partly concealed by the frontal feathers. Wings short; the second quill shorter than the third; tertials as long as the primaries. Tail short, even, or very slightly rounded. Feet large, gracile. Toes very long and slender; the lateral of equal length. Claws slender, very slightly curved.

Ploceus (Cuv.).—Bill considerably lengthened, as long as the head. Nostrils almost naked. Wings moderate; the second, third, fourth, and fifth quills nearly equal; tertails shorter than the primaries. Tail short, even. Feet large, thick. Toes robust; the lateral equal. Claws strong, thick, fully curved.

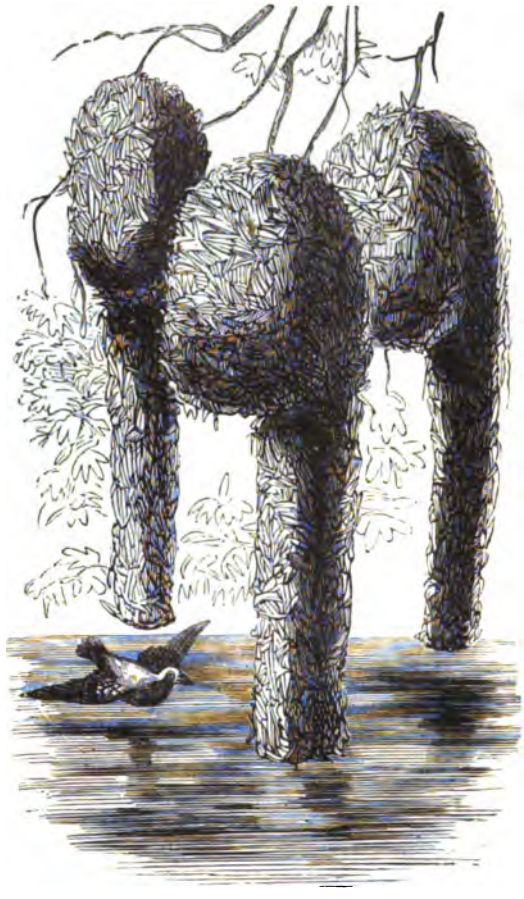
Symplectes (Sw.).—General structure of *Ploceus;* but the bill is more compressed, the commissure curved, but neither sinuated nor toothed. Wings short, rounded; the first quill half as long as the second, which, with the third, is graduated; the next three are nearly equal, and are the longest. Tail moderate, even. Feet strong. The middle toe abbreviated; inner lateral toe shorter than the outer; hinder toe long, equal to the middle toe.

Amadina follows in Mr. Swainson's arrangement, and he speaks of the genus *Ploceus* thus defined as by far the most beautiful of the division of *Coccothraustinæ*. "It is," says he, "composed of the

Weavers, a name given them on account of that surprising skill with which they fabricate their nests."

Mr. Swainson, when treating of the nests of birds, says—"There is still another sort of suspended nests mentioned by Barrow ('Travels in Africa') as fabricated by a species of *Loxia*, or Grosbeak (probably of the modern genus *Euplectes*). It seems always to build on a branch extending over a river or pool of water. The nest is shaped exactly like a chemist's retort; is suspended from the head; and the shank, of eight or nine inches long, at the bottom of which is the aperture, almost touches the water. It is made of green grass curiously woven." Of this sort of nest (which is very artfully wrought), or rather a collection of them, a plate designed by Daniell is given in Wood's 'Zoography.'

It may be considered certain that the hive-nests noticed by Barrow and Paterson are also the work of Weaver-Birds. This republic of nests, as it has been termed, is attributed by Barrow to a society of the species termed *Loxia socia* by Latham, and this bird is very properly quoted by Mr. G. R. Gray as an example of the genus *Philetærus* of Smith, *Euplectes* of Swainson, and *Ploceus* of Cuvier. The synonyms of *Loxia socia* given by Mr. G. R. Gray are *P. lepidus*, Smith, and *P Patersonii*, Less.



African Nests.

The birds in question are said to construct their nests in one clump and under one roof or cover, each nest having a separate entrance on the under side, but not communicating with the nest next to it from within. A space of ten feet in diameter is stated to be sometimes reached by these aggregated sylvan dwellings comprising a bird-population of some hundreds.

Paterson thus describes the operations of these social winged citizens:—"The industry of these birds seems almost equal to that of the bee. Throughout the day they appear busily employed in carrying a fine species of grass, which is the principal material they employ for the purpose of erecting this extraordinary work, as well as for additions and repairs. Though my short stay in the country was not sufficient to satisfy me by ocular proof that they added to their nests as they annually increased in their numbers, still, from the many trees which I have seen borne down by the weight, and others that I have seen with their boughs completely covered over, it would appear that this is really the case. When the tree that is the support of this aërial city is obliged to give way to the increase of weight, it is obvious that they are no longer protected, and are under the necessity of building in other trees. One of these deserted nests I had the curiosity to break down, to inform myself of the internal structure of

it, and found it equally ingenious with that of the external. There are many entrances, each of which forms a regular street, with nests on both sides, at about two inches' distance from each other. The grass with which they build is called the Boshman's Grass, and I believe the seed of it to be their principal food, though, on examining their nests, I found the wings and legs of different insects. From every appearance, the nest which I dissected had been inhabited for many years, and some parts were much more complete than others. This therefore I conceive to amount nearly to a proof that the animals added to it at different times, as they found it necessary, from the increase of their family, or rather of the nation and community."

One of these bird-towns is also figured in Mr. Wood's 'Zoography,' and we here present a sketch of part of the plate.

African Nests.

Another Weaver's nest, that of *P. icterocephalus*, Sw., brought together with the male, female, and eggs, from South Africa to Mr. Swainson, has been described by him, a representation of the nest of which we give in the next column.

We subjoin illustrations of some of the more remarkable species of this family.

Ploceus spilonotus, Vigors. This is the *P. stictonotus* of Smith ('South African Quarterly Journal'), and *P. flaviceps* of Swainson ('Birds of West Africa').

Dr. Smith states that this Weaver inhabits the districts bordering on the south-east coast of Africa, but he had not seen nor heard of its having been found to the westward of Kaffirland. It is rare, and generally is seen on the banks of rivers. From the trees that overhang the waters these birds suspend their nests of a somewhat kidney form, composed of blades of grass so closely interwoven as to form a complete protection against the weather.

P. Capensis, Smith (*P. Abyssiniacus*, Cuvier). Dr. Smith states that it is diffused over the more southerly districts of South Africa, and that flocks of from ten to forty individuals are often to be seen on or near the edges of marshes and rivers. From the trees or shrubs which fringe these rivers they suspend, he says, their nests, five or six of which are sometimes attached to a single branch. These nests are somewhat kidney-shaped, with the entrance towards the upper end, and directed downwards. Dr. Smith adds that trees which overhang pools of water are invariably preferred, and the twigs which approach nearest the water are commonly best supplied with nests.

The head-quarters of *P. subaureus* and *P. ocularius* must be looked for, according to Dr. Smith, to the northward of the Tropic of Capricorn; at least the paucity of specimens to the southward of it would, in his opinion, warrant such an inference. During a residence of fourteen years in South Africa, he only met with four specimens of *P. ocularius* and ten of *P. subaureus*. The specimens of *P. subaureus* procured by himself were all killed in the neighbourhood of Algoa Bay, and those contained in the collections submitted to his inspection were either obtained in the same locality or more to the eastward.

Dr. Smith states that there does not appear among the individuals of *P. ocularius* any disposition to congregate; at least he rarely found more than the male and his female associated together; and these were generally discovered in retired situations, well supplied with trees, from a branch of some of which is suspended the nest, formed of delicate fibres of bark closely interwoven, so fashioned as to present when complete the form of a retort. The male and female sit alternately upon the eggs, and while so occupied are so devoted to their duty, that they may with the greatest ease be taken in the nest alive.

Nests of *Ploceus icterocephalus*.

Yellow-Crowned Weaver (*Ploceus spilonotus*).

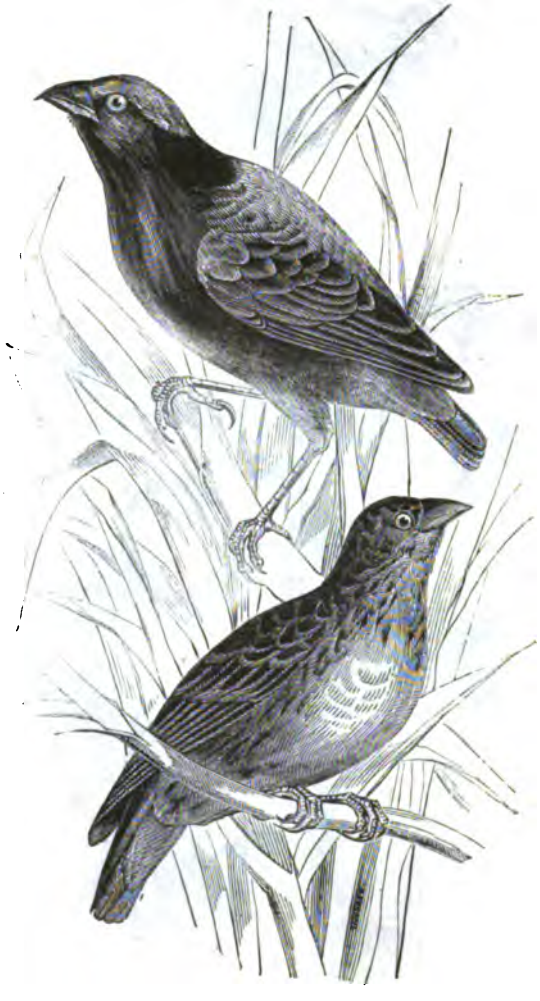
Philetærus lepidus, Smith. This is the *Loxia socia* of Latham; *Ploceus socius* of Cuvier; and *Euplectes lepidus* of Swainson.

Sociable Weaver-Bird (*Philetærus lepidus*).

Nests of Sociable Weaver-Bird.

Dr. Smith states that the banks of the Orange River appear to constitute the southern limit of the range of this species, which was only obtained in great abundance in the districts round Latakoo far from water. "The most striking peculiarity," adds Dr. Smith, "observed in this species is the extraordinary manner in which a number of individuals associate, and build their nests under a common roof. When a nestling place has been selected, and the operation of building the nests is to be commenced ab initio, the community immediately proceed conjointly to construct the general covering which interests them all; that being accomplished, each pair begins to form their own nest, which, like the roof, they construct of coarse grass; these are placed side by side against the under surface of the general covering, and by the time they are all completed, the lower surface of the mass exhibits an appearance of an even horizontal surface, freely perforated by small circular openings. They never use the same nests a second time, though they continue for many years attached to the same roof. With the return of the breeding season, fresh nests are formed upon the lower surface of those of the preceding year, which then form an addition to the general covering. In this manner they proceed year after year, adding to the mass, till at last the weight often becomes such as to cause the destruction of its support: upon which a new building is selected. They appear to prefer constructing these nests upon large and lofty trees, but where such do not occur, they will even condescend to form them upon the leaves of the Arborescent Aloe (*Aloe arborescens*), as occasionally happens towards the Orange River. The commencement of the roof is firmly interwoven with the branches of the trees to which it is intended to be suspended; and often a great part of a principal branch is actually included within its substance. Each female lays from three to four eggs, which are of a bluish-white colour, and freely mottled towards the large end with small brown dots. When once this species has attained maturity, it never afterwards exhibits any change in respect to colours. The male has no summer tints which he throws aside in winter, as is the case in *Euplectes*. Seeds, and occasionally small insects, constitute the food."

Euplectes taha. Dr. Smith states that this species does not appear to extend south of 26°, at least he discovered no individuals before he reached that latitude. They are very destructive to gardens.



Euplectes taha.

Upper figure, male; lower figure, female. (Smith.)

Plocepasser mahali (*Agrophilus*, Sw.). Dr. Smith first saw this bird upon a tree on one of the tributaries of the Orange River. The nests in figure and texture had many of the characters of those of *Ploceus*, but resembled those of some of the South African *Pyrgitæ* in the manner in which they were armed. The walls of each nest were entirely composed of stalks of grass, the thickest extremities of which were so placed as to protrude externally for several inches beyond the compact structure destined to contain the eggs. Thus each nest appeared armed with numerous projecting spines, and bore considerable resemblance to the body of a porcupine with its spines partially erected.

Plocepasser mahali. (Smith.)

Nests of *Plocepasser mahali.*

Textor erythrorhynchus. This bird is also a native of South Africa, and is found in company with herds of buffaloes, from whose hides it obtains supplies of food.

"This bird, besides being of service to its huge associates by ridding them of many of the insects with which their skins are infested, also performs for them another valuable service. On observing any unusual appearance in the neighbourhood, its attention is immediately directed to it; and, if alarm is eventually excited, the bird flies up, upon which all the buffaloes instantly raise their heads, and endeavour to discover the cause which had led to the sudden departure of this sentinel. If they are successful in the attempt, and see reason to fear for their own safety, they take to flight in a body, and are accompanied by the birds who forewarned them of their danger. On the herd again halting to feed, the birds return to their avocation, and pursue a course similar to that just described, provided the like circumstances recur. We never found this bird attaching itself to any quadruped but the buffalo, nor did we ever find the latter with any other attendants, though we found in the country in which both exist two other birds in the habit of feeding upon parasitical animals, namely *Buphaga Africana* and *B. erythrorhyncha*. These restricted their visits exclusively to the Rhinoceros." ('Zoology of South Africa.')

Textor erythrorhynchus.

PLO'CEUS. [PLOCEINÆ.]

PLOMBGOMME, a Mineral consisting of Hydrated Aluminate of Lead. It is found in the French department of Côtes du Nord.

PLOTUS. [PELECANIDÆ.]

PLOUGHMAN'S SPIKENARD. [INULA.]

PLOVER. [CHARADRIADÆ.]

PLOVER-QUAILS. [TETRAONIDÆ.]

PLUCK. [ASPIDOPHORUS.]

PLUM. [PRUNUS.]

PLUMATELLA. [POLYZOA.]

PLUMBAGINA'CEÆ a natural order of Monopetalous Exogenous Plants, with a compound superior 1-celled 1-seeded ovary, the ovule in which is supported upon a long curved funiculus, or cord. They are usually plants with a showy flower, herbaceous or under-shrubby, with several styles or stigmata, and a powerful acrid or astringent quality. The principal genus of the order is the *Statice*, whose many species, under the name of Sea-Lavenders, inhabit the salt-marshes or cliffs of all the temperate parts of Europe. [STATICE.] The prevailing colour of the flowers is blue; the instances of yellow, or any other colour, being more rare. Garden Thrift, *Armeria vulgaris*, a plant frequently used for an ornamental bordering in flower gardens, is said to possess powerful diuretic qualities in its petals.

PLUMBAGO. [GRAPHITE.]

PLUMBO-CALCITE, a Mineral consisting of Calcareous Spar with Lead. [CALCAREOUS SPAR.]

PLUMBO-RESINITE. [LEAD.]

PLUTONIC, a term applied to rocks of igneous origin and ancient geological data. [GEOLOGY.]

PLUVIA'LIS. [CHARADRIADÆ.]

PLYCTOLOPHI'NÆ. [PSITTACIDÆ.]

PLYCTO'LOPHUS. [PSITTACIDÆ.]

PNEUMOBRANCHIATA. [MALACOLOGY.]

PNEUMODERMON. [CLIONIDÆ.]

PNEUSTOI'DEA, Fitzinger's name for a family of Saurians, allied to that of the Ghameleons.

POA (the Greek πόα, 'grass'), a genus of Grasses belonging to the tribe *Festucineæ*. This tribe is characterised by very short styles, protruded stigmas, and the glumes shorter than the lowest flower. The genus *Poa* has its glumes rather unequal; the outer palea with 3 or 5 nerves, membranous below, scarious at the tip, compressed,

Plumbago capensis. [PLUMBAGINACEÆ.]

1, a flower deprived of corolla and stamens; 2, the ovary and stamens surrounding it; 3, a vertical section of the ovary, showing the peculiar position of the ovule.

keeled, unarmed; the styles terminal. The species of this genus are very numerous, constituting the commonest weeds that follow the migrations of man, and generally containing a sufficient quantity of nutritive matter to render them fodder for various animals. Thirteen species of this genus are described by Babington as natives of the British Islands. Of these the most common are the *P. annua* and *P. pratensis*. The former is perhaps the commonest of British plants, springing up on every neglected spot around the habitations of man. The latter is known by the name of the Smooth-Stalked Meadow-Grass, and is found in most pasture lands. *P. nemoralis*, the Wood Meadow-Grass, is also a common grass in shady places. Many of the recent genera of Grasses were formerly referred to the genus *Poa*.

POCHARD. [DUCKS.]

POCILLO'PORA. [MADREPORÆA.]

PODA'RCIS, a genus of Lizards.

PODA'RGUS. [GOAT-SUCKERS.]

PO'DICEPS. [COLYMBIDÆ.]

PODICEPSI'NÆ. [COLYMBIDÆ.]

PODINE'MA, a genus of Lizards.

PO'DOA. [RALLIDÆ.]

PODOCARPUS. [CONIFERÆ.]

PODOCES. [CORVIDÆ.]

PO'DOPHIS. [SCINCIDÆ.]

PODOPHTHALMATA, or PODOPHTHALMIA. [CRUSTACEA.]

PODOPHTHA'LMUS. [PORTUNIDÆ.]

PODOPHY'LLACEÆ, a small group of Polypetalous Exogenous Plants, by some regarded as a distinct natural order, and by others referred to *Ranunculaceæ* as a section. They would be Papaveraceous plants if they had consolidated carpels; but possessing no more than one carpel, they appear more referrible to *Ranunculaceæ*, from which, in fact, they seem to differ in having a solitary carpel, which however also occurs in that order, although not characteristic of it. The only species referred to *Podophyllaceæ* are *Jeffersonia* and *Podophyllum*, two North American plants, with succulent acrid root-stocks, deeply lobed leaves, and white flowers hidden among them. They have 3 or 4 sepals, twice as many petals, indefinite hypogynous stamens with linear or oval anthers, a thick sinuous stigma, and the ovules arranged along the central suture of the solitary carpel. *Podophyllum peltatum*, or May-Apple, is not uncommon in gardens, whither it has been introduced from the United States, where it is employed as a safe and active cathartic.

Podophyllum peltatum.

1, a flower; 2, a carpel; 3, a transverse section of the same; 4, a vertical section of a seed.

PODOPSIS, synonymous with *Spondylus*. [PECTINIDÆ.]

PODOSTEMA'CEÆ, *Podostemads*, an obscure natural order of tropical submersed aquatic Plants, with minute incomplete flowers. They appear to have no very obvious relation to any other natural group, and are little known even to botanists except by name. They however are certainly Exogens, and probably allied to *Urticaceæ* and *Piperaceæ*. Endlicher places them among his aquatic class, consisting of *Ceratophylleæ*, *Callitrichineæ*, and *Podostemeæ*, and enumerates seven genera.

PŒCILASMA. [CIRRIPEDIA.]

PŒCILONITTA, a genus of Ducks.

PŒCILO'PODA, M. Latreille's name for his sixth order of *Crustacea*, and arranged by him under his second sub-class, *Entomostraca*. The following is M. Desmarest's character of the order:—

Head confounded with the trunk; a shell, or the anterior of the body in the form of a buckler; mouth in the shape of a beak, or composed of appendages which cannot be compared to mandibles; antennæ short and simple or null; eyes often distinct and sessile; anterior feet terminated by one or two hooks, or by claws, fit either for walking or prehension; the posterior feet destined for natation, either composed of or accompanied by branchial laminæ, or membranous and digitated.

1st Division.

Mouth in form of a beak; antennæ to the number of four; twelve feet, of which the first two are in the form of acetabula, or suckers (ventouses). Family *Argulidæ*, Leach.

Argulus is the only genus of this division.

2nd Division.

Mouth in form of a beak; antennæ to the number of two only. Family *Caligidæ*, Leach.

These, says M. Desmarest, like the last, are crustaceous aquatic parasites; the greater part of them are marine, adhering to the branchiæ and the axillæ of fishes, having the antennæ inserted at the external angle of two lobes on the anterior surface of their shell, and the eyes most frequently not apparent.

1st Subdivision or Race.

Twelve feet; the six anterior terminated by hooks or unguiculated. Extremity of the abdomen furnished with two bristle-like appendages or oviferous tubes, which are cylindrical and elongated.

The genera arranged by M. Desmarest under this subdivision are *Anthosoma*, Leach (*Caligus*, Latr., Lam., Risso), and *Dichelestium* of Hermann the younger and authors.

2nd Subdivision or Race.

Fourteen feet; the six anterior unguiculated; the fourth or fifth pair bifid; the sixth and seventh having the haunches and the thighs very much dilated and united by pairs.

Cecrops, Leach, is the only genus placed by M. Desmarest under this subdivision.

3rd Subdivision or Race.

Fourteen feet; the six anterior unguiculated; all the others bifid.

The genera arranged under this subdivision are *Pandarus*, Leach (*Caligus*, Latr. and Lam.), and *Nogaus*, Leach.

4th Subdivision or Race.

Fourteen feet; the six anterior unguiculated; the fifth pair bifid, with the last joints ciliated with hairs.

Caligus, Müller [CALIGUS], and *Risculus*, Leach, are the genera arranged under this subdivision.

3rd Division.

Mouth with its aperture in the middle of five pairs of feet or jaw-feet, terminated in pincers, the haunches of which, rough with points, may serve for mastication; no antennæ; shell in the form of a buckler, consisting of two pieces, and terminated by a long sword-shaped tail; organs of respiration placed under the second piece of the shell. Family *Limulidæ*, Leach.

The genus *Limulus* (*Limulus*, Müll., Fabr., Lat., Leach; *Monoculus*, Linn.; *Xiphosura* and *Xiphotheca*, Gronov.; *Polyphemus*, Lam.; *Cancer*, Clus.) is the only one belonging to this division. [LERNÆADÆ; ENTOMOSTRACA; LIMULUS.]

POEPHAGUS. [BOVIDÆ.]

POGO'NIAS. [BARBETS.]

POINCIA'NA, a genus of Plants belonging to the natural order *Leguminosæ*. *P. aculeata*, or the Barbadoes Flower-Fence, is a tropical bush, about ten feet high, with bipinnate leaves, obovate leaflets, prickly branches, large terminal corymbose masses of inflorescence, covered with showy yellow or red flowers, having singularly long stamens. It has acquired its name from having been used, on account of its prickly branches, as a material for hedges in the West Indies, for which however it is ill adapted, because its branches are not much subdivided, and are always naked next the root. It is among the most beautiful of plants, and is chiefly on that account cultivated in the West Indies, to which it was introduced from the East Indies, where it is common in gardens, flowering and seeding all the year round. The leaves when bruised have a smell of savin, and are said to have the power of bringing on abortion. They are well known to be purgative, and to have been used as a substitute for senna. According to Roxburgh, the trunk of this little tree, or large shrub, when old, is constantly hollow, and occupied by a large red dark-brown ant. From this place, when disturbed, the ants issue in swarms, and inflict a severe and painful bite on their disturbers.

POINTER, a variety of the Dog used in shooting, and trained to stop and point where the game lies. This variety is the Chien d'Arrêt of the French, and the *Canis familiaris avicularis* of Linnæus.

The old Spanish Pointer was slow but very sure; and after all, where game is plentiful, there is as much or more to be picked up before one of these heavy but staunch dogs, now rarely to be found, as with the modern breed, in which swiftness is carried almost as far as it can be. Not that some of these thorough-bred fine-sterned dogs are not as staunch as any pointer of the old school, and there is something very delightful in their dashing style of ranging. A well-bred modern English Pointer, with a strong cross of the fox-hound, has perhaps as much 'travel' as can well be got out of four canine legs, and on light lands is of great endurance; whilst the true descendant of the perfect Spanish Pointer was rarely good for a second day's work. That the fine-sterned modern pointer is staunch, all who have seen high-bred and well-broken dogs act will allow; and it is recorded of Pluto and Juno, the two beauties which are immortalised in Daniel's 'Rural Sports,' that they kept their point while Gilpin took the sketch from which the picture was painted, upwards of an hour and an quarter. Steady enough this; but on the other hand, though blood will do much, these well-bred fine-sterned dogs have been found when tried on the moors to be, though fast, not stout hunters, and unable to stand work and weather like some of their rougher brethren.

Those who are interested in the subject of dog-breaking will find it well treated in Daniel's 'Rural Sports,' 'The Sportman's Cabinet,' Colonel Hawker's well-known and excellent work, and more particularly in 'Observations on Dog-Breaking,' by William Floyd, gamekeeper to Sir John Sebright, Bart., every word of which is worthy of the best attention. There are also many valuable hints in the 'Treatise on Shooting,' by the author of the 'Oakleigh Shooting Code,' in 'The Rod and the Gun.'

POISON FANGS. [OPHIDIA.]

POKE. [PHYTOLACCA.]

POLANI'SIA (from πολ, many, and ἴσος, unequal; stamens numerous and unequal), a genus of Plants belonging to the natural order *Capparidaceæ*. It has 4 spreading sepals; 4 petals; a small torus; silique sessile within the calyx, or hardly stipitate, terminated by a distinct style.

P. icosandra has a stem covered with viscid glandular hairs, 3-5 foliolate leaves, the leaflets obovate, cuneate, or oblong pubescent, scarcely longer than the petiole; the stamens are about 10 in number; the silique terete striated, rough with glandular horns, sessile and acuminated. It is a native of the East Indies, and is used in Cochin China as a counter-irritant in the same way as *sinapis* is in Europe, and as a vesicant. The root is used as a vermifuge in the United States of America.

P. graveolens is a plant beset with glandular hairs; it has trifoliate leaves; elliptical oblong leaflets; from 8 to 12 stamens; oblong siliques narrowed at the base, glandularly muricated and pubescent. It is a native of North America, and is employed as a vermifuge.

POLAR BEAR. [BEAR.]

POLECAT. [MUSTELIDÆ.]

POLEMONIA'CEÆ, a natural order of Monopetalous Exogenous Plants, with a trifid stigma, 3-celled fruit, and seeds attached to an axile placenta, the embryo lying in the midst of albumen. They are allied to *Convolvulaceæ*, from which their calyx, æstivation, placentation, seeds, and 3-celled fruit distinguish them; and also to the Echial alliance, from which their placentation, undivided capsular, not nucamentaceous fruit, and straight inflorescence, equally disjoin them. They consist for the most part of gay-flowered herbaceous plants, natives chiefly of North America. The genera *Collomia*, *Phlox*, *Leptosiphon*, *Gilia*, and *Polemonium*, are common objects of cultivation, on account of their beauty; as also is *Cobæa*, a climbing plant which grows with great rapidity, and is much used during the summer for covering trellis-work and places which require to be decorated with foliage for a few months. None of the order are of either economical or medicinal value.

POLEMO'NIUM (Πολεμόνιον of Dioscorides), a genus of Plants, the type of the natural order *Polemoniaceæ*. It has a campanulate 5-cleft calyx, a rotate corolla, and a short tube with a 5-lobed equal erect limb; 5 equal stamens inserted in the throat of the corolla, with filaments dilated at the base, bearded in a continuous ring, and nearly closing the throat, and incumbent anthers; a roundish capsule with membranous crustaceous valves, covered with the permanent calyx and many-seeded cells; the seeds oblong, trigonal, and filled with albumen; the radicle twice as long as the cotyledons. The species are erect herbaceous plants, with alternate unequally-pinnate leaves; the flowers terminal, bracteated, arranged on panicled corymbs, with blue or white corollas. About 12 species have been described, most of them being cultivated and known in our gardens as Greek Valerian.

P. cæruleum, Common Greek Valerian, Jacob's Ladder, or Ladder of Heaven, has a glabrous stem, pinnate leaves, ovate lanceolate acuminated leaflets, the segments of the calyx ovate or elliptic, lanceolate, pointed; the panicle downy, glandular. The stem is one or two feet high; the leaves alternate; the flowers numerous, bright blue or white, somewhat drooping. It is a native of Europe and America, and is found in Great Britain, but is a rare plant. A great number of varieties have been described. It is a favourite plant in our gardens, and will grow in any common garden soil, and may be readily propagated by dividing the root or by seed. Although deriving its generic name from the *Polemonium* of Dioscorides, it does not appear to agree at all with his description of that plant, and Fraas refers it to *Hypericum Olympicum*. Great virtues were attributed to the ancient *Polemonium*, and these were transferred to the modern plant; but neither the ancient nor modern plant possesses any active medical properties. Slight astringency is the only property possessed by any of the species of *Polemonium*.

(Fraas, *Synopsis Plant. Floræ Classicæ;* Babington, *Manual of British Botany.*)

POLIA'NTHES, a genus of Plants belonging to the natural order *Liliaceæ*. *P. tuberosa*, or the Tuberose (a corruption of Plante Tubéreuse), is a tuberous-rooted plant, highly prized for the delicious fragrance of its flowers, on which account it is cultivated in the warmer parts of both the Old and New World. Doubts are entertained regarding its native country. It appears to have been first seen in Europe by Clusius, who received it from Simon de Tovar as an Indian plant, but whether from the East or the West is unknown. It is extensively cultivated in the East Indies, whence it has been supposed to be an Asiatic plant; but no traveller has found it wild there, and it has no Sanscrit name. It is therefore more probable that it is of South American origin, for it is equally common there in cultivation; and, as Sir James Smith has rightly observed, its constitution is more like a Peruvian plant than one of Ceylon or Java. Of late years a wild Tuberose (*P. gracilis*) has been found in South Brazil, which is probably the origin of the garden plant.

The Tuberose is too tender a plant to be cultivated in England in the open air; but in the south of Europe it finds a climate suitable to it, and the Genoese supply the principal part of the European market with tubers for forcing. The latter are imported into this country by the Italian oilmen, who sell them, with orange-trees, Narcissus roots, and similar products of the south.

POLISHING SLATE, *Polir Schiefer*, a Mineral, occurring massive, with a slaty texture. Its colour is white, yellowish-white, or yellow. Brittle. Opaque. Specific gravity 2·59. It is found near Bilin in Bohemia, at Zwickau in Saxony, and Auvergne, and is supposed to be a volcanic product. Its analysis by Buchols gives—

Silica	83·5
Alumina	4·0
Lime	8·5
Oxide of Iron	1·6
Water	9·0
	106·6

The silica is apparently derived from *Diatomaceæ*. [DIATOMACEÆ.]

POLLACK. [MERLANGUS.]

POLLEN. [STAMENS; REPRODUCTION.]

POLLEN. [BEE.]

PO'LLIA (Gray), a genus of *Mollusca*.

POLLI'CIPES. [CIRRIPEDIA.]

POLLONTES (De Montfort), a genus of *Foraminifera*.

POLLUX, a Mineral containing Silica, Potash, and Soda.

POLYADE'LPHIA, the name given by Linnæus to the eighteenth class of his Sexual System. It was so named from πολύς, many, and ἀδελφός, a brother, in allusion to the stamens being collected into several parcels.

POLYA'NDRIA, the name given by Linnæus to the fourteenth class of his Sexual System. Although the name means literally many stamens or males, yet it is applied, in a restricted sense, to those plants only which have many stamens arising immediately from below the ovary.

POLYANTHUS, a garden variety of the Oxlip Primrose, with brown flowers, is one of those plants which have from time immemorial been favourites in gardens. It was probably obtained by accident, and is now propagated either by seeds or division of its root.

POLYANTHUS NARCISSUS is the *Narcissus Tazzetta*. [NARCISSUS.]

POLYBASITE. [SILVER.]

POLY'BIUS. [PORTUNIDÆ.]

POLY'BORUS. [FALCONIDÆ.]

POLYBRACHIONIA. [ACALEPHÆ.]

POLYBRANCHIATA, M. De Blainville's name for his second order of *Paracephalophora Monoica*, consisting of the families *Tetracerata* and *Dicerata*. The first of these families consists of the genera *Glaucus*, *Laniogerus*, *Tergipes*, *Cavolina*, and *Eolis*; the second, of the genera *Scyllæa*, *Tritonia*, and *Tethys*. [NUDIBRANCHIATA.]

POLYCARPON (from πολύ, many, and κάρπος, a seed or fruit: seeds numerous), a genus of Plants belonging to the natural order *Paronychiaceæ*. The sepals are slightly coherent at the base; the petals 5 and emarginate; the stamens 3-5; styles short and 3 in number. The fruit is a 1-celled, 3-valved, and many-seeded capsule.

P. tetraphyllum has triandrous leaves, emarginate petals, the stem-leaves in fours, and the leaves on the branches opposite. In young plants the leaves are often all opposite. It is a native of the coasts of the south-west of England, of Europe, and the Canary Islands.

There are two other species of *Polycarpon*: *P. alsinefolium*, an inhabitant of Europe, the Cape of Good Hope, and Holland; and *P. peploides*, a native of Sicily and France.

(Babington, *Manual of British Botany*.)

POLY'CERA. [NUDIBRANCHIATA.]

PO'LYCHRUS. [IGUANIDÆ.]

POLYCOTYLEDONOUS PLANTS are those which have more than two cotyledons. Instances of this occur in the *Cruciferæ*, in *Lepidium*, and *Schizopetalum*; in the *Boraginaceæ* order, in *Anchusa*; and especially in Coniferous plants. All such plants are referred to the Dicotyledonous type. [SEED.]

POLYCRASE, a mineral nearly allied to *Polymignite*.

POLYDECTUS, a genus of *Crustacea*.

POLYDONTES (De Montfort), a genus of *Helicidæ*.

POLYERGUS, a genus of *Formicidæ*, separated from *Formica* by Latreille. The type of the genus is *F. rufescens*, the Amazon Ant. The species are destitute of stings, and have the antennæ near the mouth and the mandibles narrow, curved, or very much hooked. The habits of the Amazon Ant, *P. rufescens*, are very remarkable, the neuters of this species unite with those of *Formica sanguinea* in making war upon the neuters of other species of *Formicidæ*, especially *F. cuniculuria* and *F. fusca*. The result of the conquest is the making slaves of the latter, who are always found doing the hard work of the colonies of their enslavers. [ANT.]

POLYGALA, a genus of Plants belonging to the natural order *Polygalaceæ*. It has five persistent sepals, the alæ large and petaloid; petals three, their claws all united with the stameniferous tube, the lower ones carinate (keel-shaped), the two additional ones abortive; stamens united into a tube at the base, which is cleft in front; anthers opening by a pore; ovary 2-celled; ovules solitary, pendulous from the apex of the cell; capsule 2, locular, loculicidal, compressed; seeds pendulous from the apex of the cells, pubescent, with a carunculate arillus at the hilum; albumen abundant, fleshy. The species are shrubs or herbaceous plants. The flowers arranged in terminal or axillary racemes.

P. Senega, Virginian Snake-Root, a perennial plant, native of several parts of North America, but the best is found in Virginia, having a rootstock, about the thickness of a quill, twisted, and generally branched, the rootlets being esteemed the most powerful part in medicine. The leaves are alternate, sessile, lanceolate, with a sharpish point, smooth, paler underneath; flowers white, in a close terminal spike; sepals 5; corolla small, closed, having two obtuse lateral segments, and a short crested extremity.

P. vulgaris, Milkwort, a British species. It has a crested keel; flowers in a terminal raceme; wings of calyx obovate, mucronate; lateral bracts longer than pedicels; lower leaves smaller than the upper. It is found in dry pastures. *P. calcarea* is a second British species.

P. rubella is found in dry gravelly soils in many parts of the United States. It is used in medicine as a tonic.

There are 14 species of *Polygala* found on the continent of Europe, mentioned in Wood's 'Tourist's Flora.'

POLYGALACEÆ, *Milkworts*, a natural order of Exogenous Plants. The species are herbs or shrubs with simple exstipulate leaves; the pedicels have three bracts, and the flowers are irregular, unsymmetrical, and falsely papilionaceous; sepals five, irregular, odd one posterior, two inner ones (wings) usually petaloid; petals more or less united, usually three, of which one (the keel) is anterior, larger, and sometimes crested; stamens six or eight, usually combined into a tube, which is split on the upper side; anthers 1-celled, opening by pores; ovary usually 2-celled, with a single pendulous anatropal ovule in each cell; style curved; capsule flattened, with albuminous carunculate seeds, containing a straight embryo. The order is considered by St. Hilaire and others as allied to *Sapindaceæ*, and some authors place it near *Leguminosæ*, from which it differs in its hypogynous stamens, and in the odd sepal being superior, and the odd petal inferior. The plants are scattered all over the globe. There are about 500 known species. The genera are *Salomonia*, *Polygala*, *Mundia*, and *Securidaca*. They are generally bitter and acrid, and the roots yield a milky juice. (Balfour, *Classbook of Botany*.)

POLYGAMIA, a Linnæan class of Plants in which the species have male and hermaphrodite, or female and hermaphrodite, or both female, male, and hermaphrodite flowers on the same or different individuals.

POLYGASTRICA. [INFUSORIA.]

POLYGONA'CEÆ, *Buckwheats*, a natural order of Apetalous Plants with triangular fruit and usually with stipules united into a tube or ochrea, through which the stem passes. Their fruit is composed of three aspermous carpellary leaves joined by their edges, and surrounding a single erect ovule deriving its origin from a central placenta; and it proves the truth of the modern theory, that in many cases the ovules derive their origin immediately from the centre of vegetation, or the growing point, and not from the margin of carpellary leaves. The order consists of herbaceous plants more frequently than of shrubs, and a large part of them are mere weeds; as for example our docks, and wild polygonums; some however are handsome flowers, as the *P. orientale*, or Garden Persicaria, and *P. amplexicaule* [POLYGONUM]; others are valuable for cooking, as the rhubarb, whose roots also furnish the important tonic and purgative drug of that name, and in some a great quantity of astringent matter is found, as in the *Coccoloba uvifera*, or Seaside Grape of Jamaica, from which a kind of Kino has been prepared. [COCCOLOBA.] A species of Indian *Polygonum*, *P. tinctorium*, has recently been introduced into cultivation in Belgium as a substitute for indigo. The flour of the seeds of *P. tartaricum*, *P. Fagopyrum*, and others, is made into a bad kind of bread in Lombardy and other countries. [POLYGONUM.]

The genus *Rheum* also belongs to this order. [RHEUM.]

POLY'GONUM (the Greek πολύγονον, 'much productive'), a genus of Plants belonging to the natural order *Polygonaceæ*. It has a 5-parted perianth, from five to eight stamens, and from two to three styles; a 1-seeded trigonous or compressed nut, lateral incurved embryo, the cotyledons not contorted. This is a very extensive genus, containing the Knotgrasses, Bistorts, Persicarias, and Buckwheats of our own waysides, fields, and gardens. They grow in almost any soil, some being aquatic, and others flourishing in sandy sterile tracts.

P. Bistorta, Snake-Weed, has a dense spike, ovate-suboordate leaves, the radical leaves with winged foot-stalks, the stamens half as long again as the perianth, the nut triquetrous, its faces ovate, smooth. The calyx is rose-coloured and deeply 5-cleft, obtuse, and spreading. The fruit is black and shining. This plant is one of the most powerful vegetable astringents, its root contains tannin and gallic acid in abundance; a decoction of it is employed in gleet and leucorrhœa as an injection, as a gargle in sore throats, and as a lotion to ulcers attended with excessive discharge. Internally it has been used combined with gentian in intermittents. It may also be employed in passive hæmorrhages and diarrhœa. [BISTORT, in ARTS AND SC. DIV.]

P. amphibium has a dense ovate cylindrical spike, stalked ovate-oblong floating leaves, a compressed smooth shining nut, five stamens, and a creeping root. The flowers are of a bright crimson colour. It is a native of England in ponds, ditches, and wet places. It is a fine showy plant, but one of the most difficult to eradicate from lands recovered from rivers or drained lakes and marshes. The subaquatic stems root at every joint, and extend to a surprising length, rising through the soil. They bear some resemblance to sarsaparilla, and according to Coste and Willemet they are substituted for this drug by the herbalists of Nancy; these authors also report that the apothecaries and druggists of Lorraine give it the preference.

P. hydropiper, the Water-Pepper, has drooping filiform interrupted spikes, lanceolate wavy leaves, glandular perianths, a large compressed nut, its faces ovate, acute, and of a purplish-black colour. It is a hot acrid plant, and is reputed to be a powerful diuretic, but it loses its activity by drying, and therefore requires to be used in a fresh state.

It dyes wool of a yellow colour. The seeds, according to Bulliard, are used in some of the French provinces instead of pepper. The leaves are so acrid as to act as vesicants. It is a native of England in ditches and wet places.

P. aviculare has from one to three flowers together, axillary lanceolate leaves, or elliptical plane stalked lanceolate acute ochreæ, with few distant simple nerves at length by growth becoming torn, a triquetrous nut with raised points shorter than the perianth. Its numerous seeds supply abundant food for small birds; they are said to be emetic and cathartic. Thunberg says that in Japan a blue dye is prepared from this plant.

There are many other species of *Polygonum*, natives of Great Britain and other parts of the world, but too numerous for description here. *P. tinctorium* is cultivated in France and Flanders on account of the fine blue dye extracted from it. The seeds of *P. barbatum* are used in medicine by the Hindoo practitioners, and are said to ease the pain of griping in the colic. The leaves of *P. hispidum* are said by Humboldt to be substituted in South America for tobacco; and *P. anti-hæmorrhoidale* is esteemed in Brazil on account of its astringency in baths, poultices, &c. The juice, as well as an infusion of the ashes when burned, is employed by the Brazilians in the clarification of syrup and the condensation of sugar.

P. Fagopyrum, the Buck-Wheat, is now referred to *Fagopyrum esculentum*. [FAGOPYRUM.]

(Lindley, *Vegetable Kingdom*; Babington, *Manual of British Botany*; Burnett, *Outlines of Botany*; Lindley, *Flora Medica*.)

POLY'GONUM (Schumacher), a genus of *Mollusca*.

POLYGY'RA, a genus of *Helicidæ*.

POLYHALITE. [MAGNESIA.]

POLYHYDRITE. [IRON.]

POLY'LEPAS. [CIRRIPEDIA.]

POLYLITE, a form of *Augite*, allied to *Hedenbergite*. [AUGITE.]

POLYMIGNITE, a Mineral, consisting of Titaniate of Iron, Zircon, &c. It occurs crystallised. Primary form a right rhombic prism. Fracture conchoidal. Hardness, scratches phosphate of lime, and is scratched by felspar. Colour black. Lustre nearly metallic. Opaque. Specific gravity 4·806. Before the blow-pipe infusible; acted upon by sulphuric acid, when reduced to fine powder. It is found in imbedded crystals at Frederiksvärn in Norway. The following is the analysis by Berzelius:—

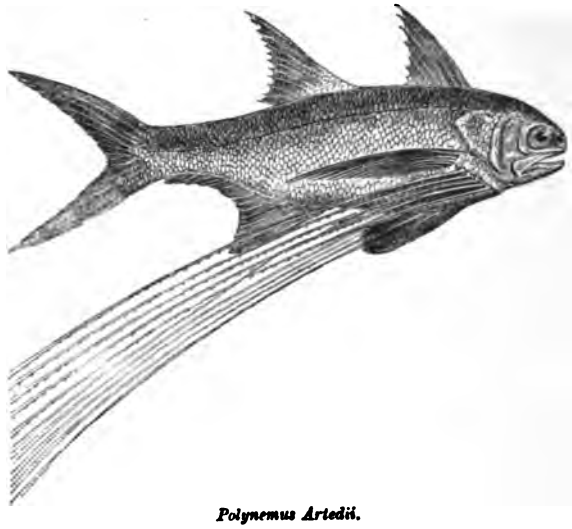
Titanic Acid	49·3
Oxide of Iron	12·2
Oxide of Cerium	5·0
Oxide of Manganese	2·7
Zirconia	14·4
Yttria	11·5
Lime	4·2
Magnesia, Potash, Silica, and Oxide of Tin	traces
	99·3

POLYNE'MUS, a genus of Fishes, placed by Cuvier in his third division of the *Percidæ*, the species of which are distinguished by the ventral fins being inserted farther back than the pectorals. These fishes are further distinguished by having several long filaments beneath the pectoral fin; these are, in fact, free rays of that fin: their teeth are minute and dense as the pile on velvet, or recurved like the teeth in a carding-machine; they are found on both jaws, as well as on the vomer and palate. The general form of the body of the *Polynemi* somewhat resembles that of the perch; the muzzle projects over the mouth; the eyes are rather large and placed very forward; the dorsal fins are short and widely separated, and the caudal fin is large, and more or less forked. The scales extend on the fins, as in many of the *Sciænidæ*, which these fishes appear to approach in some other characters.

Considerable interest is attached to the *Polynemi* on account of their yielding isinglass. This fact was first made known by Dr. Cantor, who found that several species of *Polynemus* might be used for obtaining isinglass.

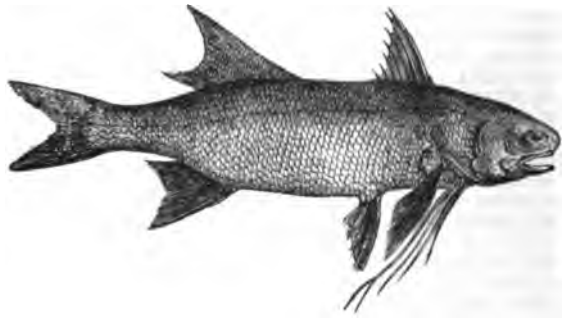
"The species best known," says Dr. Cantor, in a communication to the Zoological Society, "is the *Polynemus Risua* of Hamilton (*P. longifilis*, Cuvier; the Tupsee, or Mango Fish, of the Anglo-Indians): this inhabits the Bay of Bengal and the æstuaries of the Ganges, but enters the mouths of the rivers even higher up than Calcutta during the breeding season (April and May), when the fish is considered in its highest perfection, and is generally sought as a great delicacy. This species is the smallest, for its length seldom exceeds eight or nine inches, and one inch and a half or two inches in depth." It is remarkable for the great length of filaments, or free rays, of the pectoral fins, these being about twice the length of the body, and seven in number on each side. *P. aureus* and *P. Typsui* of Hamilton, Dr. Cantor states, are closely allied to this species. "*Polynemus Sele*, Hamilton (*P. plebeius*, Broussonnais; *P. lineatus*, Lacépède), is the Suleah Fish first mentioned in Parbury's 'Oriental Herald,' as yielding isinglass. This species, as well as another closely allied to *P. quadrifilis*, Cuvier, which I have dissected, figured, and described, under the name of *P. Salliah* (Saccolib), appears to be equally plentiful, in shoals, all the year round, in the æstuaries of the Ganges, and is appreciated by Europeans for its excellent flavour: both species attain a size from three to four feet in length, and eight to ten inches in depth." Cantor.)

Besides these species found on the coast of the mainland, two other species of *Polynemus*, *P. hexanemus* and *P. heptadactylus*, have been discovered off the coast of Java. On the coast of Africa and in the West Indies, certain species of the present genus are found. One of the African species is confounded by Cuvier with the Indian *P. longifilis*, and the mistake has been rectified by Mr. Bennett. It appears that this species (which is in all probability the *Pentamenus* of Artedi, on which Linnæus established his *P. quinquarius*) differs from the Mango Fish of India in the number of free rays to the pectoral fins, the latter having seven rays, and the African species only five. Messrs. Cuvier and Valenciennes, not having found any species of *Polynemus* with so few as five free rays, and those longer than the body, imagined that the *P. quinquarius* was founded on a mutilated specimen. Several individuals however having this character being discovered by Captain Belcher, R.N., during his survey of a part of the Atlantic coast of North Africa, Mr. Bennett proposed to name the species after Artedi.



Polynemus Artedii.

The second African species belongs to that section in which the free rays of the pectoral fins are short, and has received the name of *Polynemus quadrifilis*.



Polynemus quadrifilis. (Cuv. et Val.)

In the American *Polynemus* (*P. Americanus*) there are seven free rays to the pectoral fin, and these scarcely reach the tip of the ventral fins: it is about one foot in length, of a silvery colour; the pectoral fins are almost black, and the other fins are spotted with black.

POLYODONTA ('many-toothed' tribe), a name applied by Lamarck and M. De Blainville to the *Arcacea* [ARCADÆ] of the former, the Ark-Shells, &c., of collectors, comprehends the forms collected by Linnæus, in his 'Systema Naturæ,' under the genus *Arca*, and those designated by more modern zoologists as the genera *Arca*, *Cucullæa*, *Pectunculus*, and *Nucula*.

Lamarck's *Arcacea* constitute a part of his Conchifères Ténuipèdes, and are arranged by him between the Cardiacées and the Trigonées.

De Blainville places his family *Polyodonta* or Arcacés between the *Mytilacea* and *Submytilacea*.

Lamarck thus defines the family:—

"Cardinal teeth small, numerous, entering, and disposed in each valve in either a straight, a curved, or a broken line."

M. Rang makes the *Arcadæ* consist of the genera *Cucullæa*, *Arca*, *Pectunculus*, *Nucula*, and *Trigonia*, and gives the following as the character of the family:—Animal having the mantle entirely open throughout its circumference, excepting towards the back, without tubes or any particular apertures, and partially adherent; sometimes prolonged backwards; the foot always very considerable. Shell

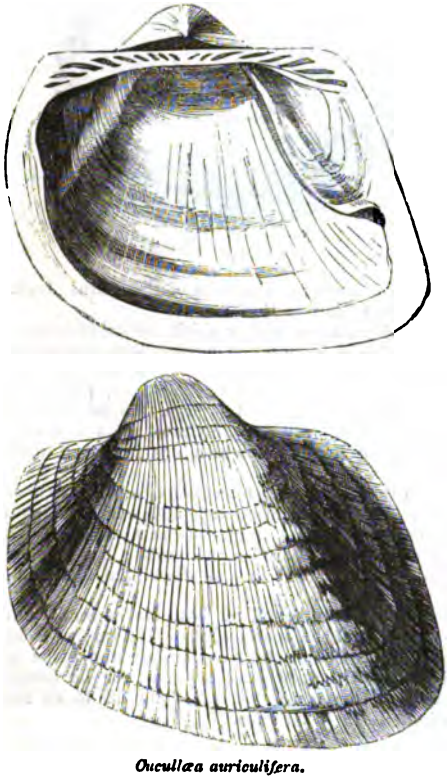
generally thick, regular, equivalve, inequilateral, with a similar hinge in each valve always formed of serial teeth, which are often lamellar, fitting into each other, straight or oblique; muscular impressions nearly always united by a pallial impression, which is very narrow, and parallel to the border of the shell.

Cucullæa (Lam.).—Animal very thick, having the mantle a little prolonged backwards, and bordered by an irregular row of tentacular filaments; labial appendages small and triangular; foot large, pedunculated, compressed, and slit longitudinally. Shell thick, navicular, equivalve, inequilateral, ventricose, with distant umbones; hinge linear, straight, formed of small transverse teeth for the greatest part of its length, and of many other teeth or longitudinal ribs; ligament entirely external; anterior muscular impression forming a projection with an angular or auriculate border. (Rang.)

There is only one recent species of *Cucullæa*.

This species is the *Arca concamerata* of Martini, *A. Cucullus* of Gmelin, *A. cucullata* of Chemnitz, and *Cucullæa auriculifera* of Lamarck, under which last name it is generally known; but, as M. Deshayes well remarks, Martini's name has the priority, and it ought to be that by which the species should be designated.

The shape of the shell, which is of fair size, will be seen better from the subjoined cut than from verbal description. The longitudinal striæ are more marked than the transverse striæ. The colour is rather a deep cinnamon-brown externally, and internally on the anterior part brown tinged with violet. It is a native of the Indian Ocean; sandy bottoms.



Cucullæa auriculifera.

There are about 100 species of *Cucullæa* fossil, chiefly Silurian.

Arca (Linn.).—Animal more or less thick, generally rather elongated; mantle prolonging itself slightly backwards, and with a row of tentacular filaments on its borders; labial appendages very small and slender; foot pedunculated, compressed, and slit throughout its length.

Shell navicular, rather thick, equivalve, inequilateral, elongated, more or less oblique; umbones distant and often a little recurved forwards; hinge linear, straight, furnished throughout its length with a numerous row of small teeth or transverse laminæ, which are equal and intrant; ligament entirely external.

M. Rang, who gives the above as the characters of *Arca*, remarks that the species sometimes adhere by their foot, and more frequently by means of a byssus.

M. De Blainville divides the *Arcæ* into the following subdivisions:—

A. (Les Navicules).—Navicular species; the hinge completely straight; the foot tendinous and adherent. (*Byssoarca*, Sw.) [Byssoarca.] Ex. *Arca Noæ.*

B. (Les Bistournées; Genus *Trisis*, Oken.) Ex. *A. tortuosa.*

C. (Genus *Cucullæa*, Lam.)—Navicular species; the hinge completely straight; the terminal teeth much longer and more oblique than the others. Ex. *Cucullæa auriculifera*, Lam.

D. Species with a straight hinge not notched or not gaping inferiorly. Ex. *A. barbata.*

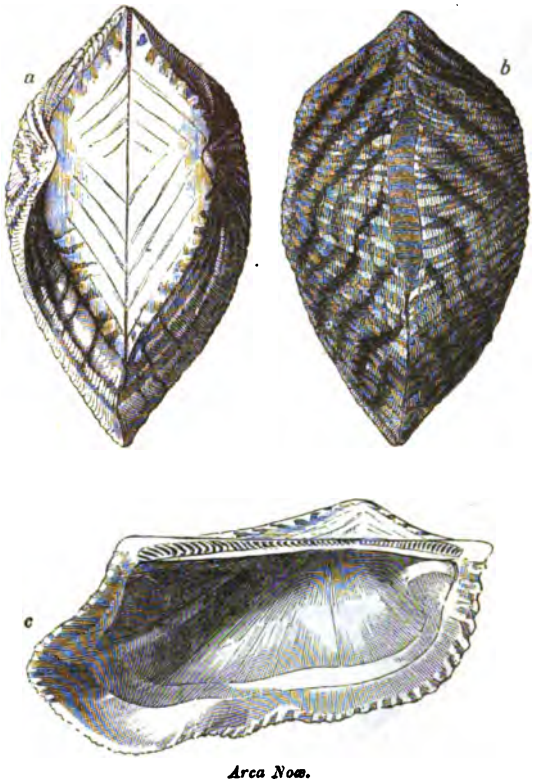
E. (Les Rhomboides.)—Species well closed, of less elongated form more pectinoid, and with a straight hinge. Ex. *A. rhombea.*

F. Oval species, elongated or a little arched longitudinally, slightly gaping inferiorly, with the umbones at a little distance from each other, the ligament nearly internal, and the dental line a little bent. Ex. *A. mytiloidea.*

The number of recent species recorded by M. Deshayes, in his Tables, is 43. Woodward gives 130 species.

The following descriptions and cuts will give some idea of the difference of form assumed by the shells of this genus:—

A. Noæ. Shell oblong, striated; apex emarginate; umbones very remote, incurved; margin gaping. It inhabits the Atlantic Ocean and seas of Europe.



Arca Noæ.

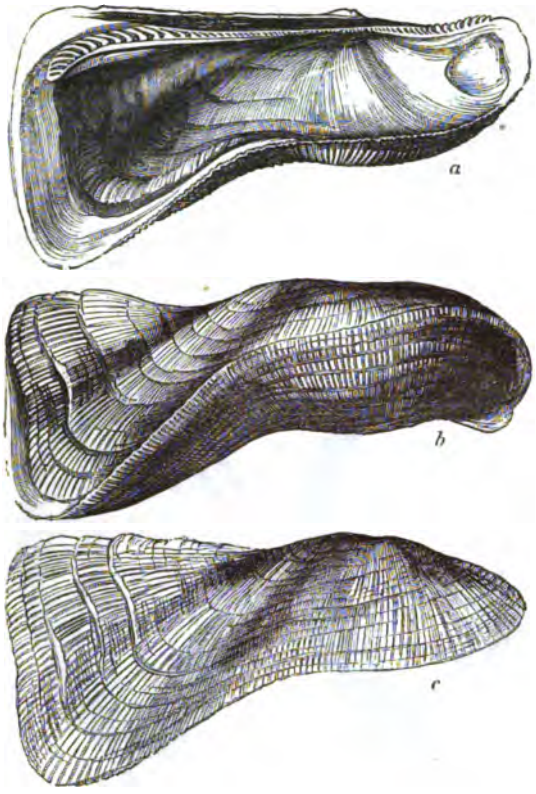
a, valves closed, with the umbones and area of the hinge towards the spectator; *b*, valves closed, with the ventral or inferior aspect, showing the margin, opposite to the spectator; *c*, internal view of one of the valves.

A. tortuosa (Genus *Trisis*, Oken). Shell twisted, parallelopiped, striated; valves obliquely carinated; umbones small, recurved. It inhabits the Indian Ocean.

A. antiquata. Shell transverse, obliquely cordate, ventricose, many-ribbed; the ribs transversely striated and blunt; the posterior ribs bifid. Colour white.

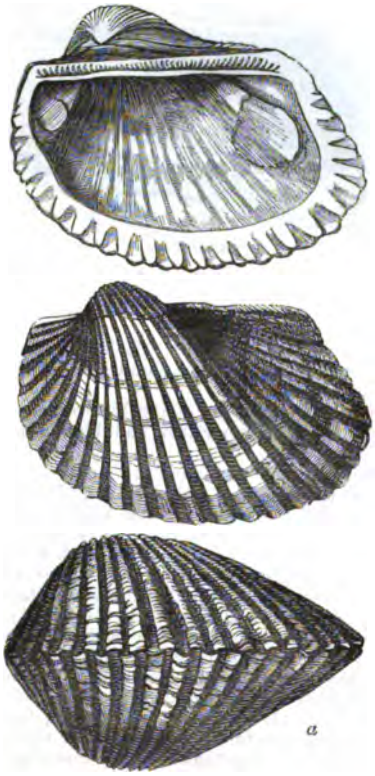
Lamarck gives the Indian Ocean, the coasts of Africa, and the Mediterranean, as the localities of this species, of which M. Deshayes, in the last edition of the 'Animaux sans Vertèbres,' says that he is convinced that since the time of Linnæus two species at least have been confounded under the denomination of *A. antiquata*, although they are easily distinguished; the one, more transverse, has the cardinal surface always furrowed into lozenge shapes when the valves are united; the other having a thicker shell, the ribs flatter, wider, and striated, but never with furrows on the cardinal surface. This last, being the most common and most anciently known, should, in his opinion, retain the name of *A. antiquata*, and he cites the following figures of the shell:—'Gualt. Test.,' pl. 87, f. C.; Chemn., 'Conch.,' t. vii. pl. 55, f. 548; 'Encyclop.,' pl. 306, f. 2; Gronov., 'Zooph.,' pl. 18, f. 13. M. Deshayes further remarks, that the shell figured by Poli and cited by Lamarck in the synonymy constitutes a species distinct from the two others. He adds that this, which inhabits the Mediterranean, is the living analogue of *A. diluvii.* Neither, in his opinion, is the *A. antiquata* of Brocchi a true *A. antiquata*, but the *A. diluvii*, the fossil analogue of the species figured by Poli.

The *Arcæ* have hitherto been found on bottoms of sandy mud and dirt, at depths varying from the surface to seventeen fathoms. Some of the species are moored to stones, corals, &c.



Arca tortuosa.

a, internal view of a valve; *b*, valves closed, the ventral or inferior margin towards the spectator; *c*, external view of a valve.



Arca antiquata.

a, valves closed, inferior or ventral margin towards the spectator.

Pectunculus, Lam.—Animal rounded, more or less thick, with no tentacular filaments on the border of its mantle; labial appendages very narrow; foot large, compressed, and slit longitudinally.

Shell lenticular, thick, solid, equivalve, subequilateral, entirely closed; umbones rather small, and more or less distant; hinge formed of a curvilinear row of small narrow, rather numerous, intrant teeth, which are often incomplete under the umbones; ligament external. (Rang.)

The *Pectunculi* live on sandy or muddy bottoms, and have been found at depths ranging from 5 to 17 fathoms. They move by means of the foot, which the animal uses to propel itself.

The number of living species stated in the Tables of M. Deshayes is 19. Woodward gives 50.

P. pilosus. Shell orbiculate; ovate, tumid, marked with decussate striæ; umbones oblique; epidermis brown, hairy. It inhabits the Mediterranean and the Atlantic Ocean. (Lam.)

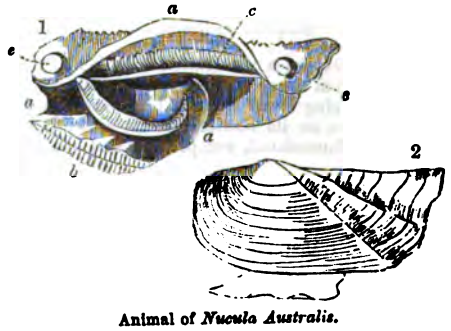
Pectunculus pilosus.

There are about 200 fossil species of the genus *Arca*. They are found in the Lower Silurian Rocks.

Nucula (Lam.).—Animal rather thick, subtriquetrous, having the mantle open only in its inferior moiety, with entire borders, denticulated throughout the length of the back, without posterior prolongations; anterior buccal appendages rather long, pointed, stiff, applied one against the other, like a kind of jaws, the posterior ones equally stiff and vertical; foot very large, delicate at its root, enlarged into a great oval disc, the borders of which are furnished with tentacular digitations.

Shell rather thick, sometimes nacreous, subtriquetrous, equivalve, inequilateral; umbones contiguous, and curved forwards; hinge formed on each valve of a numerous row of small pointed teeth, disposed in a line broken under the umbo; ligament in great part internal, short, and inserted in a small oblique fosset in each valve. (Rang.)

The species have been found on bottoms of sandy mud and sand, both in æstuaries and the open sea, at depths varying from the surface to 60 fathoms. According to Mr. Cuming, the same species vary much as to the depths at which they live; for he found *N. cuneata* from 14 to 45 fathoms; *N. obliqua* from 14 to 60 fathoms; and *N. Pisum* from 17 to 45 fathoms.



Animal of *Nucula Australis.*

1. *a a*, mantle; *b*, foot; *c*, branchia; *e e*, adductor muscles. 2, Outline of shell, with the foot of the animal projecting.

M. De Blainville divides the *Nuculæ* into two sections:—

A. Species with the border entire. Ex. *N. rostrata.*

B. Species with the border crenulated. Ex. *N. margaritacea.*

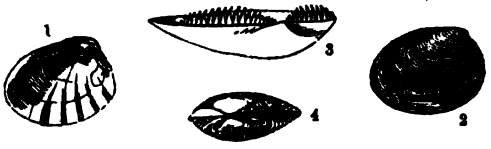
The number of recent species is 70. They are found in the seas of the United States, Norway, the Cape of Good Hope, Japan, Sitta, and Chili. The number of fossil species is about 100.

The following descriptions and cuts will give some idea of the forms of this genus.

N. rostrata. Shell transverse, oblong, rather convex, thin, transverely striated; anterior side longest, attenuated and rostrated.

Nucula rostrata.

N. margaritacea. Shell obliquely ovate, trigonal, rather smooth; cardinal teeth straight, acute; margin crenulated.



Nucula margaritacea.

1, Interior of Valve, showing the teeth on each side of the hinge, and the cartilaginous pit in the centre. 2, Exterior of Valve. 3, View of the Teeth, the dorsal margin of the shell being towards the observer, enlarged. 4, Valves closed, showing the umbones.

Trigonia is most frequently referred to the family *Trigonidæ*. [TRIGONIDÆ.]

POLYPES. [POLIPIFERA.]

POLYPHY'LLIA. [MADREPHYLLIÆA.]

POLYPHYSA (Lamouroux), a little-known genus of Corallines.

POLYPIARIA. [POLYPIFERA.]

POLYPIFERA, POLYPIARIA, or POLYPI, an order of Radiate Animals, thus characterised by M. Milne-Edwards:—Animals organised for a sedentary mode of life, having no locomotive organs, and being provided with a circle of retractile tentaculæ around the mouth, and a central gastric cavity, not communicating with an anus, and containing the reproductive organs when these exist, in general fissiparous, or multiplying by buds as well as by ovules.

Our knowledge of the forms and functions of this group of animals is comparatively recent. The discoveries of Trembley regarding the structure and animal functions of the Phytoid *Hydræ*, and *Plumatellæ* of fresh-water, opened a new field of research into the nature and relations of many neglected forms of life, and gave occasion for much correct inference and baseless conjecture. [HYDRA.] Borrowing from Aristotle and Pliny the term 'Polypus,' by them applied to a cephalopod, the systematic naturalists who followed Linnæus collected under this title many really animalised masses in the form of plants, and after abundant examinations by Ellis and others of the membranous, horny, or stony 'fulcra,' bases or axes, which remain after desiccation or decay of the softer parts, generally agreed in opinion that to all these plant-like bodies were associated active living animals like the *Hydræ* described by Trembley.

As in a tree the flowering and reproductive organs manifest more active and varied functions than the general mass of bark and wood which serves to unite them in one common life, so in these *Zoophyta* the little *Polypi* expanding from their cells for food, light, or aëration, and shrinking back upon the agitation of the water, or withdrawal of the light, seemed like so many animal flowers, which might be studied apart from the *Polypiaria* which they adorned. They were in fact studied apart, and unfortunately attention was more directed to the wonderful permanent fabric, or Polypidom, as Lamouroux calls it, than to the *Polypi* themselves. Hence the imperfection of all the schemes of classification for this portion of the Zoophytic division of the animal kingdom, and many of the erroneous generalisations and hypotheses regarding the lower forms of animal life. There was besides a real impediment in the way of accurate and satisfactory observation of these minute parts of creation in the imperfection of microscopes.

Lamarck was the first who attempted to classify these creatures in the following way:—

Polypi Ciliati, as many of the Rotiferous *Infusoria*.

Polypi Denudati, as the *Hydra*.

Polypi Vaginati, as the compound *Sertulariæ*, Corals, &c.

Polypi Tubiferi, as the *Lobularia* and its allies.

Polypi Natantes, as the *Pennatulariæ*.

The *Actiniæ*, thus expressly excluded from the class of *Polypi*, are very closely related to them.

Dr. Johnston, in his 'British Zoophytes,' gives the following classification of these animals:—

Sub-Class 1. Radiated *Zoophyta*.—Body contractile in every part, symmetrical; alimentary canal with one opening; gemmiparous and oviparous.

Order 1. *Hydroida*.—Polypes compound; mouth with filiform simple tentacula; stomach excavated in the cellular substance of the body; no distinct muscular apparatus; the body contractile in all its parts; gemmiparous externally. Polypidom (if existing) external to the polypes. (*Hydra, Sertularia*, &c. *Nudibrachiata* of Farre.)

Order 2. *Asteroida*.—Polypes compound; mouth encircled with eight fringed tentacula; gemmiparous internally; stomach membranous. Polypidom an internal axis. (*Gorgonia*, &c.)

Order 3. *Helianthoida*.—Polypes single; mouth encircled by tubulous (aquiferous?) tentacula; stomach membranous, plaited; oviparous by internal ovaria. (*Actinia*, &c.) [ACTINIADÆ.]

Sub-Class 2. Molluscan *Zoophyta* (*Polyzoa* of Thompson; *Ciliobrachiata* of Farre; *Bryozoa* of Ehrenberg).—Body not contractile, symmetrical; mouth and anus separate; gemmiparous and oviparous.

Order 4. *Ascidioida*.—Polypes aggregated; the mouth encircled with filiform ciliated tentacula; stomach distinct, intestine recurved to an anus near the mouth; ova internal. (*Cellaria*, &c.)

In this work the last sub-class of Dr. Johnston is treated of in a separate article, POLYZOA, which has been written by Mr. Busk, who has subjected this order of animals to a thorough examination, the results of which have been given in his beautifully illustrated 'Catalogue of the Polyzoa,' in the collection of the British Museum.

In the present article we propose to give a synopsis of the families and the names of the genera of the *Polypi*, drawn up principally from M. Milne-Edwards's 'Introduction to the British Fossil Corals,' published by the Palæontographical Society.

Sub-Class I. CORALLARIA.

Polypi possessing distinct internal reproductive organs, and having the gastric or visceral cavity surrounded by vertical radiating membranaceous lamellæ.

Order 1. ZOANTHARIA.

Polypi with conical, tubular, simple or arborescent but not bipinnate tentacula, and with numerous perigastric membranaceous laminæ, containing the reproductive organs.

Sub-Order 1. *Zoantharia Aporosa.*

Corallum composed essentially of lamellar dermic sclerenchyma, with the septal apparatus highly developed, completely lamellar, and primitively composed of six elements; no tabulæ.

Family 1. *Turbinolidæ.*

Corallum in general simple, never fissiparous, and multiplying by lateral gemmation in compound species. Interseptal loculi extending from the top to the bottom of the visceral chamber, and containing neither dissepiments as in the *Astreidæ*, nor synapticulæ as in the *Fungidæ*. Walls thin, lamellar, and imperforated. Septa highly developed, simple, compact, in general regularly granulated on each side, and never denticulated or lobulated at their apex. Costæ in general well marked and straight. No cœnenchyma in the compound polypidoms.

First Tribe. *Cyathininæ.*

Calicule presenting one or more rows of pali, placed between the columella and the septa.

A. A single coronet of pali.

Genera, *Cyathina, Cœnocyathus, Acanthocyathus, Bathycyathus, Brachycyathus, Discocyathus, Cyclocyathus.*

B. Pali of divers orders, forming two or more coronets.

Gen. *Trochocyathus, Leptocyathus, Thecocyathus, Paracyathus, Heterocyathus, Deltocyathus, Tropidocyathus, Placocyathus.*

Second Tribe. *Turbinolinæ.*

Corallum destitute of pali; the septa extending to the columella, or meeting in the centre of the visceral chamber.

Gen. *Turbinolia, Sphenotrochus, Platytrochus, Ceratotrochus, Discotrochus, Desmophyllum, Flabellum, Placotrochus, Blastotrochus, Rhizotrochus.*

Aberrant Group. *Pseudo-Turbinolidæ.*

Corallum simple, with the loculi open and devoid of synapticulæ, or dissepiments, as in *Turbinolidæ*, but having the septa represented by groups of three vertical laminæ, not adhering together, excepting near their external margin, where they are united by a common costa, a mode of structure which is quite anormal in the whole order of *Zoantharia.*

The only genus is *Dasmia.*

Family 2. *Oculinidæ.*

Corallum composite, produced by gemmation, and presenting in general an abundant compact cœnenchyma, or common tissue, the surface of which is smooth, delicately striated near the calices, or slightly granular, but never echinulate; walls of the corallites complete (that is to say, presenting no perforations), not distinct from the cœnenchyma, and increasing by their internal surface so as to invade progressively the inferior part of the visceral cavity, and to fill it up more or less completely in old age. Loculi imperfectly divided by a few dissepiments; no synapticulæ. Septa entire, or having their upper edge slightly divided.

1. Septa of various sizes forming distinct cycla.

Gen. *Oculina, Trymhelia, Cyathelia, Astrhelia, Symhelia, Acrhelia, Lophelia, Amphelia, Diplhelia, Enallhelia, Axhelia, Crypthelia, Endhelia, Stylaster.*

Transitional Group. *Pseudo-Oculinidæ.*

Corallum composite, with a highly developed spongy or cellulose, echinulate, dermic cœnenchyma; costal apparatus rudimentary; walls imperforate, and never invading the visceral cavity. Septal apparatus well developed; dissepiments few in number.

Gen. *Madracis, Stylophora, Dendracis, Araeacis.*

Family 3. *Astreidæ.*

Corallum composite, or simple, circumscribed by imperforated walls, and often increasing by fissiparity. Corallites becoming tall by the progress of their growth, each individual, or series of individuals, well defined, and separated from the others by perfect walls; cœnenchyma not existing, or being formed either by the development of the costæ and their dissepiments, or by the epithecal tissue alone, and not forming a compact mass as in the *Oculinidæ*. The visceral chamber never obliterated inferiorly by the growth of the walls, but subdivided and more or less completely closed up by the interseptal dissepiments, which are in general very abundant; never any synapticulæ like those of the *Fungidæ*.

First Tribe. *Eusmilinæ.*

Septa completely developed and entire (that is to say, with their apical margin neither lobate nor denticulate); costæ always unarmed; columella often compact, or even styliform.

Section 1. *Eusmilinæ Propriæ.*

Corallum simple or composite, and in that case formed by distinct corallites, affecting an arborescent disposition; fasciculate, or presenting a linear arrangement; free laterally, at least in a great part of their length, and never having their calices blended together. Reproduction usually fissiparous in the compound species.

Gen. *Cylicosmilia, Placosmilia, Trochosmilia, Parasmilia, Cœlosmilia, Lophosmilia, Diploctenium, Montlivaltia, Peplosmilia, Axosmilia, Eusmilia, Aplosmilia, Leptosmilia, Thecosmilia, Baryesmilia, Dendrosmilia, Stylosmilia, Placophyllia.*

Section 2. *Eusmilinæ Confluentes.*

Corallum composite, and presenting no separation between the corallites; united in rows, so as to assume a meandriform disposition; multiplication essentially fissiparous.

Gen. *Ctenophyllia, Dendrogyra, Rhipidogyra, Pachygyra, Plerogyra.*

Section 3. *Eusmilinæ Aggregatæ.*

Corallum composite and massive, in which the corallites are not arranged in series; and although remaining quite distinct, are united together by their walls, by a costal cœnenchyma, or by mural annular expansions.

Gen. *Stylina, Stylocœnia, Astrocœnia, Stephanocœnia, Phyllocœnia, Dichocœnia, Heterocœnia.*

Section 4. *Eusmilinæ Immersæ.*

Corallum composite; corallites disposed as in the preceding section, but imbedded in an epithecal cellular tissue, and not united by costal laminæ or mural annular expansions; gemmation lateral and basal; reproduction never fissiparous.

Genus *Sarcinula.*

Second Tribe. *Astreinæ.*

Septa having their upper edge lobulated, dentate, or armed with spines, and often imperfect near their inner edge. Costæ also spinulose, dentate, or crenulate, but never forming simple cristæ, as is often the case in *Eusmilinæ*. Columella in general spongy, rarely lamellar, and never styliform; corallum in general massive.

Section 1. *Astreinæ Hirtæ.*

Corallum simple or composite, and then formed by perfectly delineated corallites; produced by fissiparity, or by calicular gemmation. [MADREPHYLLIGÆ.]

Gen. *Caryophyllia, Circophyllia, Thecophyllia, Lobophyllia, Symphyllia, Mycetophyllia, Eunomia, Calamophyllia, Dasyphyllia, Colophyllia, Oulophyllia, Latomeandra, Tridacophyllia, Trachyphyllia, Aspidiscus, Scapophyllia.*

Section 2. *Astreinæ Confluentes.*

Corallum massive, increasing by fissiparity, formed by a series of corallites, the individuality of which is not distinct. The calices, thus united in a common trench, have their septa arranged in a parallel manner in two lines, and the columella, when existing, is continuous in the whole length of the series. [MADREPHYLLIGÆ.]

Gen. *Meandrina, Manicina, Diploria, Leptoria, Cœloria, Astroria, Hydnophora.*

Section 3. *Astreinæ Dendroidæ.*

Corallum always increasing by lateral gemmation; the corallites segregate, and having an arborescent or fasciculate arrangement; septa regularly and delicately serrated, those of the principal cycla always bearing pali.

Gen. *Cladocora, Pleurocora.*

Section 4. *Astreinæ Aggregatæ.*

Corallum composite, massive, increasing by gemmation or by fissiparity, and in that case not presenting a linear mode of arrangement of the corallites, which are always completely united laterally, but remain well-defined, and never lose their individuality as in the confluent *Astreinæ*. [MADREPHYLLIGÆ.]

Gen. *Astrea, Cyphastrea, Oulastrea, Plesiastrea, Leptastrea, Solenastrea, Phymastrea, Astroides, Perionastrea, Siderastrea, Baryastrea, Acanthastrea, Synastrea, Thamnastrea, Goniastrea, Aphastrea, Parastrea.*

Section 5. *Astreinæ Reptantes.*

Corallum increasing by the development of buds on stolons, or on membraniform basal expansions; the corallites not united by their sides, excepting accidentally by means of their walls, and remaining short; septa feebly denticulated; dissepiments almost rudimentary.

Gen. *Angia, Cryptangia, Rhizangia, Astrangia, Phyllangia, Oulangia.*

Aberrant Group. *Pseudo-Astreidæ.*

Corallum composite, thin, and foliaceous, and increasing by extracalicular gemmation; corallites short, well-circumscribed and dispersed on the surface of a common lamellar plate; cœnenchyma echinulate; septa well-developed, very echinulate; dissepiments not numerous; no synapticulæ; common basal wall imperforate, sub-costulate, and naked.

Genus *Echinopora.*

Transitional Group. *Pseudo-Fungidæ.*

Corallum composite and foliaceous, having a perforated plate or basal wall (as in *Fungidæ*), and interseptal dissepiments (as in *Astreidæ*). Calices forming rudimentary series, separated by lobes or ridges. No synapticulæ.

Genus *Merulina.*

Family 4. *Fungidæ.*

Corallum simple or composite, very short and expanding, so as to constitute a disc or foliaceous lamina. Calice very shallow, and open laterally in simple species, confluent, and not circumscribed in the compound species; septa not distinct from the costæ, and formed by complete, imperforate laminæ, with the edges dentate, and the sides covered with styliform or echinulate processes, which in general meet so as to constitute numerous synapticulæ, or transverse props, extending across the loculi like the bars of a grate; no dissepiments or tabulæ, so that no part of the visceral chamber is completely closed; walls basal, in general porous. The compound species increase by submarginal gemmation, and not by fissiparity.

First Tribe. *Cyclolitinæ.*

Corallum simple; plate or basal wall having a well developed epitheca, presenting concentric folds. [MADREPHYLLIGÆ.]

Gen. *Cyclolites, Palæocyclus.*

Second Tribe. *Funginæ.*

Corallum simple or composite; plate or basal wall without an epitheca, in general strongly echinulate and porous. [MADREPHYLLIGÆ.]

Gen. *Fungia, Micrabacia, Anabacia, Genabacia, Herpolitha, Cryptabacia, Halomitra, Podobacia, Lithactinia, Polyphyllia, Zoopilus.*

Third Tribe. *Lophoserinæ.*

Plate (or basal wall) not perforate or echinulate; no epitheca.

Gen. *Cycloseris, Diaseris, Trochoseris, Cyathoseris, Lophoseris, Agaricia, Pachyseris, Phyllastrea, Haloseris, Leptoseris.*

Sub-Order 2. *Zoantharia Perforata.*

Corallum composed essentially of porous sclerenchyma, with the septal apparatus well characterised, and consisting of six primitive elements, but being sometimes represented only by series of tabiculæ. Dissepiments rudimentary; no tabulæ.

The principal character of this section of *Zoantharia* is furnished by the structure of the sclerenchyma, which instead of forming imperforated lamella, as in the preceding groups, is always porous, or even reticulate. In general the mural apparatus constitutes here the greatest part of the corallum, does not consist of costal laminæ; the walls are always perforated, and completely, or nearly completely, naked. It is also to be remarked that the visceral chamber is almost completely open from top to bottom, and never filled up with dissepiments or synapticulæ, as in most of the *Z. Aporosa*, or with tabulæ, as will be seen in the next two sections of this order.

The perforated *Zoantharia* form three natural families:—*Eupsammidæ, Madreporidæ, Poritidæ.*

Family 5. *Eupsammidæ.*

Corallum simple or complex, with well developed lamellar septa, a spongiose columella, and perforated granular suboostulated walls.

Gen. *Eupsammia, Endopachys, Balanophyllia, Heteropsammia, Leptopsammia, Endopsammia, Stephanophyllia, Dendrophyllia, Lobopsammia, Cœnopsammia, Stereopsammia.*

Family 6. *Madreporidæ.*

Corallum composite, increasing by gemmation, and not by fissiparity; cœnenchyma abundant, spongy, and reticulate; walls very porous, and not distinct from the cœnenchyma; septa lamellose, and well developed; loculi free. [MADREPORÆA.]

First Tribe. *Madreporinæ.*

Visceral chambers divided into two equal parts by two of the principal septa, which are more developed than the others, and meet by their inner edge.

Genus *Madrepora.*

Second Tribe. *Explanarinæ.*

Visceral chamber presenting at least six equally developed principal septa.

Gen. *Explanaria, Astreopora.*

Family 7. *Poritidæ.*

Corallum entirely composed of reticulate sclerenchyma.

First Tribe. *Poritinæ.*

Cœnenchyma rudimentary or not existing.

Gen. *Porites, Litharæa, Coscinaræa, Microsolena, Goniopora, Rhodaræa, Poraræa, Holaræa.*

Second Tribe. *Montiporinæ.*

Cœnenchyma abundant, spongy.

Gen. *Alveopora, Montipora, Psammocora.*

Sub-Order 3. *Zoantharia Tabulata.*

Corallum essentially composed of a well developed mural system, and having the visceral chambers divided into a series of stories by complete transverse tabulæ or diaphragms; septal apparatus rudimentary.

Family 8. *Milleporidæ.*

Corallum principally composed of a very abundant cœnenchyma, distinct from the walls of the corallites, and of a tubular or cellular structure; septa not numerous; tabulæ numerous and well formed. [Milleporidæ.]

Gen. *Millepora, Heliopora, Heliolites, Fistulipora, Plasmopora, Propora, Axopora, Lobopora.*

Family 9. *Favositidæ.*

Corallum essentially formed by lamellar walls, with little or no cœnenchyma; visceral chambers divided by numerous and well developed complete tabulæ.

First Tribe. *Favositidæ.*

Corallum massive; walls perforated; septa rudimentary; no cœnenchyma. [Milleporidæ.]

Gen. *Favosites, Michelinia, Koninckia, Alveolites.*

Second Tribe. *Chætetinæ.*

Corallum massive; walls not perforated; neither septa nor cœnenchyma.

Gen. *Chætetes, Dania, Stenopora, Constellaria.*

Third Tribe. *Halysitinæ.*

Corallum composed of corallites constituting vertical laminæ or fasciculi, but more or less free laterally, and united by means of connecting tubes or mural expansions; walls well developed and not porous; septa distinct but small.

Gen. *Halysites, Harmodites, Thecostegites.*

Fourth Tribe. *Pocilloporinæ.*

Corallum massive, gibbous; walls imperforated; cœnenchyma abundant.

Genus *Pocillopora.*

Family 10. *Seriatoporidæ.*

Corallum arborescent or bushy, with an abundant compact cœnenchyma; visceral chambers filling up by the growth of the columella and the walls, and showing but few traces of tabulæ.

Gen. *Seriatopora, Dendropora, Rhabdopora.*

Family 11. *Thecidæ.*

Corallum massive, with an abundant compact spurious cœnenchyma, produced by the septa becoming cemented together laterally; tabulæ numerous.

Genus *Thecia.*

Sub-Order 4. *Zoantharia Rugosa.*

Corallum simple or composite, with a septal apparatus never forming six distinct systems, as in all the preceding *Zoantharia*, but appearing to be derived from four primary elements. The corallites are always perfectly distinct, and are never united by means of a cœnenchyma, nor do they ever form linear series, which is often the case in the preceding sections. They multiply by gemmation, and the reproductive buds are in general developed on the surface of the calices of the parents; this often arrests the growth of the latter, and gives rise to a superposition of generations.

Family 12. *Stauridæ.*

Corallum with well-developed septa, extending without any interruption from the bottom to the top of the visceral chamber, united by lamellar dissepiments, and arranged in four systems, characterised by an equal number of large primary septa.

Gen. *Stauria, Holocystis.*

Family 13. *Cyathaxonidæ.*

Corallum with well-developed complete septa, which extend without interruption from the bottom to the top of the visceral chamber, and not forming a regular radiate circle; those of the primary cyclum not much larger than the others, and not forming a 4-branched cross as in the *Stauridæ*, one well-characterised septal fossula; no dissepiments nor tabulæ.

Genus *Cyathaxonia.*

Family 14. *Cyathophyllidæ.*

Corallum with incomplete septa that do not extend from the bottom to the top of the visceral chamber in the form of uninterrupted laminæ; those of the primary cyclum similar to the others, and not forming a central 4-branched cross; septal fossulæ varying in number and in size; visceral chamber divided by a series of superposed tabulæ.

First Tribe. *Zaphrentinæ.*

A single septal fossula well-developed, or replaced by a sulcus or a crestiform process, and occasioning more or less irregularity in the radiate arrangement of the septal apparatus. The corallum is simple and free in all the known species.

Gen. *Zaphrentis, Amplexus, Menophyllum, Lophophyllum, Anisophyllum, Baryphyllum, Hallia, Aulacophyllum, Trochophyllum, Hadrophyllum, Combophyllum.*

Second Tribe. *Cyathophyllinæ.*

Septal apparatus radiate and uninterrupted, or divided into four groups; no true columella.

Gen. *Cyathophyllum, Pachyphyllum, Campophyllum, Streptelasma, Omphyma, Goniophyllum, Chonophyllum, Ptychophyllum, Heliophyllum, Meriophyllum, Clisiophyllum, Aulophyllum, Acervularia, Strombodes, Phillipsastrea, Eridophyllum.*

Third Tribe. *Lithodendroninæ.*

Axis of the visceral chamber of the corallite occupied by a styliform or lamellar columella.

Gen. *Lithodendron, Nematophyllum, Lithostrotion, Axophyllum, Syringophyllum.*

Family 15. *Cystiphyllidæ.*

Corallum essentially composed of a vesicular tissue, and presenting little or no traces of septa or radiate striæ.

Genus *Cystiphyllum.*

Sub-Order 5. *Zoantharia Cauliculata.*

Polypi supported on a sclerobasis or epidermic stem-like corallum.

Family 16. *Antipathidæ.*

Gen. *Antipathes, Cirripathes, Leiopathes.*

Sub-Order 6. *Zoantharia Insertæ Sedis.*

Gen. *Heterophyllia, Mortieria, Cyclocrinites.*

Order 2. Alcyonaria.

Polypi with bi-pinnate tentacula, and only eight perigastric membranaceous lamfnæ, containing the reproductive organs.

Family 1. *Alcyonidæ.*

Polypi adherent, and not provided with an epidermic sclerenchyma.

First Tribe. *Cornularinæ.*

Polypi simple or aggregate, and produced by gemmation on creeping stolons or basal membranaceous expansions, and having no lateral buds or connecting appendices.

Gen. *Cornularia, Clavularia, Rhizoxenia, Sarcodictyon, Anthelia, Sympodium, Aulopora, Cladochonus.*

Second Tribe. *Tubiporinæ.*

Polypi fasciculate, and provided with independent tubular polypidoms, united at various heights by means of horizontal connecting plates, the surface of which produces the reproductive buds.

Genus *Tubipora.*

Third Tribe. *Telesthinæ.*

Polypi segregate; buds in lateral branched tufts.

Genus *Telestho.*

Fourth Tribe. *Alcyoninæ.*

Polypi aggregate and multiplying by lateral gemmation, so as to constitute a ramified, lobate, or simple mass. [Alcyonidæ.]

Gen. *Alcyonium, Xenia, Nephthya, Paralcyonium, Sarcophyton, Cespitularia, Distichopora.*

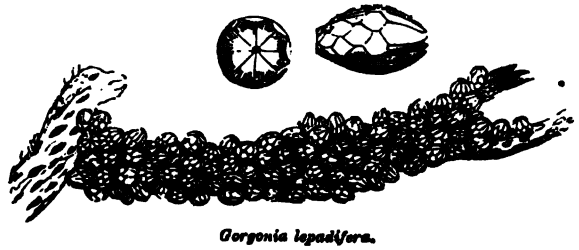
Family 2. *Gorgonidæ.*

Polypi provided with a thick tuberous cœnenchyma, surrounding a central stem that is adherent to an extraneous body by its basis, and is formed of epidermic sclerenchyma.

First Tribe. *Gorgoninæ.*

Common axis inarticulate, horny, or fasciculate, but not calcareous. [Gorgonia.]

Gen. *Gorgonia, Pterogorgia, Bebryce, Phyllogorgia, Phycogorgia, Muricea, Primnoa, Solanderia, Briareum.*

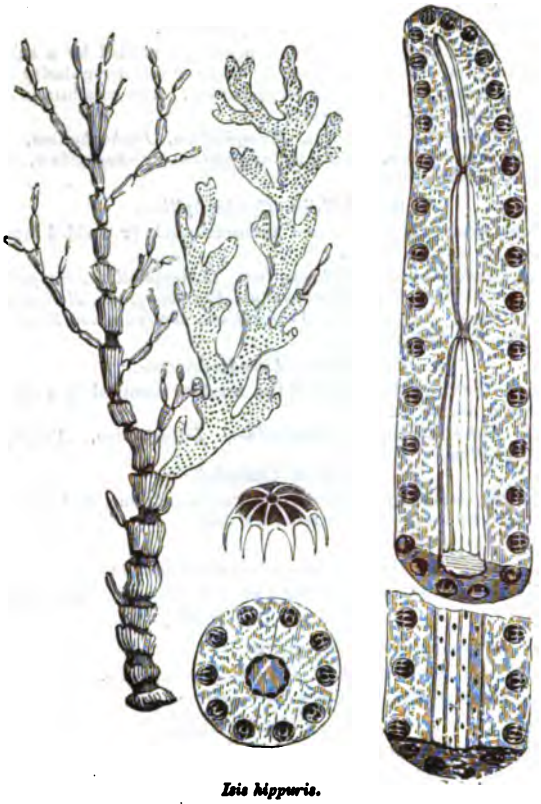


Gorgonia lepadifera.

Second Tribe. *Isinæ.*

Common axis articulated or composed of segments, the structure of which differs alternately.

Gen. *Isis, Mopsea, Melitæa.*



Isis hippuris.

Third Tribe. *Corallinæ.*

Common axis inarticulate, solid, and calcareous.

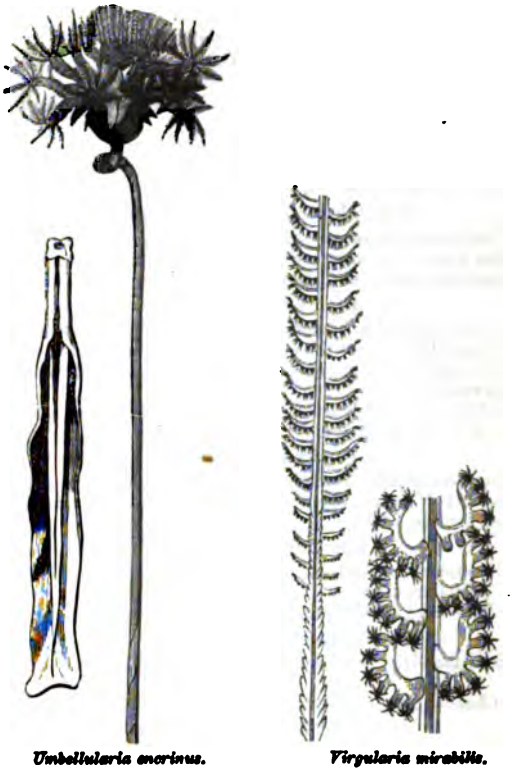
Genus *Corallium.*

Family 3. *Pennatulidæ.*

Polypi aggregate, and having a common peduncle, the centre of which is occupied by a peculiar cavity, and usually contains a solid axis, this sclerobasis styliform and never expanding at its under extremity so as to adhere to extraneous bodies. The polyp-mass is consequently free.

Gen. *Pennatula, Virgularia, Pavonaria, Graphularia, Umbellularia, Veretillum, Lituaria, Cavernularia, Renillia.*

Pennatula grisea.



Umbellularia encrinus. *Virgularia mirabilis.*

Order 3. *Podactinaria.*

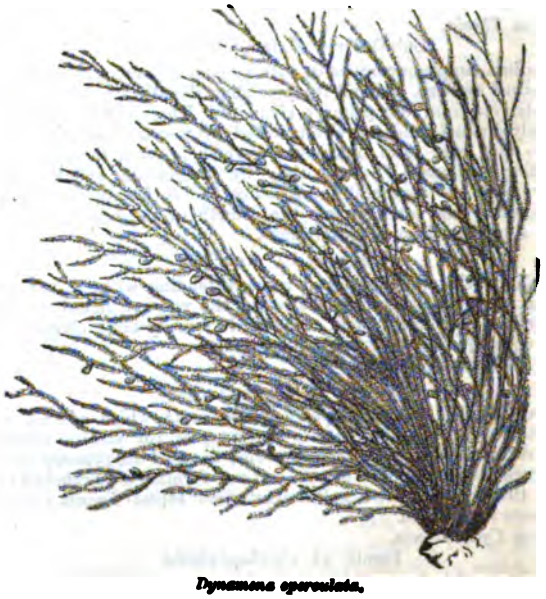
Polypi having the gastric cavity surrounded by four vertical membranaceous septa, at the upper end of which are placed four pairs of intestiniform reproductive organs. The tentacula discoidal, pedunculated, not tubular as in *Zoantharia* and *Alcyonaria*, but organised much in the same way as in *Echinoderma*. The mouth proboscidiform, and the fauces surrounded by numerous internal filiform contractile appendices.

The genus *Lucernaria* is the only representative of this zoological type, and comprises no coralligenous *Polypi*. [LUCERNARIADÆ.]

Sub-Class II. HYDRARIA.

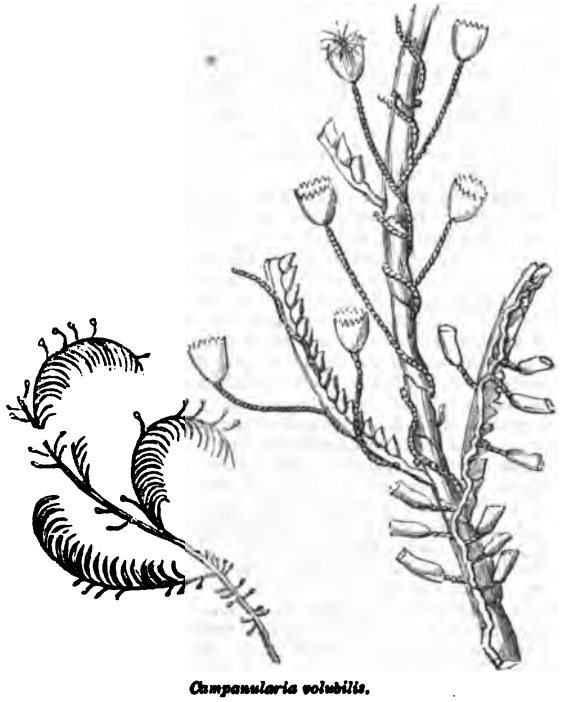
Polypi with a simple non-lamelliferous digestive cavity. No internal generative organs. Tentacula filiform and subverrucose. [HYDROIDA.]

We subjoin illustrations of three of the genera belonging to this sub-class.



Dynamena operculata.

Sertularia pluma.



Campanularia volubilis.

(Johnston, *A History of the British Zoophytes;* Milne-Edwards, *A Monograph of British Fossil Corals;* Landsborough, *Popular History of British Zoophytes;* Adams, Baikie, and Barron, *Manual of Natural History for Travellers;* articles on *Zoophytology* in *Quarterly Journal of Microscopical Science.*)

POLYPLECTRON. [PAVONIDÆ.]

POLYPODIA'CEÆ are one of the chief divisions of the natural order of Ferns. [FILICES.] They constitute the highest form of Acrogenous or Cryptogamic vegetation, and are regarded as approaching more nearly to Cycadaceous Gymnosperms than to any other part of the vegetable kingdom now in existence.

They are usually herbaceous plants, with a permanent stem, which remains buried and rooting beneath the soil, or creeps over the stems of trees, or forms a scarcely moveable point of growth, round which new leaves are annually produced in a circle; or it rises into the air in the form of a simple stem, bearing a tuft of leaves at its apex, and sometimes attaining the height of 50 or 60 feet. [ACROGENS.]

The stems seem always to produce roots in great quantities from their surface, even when elevated in the air; such roots are more especially met with near and under the ground, where they form a stratum of some thickness, acting both as feeding-organs and as an external protection; on all Tree-Ferns they appear upon the stem at least in the form of tubercles; and in *Cibotium Billardieri* they cover over the whole surface from the top to the bottom with a dense layer several inches deep.

The surface of tree-fern stems may be taken to represent that of the order in general. It is always marked with scars of considerable size, having either a lozenge form or that of an irregular oval, and bearing within their area evident traces of the fracture of woody plates which passed from the stem into the leaves.

These scars lengthen as the stem increases in age, till the lozenge or oval form is entirely destroyed; the scars then become separated to considerable distances, and extended into long and often irregular and indefinite spaces separated by deep furrows. Hence it happens that the appearance of the upper and lower end of the same tree-fern stem is so dissimilar, that they would not be supposed to belong to even the same species. Below the scars, or interposed among them, are found openings down into the interior of the stem, filled with pulverulent matter, and of unknown use. They appear to be of the same nature as the apertures into the superficial cells of *Sphagnum*, or more especially as the perforations in the rhizoma of *Nymphæa*.

Although tree-ferns are unknown in any countries except those having either a damp tropical climate, or at least an equable mild temperature and humid atmosphere, yet the common ferns of this country, whose stems, vulgarly called roots, are formed under ground, exhibit the same kind of organisation as that just described, only in a less conspicuous manner. It does not therefore follow that the remains of tree-ferns found in this country in a fossil state prove Great Britain to have had formerly a tropical climate, especially as the number of such remains hitherto met with has been extremely small; the utmost value that can be assigned to their evidence is that of probability. In those tropical lands where the tree-fern acquires its full size, as for example Brazil, the Philippines, Pitcairn's Island, &c., it becomes one of the most majestic and graceful objects, having an enormous plume of the most delicate and verdant foliage at the extremity of a lofty flexible stem, which sways beneath the gentlest breeze.

POLYPODIUM, a genus of Ferns, the type of the natural order *Polypodiaceæ*. The species of this genus are known by the thecæ being in clusters on the back of the frond, and by their opening transversely; the ring is usually vertical and incomplete. This is the case with *Allosurus* and *Woodsia*. *Polypodium* is distinguished by the sori being circular and naked, and the margin of the frond is flat, not reflexed. Several species are found in Great Britain.

P. vulgare, Common Polypody, has the fronds deeply pinnatifid; the lobes linear-oblong, somewhat serrated, all parallel, upper ones gradually smaller. This plant is very common in every part of Great Britain, delighting in shady banks, walls, and old trees. It may be easily cultivated in a Ward's case, amidst the smoke of our most populous cities. It is subject to a great many varieties. These have been beautifully illustrated in Mr. Henry Bradbury's process of 'Nature Printing.' 'The Ferns of Great Britain and Ireland,' executed by this process, and edited by Dr. Lindley and Mr. Moore, is one of the most useful works that the student of ferns can consult.

P. Phegopteris has pinnate fronds, with the lowest pair of pinnæ turned downwards and forwards; the rest are turned upwards. It loves damp places, near the spray of waterfalls.

P. Dryopteris has the fronds ternate and glabrous. It inhabits shady mountainous places.

P. calcareum has triangular subternate fronds, which are glandular-mealy; the lower branches are pinnate. It is found on broken limestone ground.

(Babington, *Manual of British Botany.*)

POLYPO'GON (from πολύ, and πώγων, a beard), a genus of Grasses belonging to the tribe *Agrostideæ*. It has scarious nearly equal glumes, each furnished with a long seta from just below the emarginate summit. The paleæ are shorter than the glumes, the outer ones usually curved from below the summit.

P. Monspeliensis has the setæ more than twice as long as the rather obtuse glumes. It has a fibrous root, a stem from a foot to a foot and a half high, a dense-lobed silky panicle often two inches long. The glumes are linear and hairy. It is a very beautiful grass, and is a native of Great Britain in salt marshes. It is the 'Αλωπέκουρος (Fox-Tail) of Theophrastus, 'Hist. Plant.,' 7, 17.

P. littoralis has its setæ equalling the acute glumes. The root is somewhat creeping, the stem about a foot high, the panicle close lobed and purplish. The glumes are linear lanceolate. It is a British species and is found in muddy salt marshes.

(Babington, *Manual of British Botany.*)

POLYPORUS. [DRY-ROT.]

POLYPTERUS, a genus of Fishes belonging to the family *Clupeidæ*. The sides of the upper jaw are immoveable; the head is covered with sharpened bony plates; the body with strong scales; it has one gill ray; a number of separate fins on the back; the teeth like a rasp, with long ones in front; the stomach large; a double air-bladder, with large lobes, the left one opening freely into the gullet. There are two species, one found in the Nile, the other in the rivers of Senegal. These fish are interesting as forming the only living representatives of a large family now extinct. They belong to the large division of extinct fish called Sauroid, on account of their resemblance to the Lizard tribes. [FISH.]

POLYSTICHUM, a genus of Plants belonging to the natural order of *Filices*, the sub-order *Polypodiaceæ*, and the tribe *Aspideæ*. The indusium is circular, attached by the centre; the veins are distinct after leaving the midrib. There are three British species:—

P. Lonchitis, with rigid simply pinnate fronds. Found on alpine rocks.

P. aculeatum, with linear rigid bipinnate fronds; the pinnules obliquely decurrent. Common in hedge banks.

P. angulare, with the fronds lax, drooping, bipinnate, pinnules truncate below, distinctly stalked. Found in the west of England, on sheltered banks.

(Babington, *Manual of British Botany*; Lindley and Moore, *The Ferns of Great Britain and Ireland*, nature-printed.)

POLYSTOMELLA. [FORAMINIFERA.]

POLYTHALAMACEA. [ORTHOCERATIDÆ.]

POLYTREMA. [MILLEPORIDÆ.]

POLYZOA, frequently termed *Bryozoa*, are animals belonging to the Molluscous Sub-Kingdom, closely allied in some respects with the *Tunicata*, and especially with the Compound Ascidians, whilst in others they approach the *Brachiopoda*.

The analogies presented in their structure with that in other Molluscous groups having been pointed out in the article MOLLUSCA, it will be needless here further to refer to them. The present article, after giving a brief view of the more important structural peculiarities of the class, will be devoted more especially to their mode of classification; but since the term *Polyzoa*, here employed, has by no means obtained universal adoption, it appears requisite to say a few words explanatory of the reasons which have induced us to prefer that term to the name *Bryozoa*, more usually employed by many British and by most continental naturalists.

Section I. Historical.

Formerly confounded with the Sertularian and other phytoid *Zoophytes*, or *Radiata* [POLYPIFERA], it is only within the last thirty years that the *Polyzoa* have been admitted to their proper place in the animal kingdom, having been advanced in fact from one sub-kingdom to another. Their advance from the *Radiata* to the *Mollusca* may be said to date from the researches of Dr. Grant, contained in his 'Observations on the Structure and Nature of Flustræ,' in 1827; and of Milne-Edwards, in conjunction with M. Audouin, given in their 'Résumé des Recherches sur les Animaux sans Vertèbres faites aux îles Chaussey,' in 1828. To the former of these observers we are indebted for the first intimation of several important facts in the anatomy of these creatures—among others, of the existence of cilia on the tentacles, and the curvature of the intestinal canal, with other particulars of less importance. He failed however to notice the existence of a second or anal orifice to the intestinal canal, a fact of the highest importance, as indicating in that respect their close approximation to the *Ascidiæ*, or tunicate mollusca. This opening was discovered by Milne-Edwards and Audouin, and its importance was by them duly appreciated. In other respects their observations agreed with those of Dr. Grant. The existence of this anal orifice was regarded by its discoverers as sufficient to justify a complete change in the ideas then generally entertained with respect to the natural affinities of these animals with the rest of the *Zoophytes*. They proposed to distribute the animals belonging to the class of *Polypi*, as then received, into four principal groups, which are in fact pretty nearly identical with those in which they are at present most generally placed. The fourth of these families contained the *Flustræ* and other Polypes whose digestive canal opened on the exterior by two distinct openings, and whose organisation approached that of the Compound Ascidians.

The latter class, though thus distinguished from its apparent allies, received no name from the eminent naturalists to whom its foundation was due; and of the names subsequently applied to it, it remains simply to determine which is entitled to the priority. The appellations proposed for this class that have received any acceptation at all are three—*Polyzoa*, *Bryozoa*, and *Ciliobrachiata*. The first of these terms (as a singular noun) was used by Mr. J. V. Thompson in a Memoir, constituting the fifth part or number of his 'Zoological Researches,' and applied by him "to a distinct class of Polypes hitherto in great measure confounded with the *Hydroida*." This paper was published in December, and probably on the 1st of December, 1830. The appellation of *Bryozoa* was given by Professor Ehrenberg to those Polypes in which two openings existed to the digestive canal, and which he thus distinguished from a second class, termed by him the *Anthozoa*, in which but one orifice was presented. His paper on the 'Corals of the Red Sea,' in which this subdivision of the Polypes was first proposed, was read, or rather was in part read, before the Berlin Academy, on the 3rd of March 1831. It was not completed however till December 1833, nor published until February 1834; and this date, for reasons it is needless here to refer to, should most probably be regarded as the true date of its publication. The part of the same writer's 'Symbolæ Physicæ,' in which the term is used, was not published till June 1831. Consequently, the earliest date which can by any latitude of admission be given to the first publication of the term *Bryozoa*, is March 1831, or at least three months after that of Mr. J. V. Thompson's 'Researches,' in which that of *Polyzoa* is proposed. In a very valuable paper published in the 'Philosophical Transactions' for 1837, Dr. A. Farre proposes to employ the term *Ciliobrachiata* for this class of Polypes, from the circumstance that their tentacles are ciliated. But this term, though appropriate and good, has since been but rarely employed, and is obviously without any claim to priority.

Section II. Structure and Functions.

The main points in the anatomy and structural relations of the *Polyzoa* will be found under the article MOLLUSCA; but in order to render the account of their classification (which is properly the subject of the present article) more intelligible, it will be necessary briefly to detail the structural, and with them some of the physiological conditions presented in the soft and hard parts of the animals.

The *Polyzoa* may be defined as Compound Molluscous Animals, in which the nervous system consists of a single ganglion, situated between the mouth and the anus, having a distinct mouth surrounded more or less completely by a row of ciliated tentacles; usually hermaphrodite, and propagated by buds or ova; in the mature state mostly fixed, though some possess the power of locomotion.

Though differing widely in external appearance, the animal itself is constructed upon a very uniform type throughout all the subdivisions of the class, and for this reason, the anatomy of one species or order will, with trifling exceptions, apply to all. The following account of their structure is, in great measure, taken from that given by Professor Allman in his 'Report on the Freshwater Polyzoa,' published in the 'Proceedings of the British Association' for 1850; and, with the exception of the word 'polyzoary,' or 'polyzoarium,' which is here used to express the compound growth formed by the associated animals, instead of 'cœnœcium,' proposed by that naturalist, the terms used by him have been adopted—

1. Polypide, to signify the soft or retractile portion of the *Polyzoa*
2. Ectocyst and Endocyst, to express the two distinct tunics of which the cells of the polyzoary are formed; the former being applied to the external and the latter to the internal tunic. The part surrounding the mouth, upon which the tentacles are placed, is termed, 3, the Lophophore; and 4, the Perigastric Space, is the space included between the walls of the endocyst and the alimentary canal.

But besides these terms, which apply more particularly to the polypide itself, several others are required in the description of the polyzoary. These are—

Cell, the hard portion of the external tunic, into which in most cases the polypide is capable of being retracted by the action of certain muscles. The parts of the cell are—1, the Mouth, or that opening, as it may be termed, through which the polypide makes its exit and its entrance. The borders of this opening are sometimes furnished with Oral Spines, and it is sometimes closed when the creature has retreated into the cell, by a Crescentic Lip, usually having a cartilaginous border, and closed by special muscles. (*Figs.* 5 and 5*a*.) In many cases the wall of the cell is of equal thickness and similar structure throughout, but in the Cheilostomatous sub-order the front of the cell, or that side upon which the mouth opens and the animal comes out, very often differs in structure from the rest. That is to say, a greater or less extent of the front may remain wholly or in great measure membranaceous, as in the genus *Membranipora* (*fig.* 14); or be filled in by a sculptured or perforated calcareous expansion, as in *Catenicella* (*figs.* 1, 2), *Lepralia* (*fig.* 15), and many others. The space thus defined when left membranaceous (as it appears in most if not all cases to be at an early period in the formation of the cell), is termed the Aperture. The borders of the aperture are sometimes furnished with Marginal Spines. In some instances, as in *Caberea* and *Scrupocellaria* (sp.), the aperture is protected in front by a curious outgrowth from near the margin, which is termed a Pedunculate Operculum. The back of the cell is that part, of course, which is opposite to the front; the mouth is situated at or near the upper part of the cell, and is either terminal or subterminal. Other parts, which may be regarded as appendages to the cells, but which are not universally present, are certain organs, either of offence, defence, or prehension, termed Avicularia and Vibracula; the former constituting a sort of pincers, and the other consisting of a long, slender, moveable seta. However diverse in appearance, these two kinds of organs are all constructed upon the same general type; that is to say, the organ consists of a hollow cup, or cell, containing two sets of muscles, for the movements of the mobile limb, the mandible, as it is termed, in the one case, and the seta in the other. The avicularia again are either pedunculate and moveable upon the peduncle, or sessile, which latter may be either simply sessile or deeply immersed. The Ovicell is an organ of an arched or globose or pyriform shape, found on many of the *Cheilostomata* and on some of the *Cyclostomata*, apparently destined for the development of ova. In the former class it is invariably situated above the mouth; and in the latter the analogous organ seems to represent a metamorphosed cell, and in situation corresponds with the other cells of the polyzoary.

The importance of the avicularian and vibracular organs, in a systematic point of view, may be estimated from the circumstance that, out of 36 genera of Cheilostomatous *Polyzoa*, 20 include species armed with one or the other, or with both; and that of 191 species no less than 126 are so furnished. They appear to be confined solely to the *Cheilostomata*.

In many cases the polyzoary is affixed by numerous slender corneous tubes, which seem to be merely subservient to that purpose; these are termed Radical Tubes.

The Polyzoary, or colony itself, is formed of an aggregation of cells, which throughout the two former orders of the class as here arranged

arise one from another, either singly or in pairs, from each cell (*fig.* 15*a*, which represents the beginning of the polyzoary of *Lepralia ciliata*), and from various parts of the cell, as on the back or sides, near the top or not far from the bottom. And it is to the variety of modes in which the cells arise that the diversity of form of the polyzoary is due. In one division of the third sub-order, the *Ctenostomata*, the cells do not arise one from another, but from a tube common to several cells, and which is either divided or not into distinct internodes. This portion of the polyzoary is termed the Basal Tube.

Having thus defined most of the terms which it is necessary to employ for the purposes of classification, we will briefly describe the anatomy of the various parts of the animal in the order in which it is given by Professor Allman.

Organs for the Preservation of the Individual.

A. Dermal System.

The Polyzoary is formed of a number of little chambers, or cells, organically united, each of which contains a polypide, and consists of two portions—an internal tunic, soft, transparent, and contractile (the Endocyst), and an external investment (the Ectocyst). The endocyst lines the interior of the cells and when it arrives at their orifice would protrude beyond the ectocyst, were it not that here it becomes invaginated, or inverted into itself, and then terminates by becoming attached round the base of the tentacular crown; during the exsertion of the polypide it undergoes eversion, sometimes complete, sometimes incomplete. The endocyst consequently constitutes a cell, or sac, in which the polypide is suspended, surrounded by the perigastric space. These sacs are all closed above where they are attached to the polypide, and below, in some cases, their cavities are in communication with those of the neighbouring sacs (or with the basal tube); but more generally no such communication exists. The ectocyst and endocyst represent respectively the external and middle tunics of the *Tunicata*, or the mantle and shell of other Molluscs.

The endocyst is in all cases thin and membranaceous, and often contains transverse muscular fibres. A portion, perhaps the whole, of the inner surface is clothed with vibratile cilia. The ectocyst varies greatly in composition and aspect. Throughout the greater number of the *Polyzoa* it is hardened by the deposition of calcareous matter, whilst in many others it is horny and flexible, and in some even of an almost gelatinous consistence. In the *P. hippocrepia* it is in most species composed of a tough pergamentaceous brown membrane, strengthened by the deposition of irregularly formed siliceous particles, sometimes rendering it quite opaque. In other cases again, as in the genus *Anguinella* v. Ben., the soft and flexible, and as it were flocculent ectocyst, is pervaded by aluminous and siliceous particles, and the same is the case, to a less marked extent, in some other of the *Ctenostomata*. In *Cristatella* and *Pedicellina* the ectocyst would, at first sight, seem to be entirely absent, and the cell to be composed exclusively of the endocyst. Careful examination however shows that both are present, and that the ectocyst consists of a highly organised and transparent tunic, free from any earthy deposit. In some instances, and very distinctly in the *Selenariadæ*, or Lunulites, the surface of the calcareous ectocyst is further covered with a thin horny cuticle, apparently resembling that on the shells of many Molluscs.

B. Organs of Digestion.

These consist of an alimentary canal, commencing at the mouth and terminating at the anus; and subdivided into several portions, which have received the same names as those of the apparently corresponding parts of the alimentary tract in the higher animals. The mouth is edentulous and usually unarmed, though sometimes (as in the proper *P. hippocrepia*) furnished with a valve-like organ of very peculiar formation, and which is considered by Professor Allman to be analogous with the 'languet' of the Ascidians.

From the mouth an œsophagus, or pharynx, leads downwards to the stomach, or in some cases, as in *Bowerbankia*, into a sort of gizzard, which in that genus is armed on each side with a serrated tooth. The stomach is a thick walled sac, which in most cases dilates inferiorly into a rounded cul-de-sac, or pyloric cavity, from which the intestine springs. The pyloric orifice is distinctly valvular, and is furnished with prominent lips, which project into the intestine. The intestine, wide at the origin, rapidly diminishes in diameter till it terminates at a distinct anus near the mouth. The liver is represented by spherical corpuscles of a brown colour, seated on the wall of the stomach. The mouth and upper part of the œsophagus and the commencement of the intestines, are, in most cases, at any rate, furnished with vibratile cilia.

C. Organs of Respiration and Circulation.

Upon the tentacular crown and the walls of the perigastric space, which corresponds with the 'sinus system' of the *Tunicata*, would seem chiefly to devolve the function of bringing under the influence of the aerating medium the nutritious fluid of the tissues.

The tentacular crown of a Polyzoon consists of two portions: 1, a sort of stage, or disc, which surrounds the mouth—the Lophophore; and 2, of a row of tentacles, which are borne in an uninterrupted series round the margin of the lophophore. The lophophore throughout almost the entire class is orbicular or annular; but in the *Hippocrepia* its posterior margin, or that which corresponds to the rectum, is prolonged into two triangular lobes, or arms, so that in that order it exhibits the form of a deep crescent. This condition of the lophophore is found in no marine species, and in *Fredericella*, a fresh-water form, the arms of the crescent are obsolete, and the lophophore might, on a superficial view, be regarded as orbicular; but a careful examination, Professor Allman goes on to say, will render manifest its departure from the orbicular form, the side corresponding to the arms of the crescent being slightly prolonged obliquely upwards. In all cases the lophophore forms the roof of the perigastric space; in the species with crescentic lophophores the interior of the arms is clothed with vibratile cilia.

The tentacles are tubular, closed at their free extremity and opening at the opposite end through the lophophore into the perigastric space. In all the *Polyzoa* they are armed upon their opposed sides (in *Pedicellina* on one only!) with vibratile cilia, arranged in a single series, and vibrating towards the extremity of the tentacle upon one side and towards the base on the other. A nervous filament and muscular fibres may be traced into the tentacles. In the proper *P. hippocrepia* the entire plume of tentacles is surrounded at its base by an exceedingly delicate transparent membrane in the form of a cup or calyx, considered by Professor Allman as analogous to the membrane of the respiratory sac in the *Tunicata*; but this calyx has not yet been detected in any marine polyzoon. In the genus *Pedicellina* the tentacles are also surrounded at their base by a kind of membranous calyx, but this is of an entirely different import from the membrane connecting the bases of the tentacles in the *P. hippocrepia*.

The perigastric space and the interior of the lophophore and tentacles all freely communicate with one another, and are filled with a clear fluid, in which float numerous particles of a very irregular form and size. This fluid obviously represents the blood or common nutrient and respiratory fluid of other Molluscs. It is kept in motion by the cilia with which the endocyst is lined, but there is no special circulatory organ as in the *Ascidiæ*.

D. Organs of Motion.

The muscular system in the *Polyzoa* is highly developed, and the muscles are especially interesting in a physiological point of view, for they seem to present an example of true muscular tissue reduced to its simplest and essential form. They are composed of bundles of elementary fibres, totally separate from each other, throughout their entire course, and which are distinctly marked with transverse striæ. They resemble in fact very closely the fibres of the thoracic muscles of insects. In the marine *Polyzoa* however another kind of fibres may be noticed, presenting nodular enlargements, which would seem to resemble very closely the isolated, organic muscular fibres of the higher animals. The muscles are disposed in distinct sets, and it is by the agency of these various groups that the different movements of protrusion and retraction of the polypide are effected, together with the actions of the tentacles and of the avicularia and vibracula. For the arrangement of the muscles in the former class of organs see *fig.* 2 (5) in the article Mollusca. The curious analogies in the disposition of these muscles in the *Polyzoa* with that of the muscles which act upon the shells of the *Brachiopoda* are also pointed out in that place.

E. Organs of Life of Relation.

A distinct nervous system was first shown to exist in the *Polyzoa* by M. Dumortier in *Lophopus crystallinus*, and has been demonstrated by Van Beneden in *Laguncula*, and by Allman in all the Hippocrepian genera except *Paludicella*; it may be deemed therefore to exist generally in the class, and will probably be found essentially alike in all. In all the species of the Hippocrepian order there may be seen, attached to the external surface of the œsophagus, on its rectal aspect, just below the mouth, a hollow oval body of a yellowish colour, which is undoubtedly a nervous ganglion, as Professor Allman has succeeded in distinctly observing nervous filaments in connection with it; some of which may be traced going to each tentacle. The ganglion also sends off filaments upwards towards the mouth, and one may be observed passing downwards along the œsophagus; but nothing like a complete collar surrounding the tube has been observed. The *Polyzoa* do not seem to possess any special organs of sense.

F. Organs of Locomotion.

In *Cristatella*, the ectocyst, according to Professor Allman, is highly contractile, and presents, below, a flattened disc destitute of apertures. Upon this disc, which closely resembles the foot of a Gasteropod, the singular polyzoary creeps about upon the stems and leaves of aquatic plants. Except in the embryonic condition no other Polyzoon would seem to possess any power of locomotion; or at any rate none has been noticed, but several reasons would seem to render it probable that the species belonging to the *Selenariadæ* may be capable of locomotion by means of their curiously-constructed vibracula.

G. Reproduction.

In the *Polyzoa*, observes Professor Allman, three distinct modes of reproduction may be witnessed, namely:—By buds or gemmæ; by true ova; and by free locomotive embryoes.

1. Reproduction by Gemmæ.—The gemmæ always originate in the endocyst, first appearing as small tubercles projecting into

perigastric space, but which may soon be seen to take a development in an outward direction. The bud now presents the appearance of a vesicle projecting from the exterior of the parent-cell, closed at its external or free extremity, but having its cavity in communication with the perigastric space. The polypide is gradually developed in the interior of the gemma by the differentiation of its fine granular contents, and the extremity of the bud ultimately opens so as to admit of the exsertion and retraction of the young animal. Thus is produced a fresh cell of the polyzoary, whose ultimate form, as has been before observed, depends upon the point of the cell at which the bud springs. This differs in almost every species, and upon this difference depends the diverse physiognomy of the various species. For instance, if each cell pullulates at a single point at the upper and back part, a polyzoary, consisting of a single series of cells, such as that of *Ætea*, or of *Hippothoa* (*fig.* 6), will be presented; if from each cell two are given off and remain in close apposition, a circularly expanded disc of greater or less regularity will be produced, as seen in *Lepralia* (*figs.* 15 and 15*a*), some *Membraniporæ*, &c., and so on.

2. Reproduction by Ova.—All the fresh-water, and probably, also, all the marine *Polyzoa*, produce true ova, which are formed in a definite organ or ovary; and from the existence of a true ovary and of ova, we are at once led to expect the co-existence of a male organ. That a testis is present in all the species of fresh-water *Polyzoa*, at any rate, no doubt, according to Professor Allman, can be entertained, and in *Laguncula* (*Farrella*) *repens*, the existence of this organ is described and figured by Van Beneden. In *Paludicella* Professor Allman says, "that the ovary and testes are both found in the same cell. The former is an irregularly shaped body, adherent to the inner surface of the endocyst, towards the upper part of the cell. The testicle is an irregularly lobed mass attached, like the ovary, to the inner surface of the endocyst. It occupies a position near the bottom of the cell, and is thus separated by a wide interval from the ovary. Both organs are attached to the side of the stomach by a cylindrical cord. The form of the ovary in the proper *Hippocrepia* would appear more to resemble a moniliform cord. In *Laguncula* (*Farrella*), according to Van Beneden, the ovary and testis, in form and situation would seem very closely to resemble those in *Paludicella*. It would appear also that the impregnation of the ova is effected by their escaping from the ovary into the perigastric cavity, where they are brought into contact with the spermatozoa, which have in like manner escaped from the testis into the same cavity, and are swimming actively about in vast numbers in the fluid with which it is occupied. There does not appear to be any special opening for the escape of the ova after impregnation, which is probably effected by a rupture in some part of the endocyst. The forms of the ova vary a good deal in different genera, and in some cases they are ciliated.

3. Professor Allman also describes a mode of reproduction by free embryoes, but does not seem to have noticed their mode or plan of development.

The embryo upon its escape from the ovum appears sometimes to be ciliated, sometimes not. In the case of *Lepralia coccinea*, a cheilostomatous species, the appearance of an embryo of the ciliated kind and its subsequent development are well described by Mr. Gosse. ('Naturalist's Rambles on the Devonshire Coast,' p. 218.)

But although the above brief description of the reproduction of the *Polyzoa* by ova formed and impregnated within the perigastric sac be undoubtedly correct, as applied not only to the species in which it has actually been observed, but from analogy to others as well, it cannot be denied that very considerable obscurity rests upon the mode in which the ova are developed in the ovicells or receptacles, which have received that name, and as to the relation which those organs bear to the rest of the animal. There can be no doubt that these organs do contain an ovum or ova, and that these ova are developed, ab origine, in them, and there undergo segmentation; but how these ova are fertilised, and why a difference so great as this in the position of the ovigerous organ should exist in apparently closely allied genera or even species, is at present inscrutable.

Section III. Classification.

The more general relations of the *Polyzoa* having, as before observed, been described under the head of Mollusca, the remainder of this article will be devoted to the mode in which they may be conveniently arranged among themselves.

With our present defective knowledge of many particulars respecting the conformation of the *Polypides*, the classification of the *Polyzoa* can only be attempted with any prospect of useful results, from the study of the Polyzoary; that is to say, so far as regards the determination of the subordinate groups—the orders themselves being defined by characters derived from the Polypide, or soft portion of the animal. The following scheme, which in its main features has been long received, appears to offer as convenient, and so far as our present acquaintance with the subject allows, perhaps as natural a classification as can be expected.

Class Polyzoa.

Social molluscous animals, whose nervous system consists of a single post-œsophageal ganglion, with branches, but without a nervous ring around the œsophagus; and without any special organs of sense or of circulation. Mouth surrounded more or less completely with a single row of ciliated tentacles.

Polyzoa, J. V. Thompson, 'Zool. Research.,' Mem. 5, p. 92 (1830).
Bryozoa, Ehrenb., 'Corallen-Thiere des Roth. Meer,' 1831 (1834 ?).
Molluscan Zoophytes, seu *Zoophyta Ascidioida*, Johnston, 'Mag. Zool. and Bot.,' 1836.
Ciliobrachiata, Farre, 'Phil. Trans.,' 1837.

Order I. *Polyzoa infundibulata*, Gervais.

Tentacles disposed on an uninterrupted annular lophophore, surrounding the unarmed mouth.

Sub-Order I. *Cheilostomata*.

The crescentic subterminal mouth of the cell is furnished with a moveable lip, by which it is closed when the animal retreats.

Escharadæ, *Flustradæ*, *Cellariadæ* (ex. *Crisia*), Fleming.
Polypiaria operculifera et cellariæa (ex. *Crisia*), Blainville.
Escharina, *Celleporina*, Ehrenberg.
Urceolata (pars), Hagenow.

A. Cells disposed in a single series.

Family 1. *Catenicellidæ*, Busk.

Cells connected by short flexible tubes.

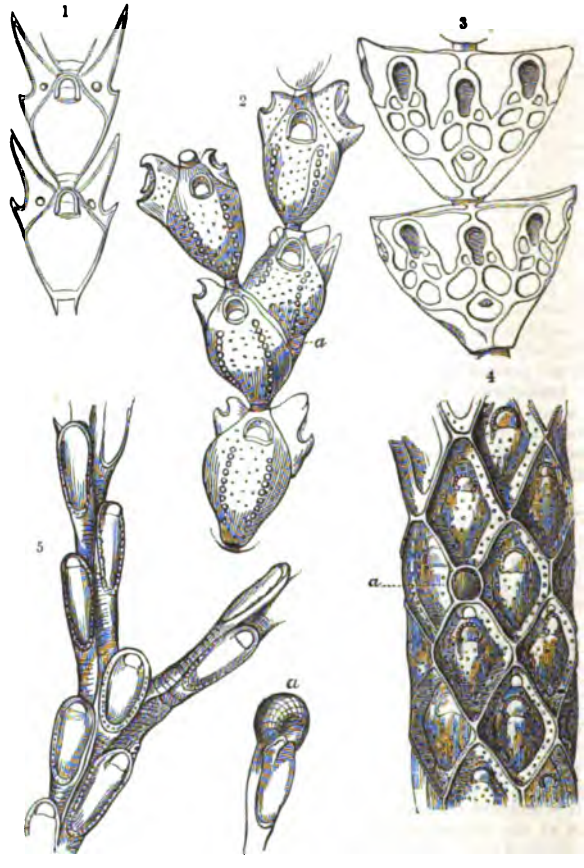
Gen. 1. *Catenicella*, Blainv. (*Figs.* 1, 2.)

Cells connected by short corneous tubes, all facing the same way; polyzoary phytoid, erect, dichotomously-branched; cell at the bifurcation geminate.

a. Fenestratæ. Cells fenestrate in front; ovicells terminal.

β. Vittatæ. Cells with a narrow elongated band or vitta on each side in front; ovicells galeriform, not terminal.

Catenicella, Blainville; 'Brit Mus. Cat.,' p. 3.
Catenaria, Savigny, 'Egypt,' pl. 13.
About seventeen species known; mostly Australian.



1, *Catenicella taurina*. 2, *Catenicella elegans*; *a*, geminate cell. 3, *Calpidium ornatum*. 4, *Salicornaria farciminoides*; *a*, avicularium. 5, *Cellularia Peachii*; *a*, ovicell.

Gen. 2. *Alysidium*, Busk.

Cells connected by short corneous tubes. Two cells arising from each cell at a bifurcation.

Alysidium, 'Brit. Mus. Cat.,' p. 13.
Three species known.

Gen. 3. *Calpidium*, Busk. (*Fig.* 3.)

Cells with an avicularium on each side; each cell with three distinct apertures, arising one from the upper part of another in a linear series, connected by short corneous tubes.

Calpidium, Busk; 'Voyage of Rattlesnake,' i. 364 (*fig.* 3); 'Brit. Mus. Cat.,' p. 14.
One species.

Family 2. *Scruparidæ*.

Junctions of the cells rigid.

Crisiadæ (part), Gray.
Scuparidæ, Gray.
Eucratiadæ (part), Johnst.

Gen. 1. *Scruparia*, Oken.

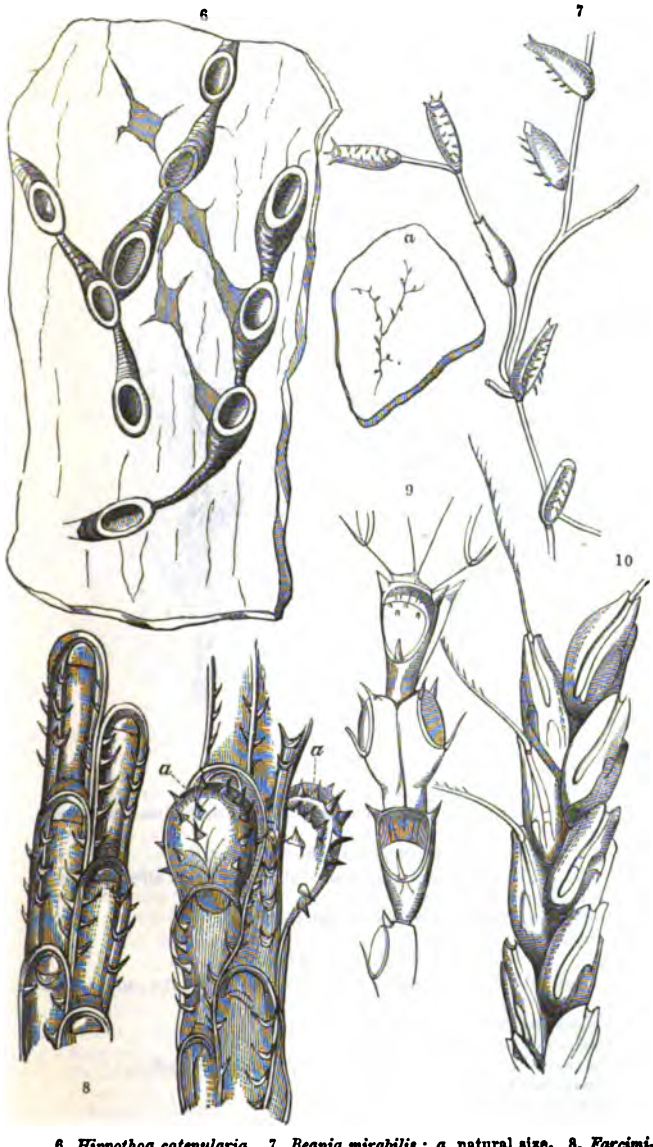
Cells decumbent; aperture oblique, subterminal; branches given off from the front of a cell below the aperture.

Scruparia (α), Oken.
Scruparia, 'Brit. Mus. Cat.,' p. 28.

Gen. 2. *Hippothoa*, Lamouroux. (*Fig.* 6.)

Cells decumbent, adherent; branches given off from the sides of the cells.

Hippothoa, Lamx.; Gray; Johnst.; 'Brit. Mus. Cat.,' p. 29.
Catenicella (pars), Blainville (non M. Edwards).
Terebripora, D'Orbigny.
Tubulipora (sp.), Jameson.
Three species known.



6, *Hippothoa catenularia*. 7, *Beania mirabilis*; *a*, natural size. 8, *Farciminaria aculeata*; *a*, ovicells. 9, *Dimetopia cornuta*. 10, *Caberea Boryi*.

Gen. 3. *Ætea*, Lamouroux.

Cells tubular, erect, scattered; adnate and decumbent at the base.

Ætea, Lamx.; Gray; 'Brit. Mus. Cat.,' p. 30.
Anguinaria, Lamarck; Johnston.
Falcaria (β), Oken.
Four species.

Gen. 4. *Beania*, Johnston. (*Fig.* 7.)

Cells arising one from another by a slender filiform prolongation or tube, and open in front; marginal spines hollow, inarching.

Beania, Johnst.; Gray; 'Brit. Mus. Cat.,' p. 32.
Two species.

B. Cells disposed in a double or in multiple series.

Family 3. *Salicornariadæ*.

Cells disposed around an imaginary axis, forming cylindrical branches of a dichotomously-divided erect polyzoary.

Salicornariancæ, Gray.
Salicornariadæ, 'Brit. Mus. Cat.,' p. 15.

Gen. 1. *Salicornaria*, Cuvier. (*Fig.* 4.)

Front of each cell much depressed, surrounded by an elevated ridge, by which the surface of the branch is divided into more or less regular, rhomboidal or hexagonal spaces; avicularia scattered; ovicells immersed, inconspicuous; branches articulated.

Salicornaria, Cuvier; Johnston; 'Brit. Mus. Cat.,' p. 16.
Farcimia, Fleming; Johnston, 'Ed.' i.
Cellaria (α), Lamarck; Lamx.; De Blainville.
Five species.

Gen. 2. *Nellia*, Busk.

Front of cell convex, with a distinct raised border; aperture very large; ovicells (?); no avicularia.

Salicornaria (sp.), Busk., 'Voyage of Rattlesnake,' i. 367.
Nellia, 'Brit. Mus. Cat.,' p. 18.
Two species.

Gen. 3. *Vincularia*, Defrance. (*Fig.* 19.)

Polyzoary rigid, calcareous, inarticulated; surface not areolated; aperture large; no avicularia; ovicells inconspicuous.

Vincularia, Defrance; Blainv.; Hagenow; 'Brit. Mus. Cat.,' p. 96.
Glauconoma, Goldfuss.
Siphonella, Hagenow.
Cellaria (pars), Reuss.
One recent species; numerous fossil.

Gen. 4. *Farciminaria*, Busk. (*Fig.* 8.)

Polyzoary corneous, flexible; margin of aperture much raised; aperture very large; ovicells cucullate, prominent; no avicularia.

Farciminaria, 'Brit. Mus. Cat.,' p. 32.
One species.

Family 4. *Cellulariadæ*, Busk.

Cells disposed in the same plane, forming linear branches of a dichotomously divided phytoid, erect, articulated polyzoary.

Bugulidæ (pars), Gray.
Cellularidæ (pars), Johnston.
Escharidæ (pars), Johnston; Gray.
Cellulariadæ, 'Brit. Mus. Cat.,' p. 19.

Gen. 1. *Cellularia*, Pallas. (*Fig.* 5.)

Cells bi-triserial; more than four in each internode; oblong or rhomboidal, contiguous; perforated behind, unarmed, or very rarely with an avicularium on the upper and outer angle of the cells.

Cellularia (pars), Pallas; Fleming; Johnston (pars); 'Brit. Mus. Cat.,' p. 19.
Bugula (pars), Gray; Oken.
Three species.

Gen. 2. *Menipea*, Lamouroux.

Cells oblong, or elongated and attenuated downwards; imperforate behind, with a sessile avicularium (frequently absent) on the upper and outer angle, and one or more sessile avicularia on the front of the cell below the aperture (not always present).

Menipea, Lamx.; 'Brit. Mus. Cat.,' p. 20.
Cellaria (pars), Linn.; Solander.
Crisia (pars), Lamx.
Tricellaria, Fleming; Blainville.
Six species.

Gen. 3. *Scrupocellaria*, Van Beneden.

Cells rhomboidal, with a sinus on the outer and hinder aspect; each furnished with a sessile avicularium at the upper and outer angle, and with a vibraculum behind. Cells biserial and numerous in each internode.

Scrupocellaria, Van Beneden; Gray; 'Brit. Mus. Cat.,' p. 23.
Bicellaria (sp.), Blainville.
Cellularia (sp.), Pallas; Johnston.
Cellaria (sp.), Solander; Lamarck.
Scruparia (sp.), Oken.
Seven species.

Gen. 4. *Canda*, Lamouroux.

Cells rhomboidal, sinuated on the outer side for the lodgment of a vibraculum; no avicularium on the upper and outer angle; sometimes one in front of the cell.

Canda, Lamx.; Blainville; Gray; 'Brit. Mus. Cat.,' p. 26.
Cellaria (sp.), Lamarck.
Cellarina, Van Beneden.
Bicellaria (sp.), Blainville.

Scrupocellaria, Gray.
Cellularia (sp.), Johnston.
Two species.

Gen. 5. *Emma*, Gray,

Cells in pairs or triplets; a sessile avicularium (sometimes wanting) on the outer side below the level of the aperture.
Emma, Gray; 'Brit. Mus. Cat.,' p. 27.
Two species.

Family 5. *Cabereadæ*, Busk.

Polyzoary dichotomously divided into ligulate bi-multiserial branches; on the backs of which are vibracula, each of which is common to several cells.
Cabereadæ, Busk.; 'Voyage of Rattlesnake;' Brit. Mus. Cat.' p. 37.

Gen. 1. *Caberea*, Lamx. (*Fig.* 10.)

Cells bi-multiserial, in the latter case quincuncial. Back of branches covered with large vibracula, which are placed obliquely in two rows, diverging in an upward direction from the middle line, at which the vibracula of either side decussate with those of the other.
Caberea, Lamx.; Blainville; Gray; 'Brit. Mus. Cat.,' p. 37.
Selbia, Gray.
Crisia (sp.), Audouin.
Cellaria (sp.), Lamarck.
Cellularia (sp.), Fleming; Johnston.
Four species.

Gen. 2. *Amastigia*, Busk.

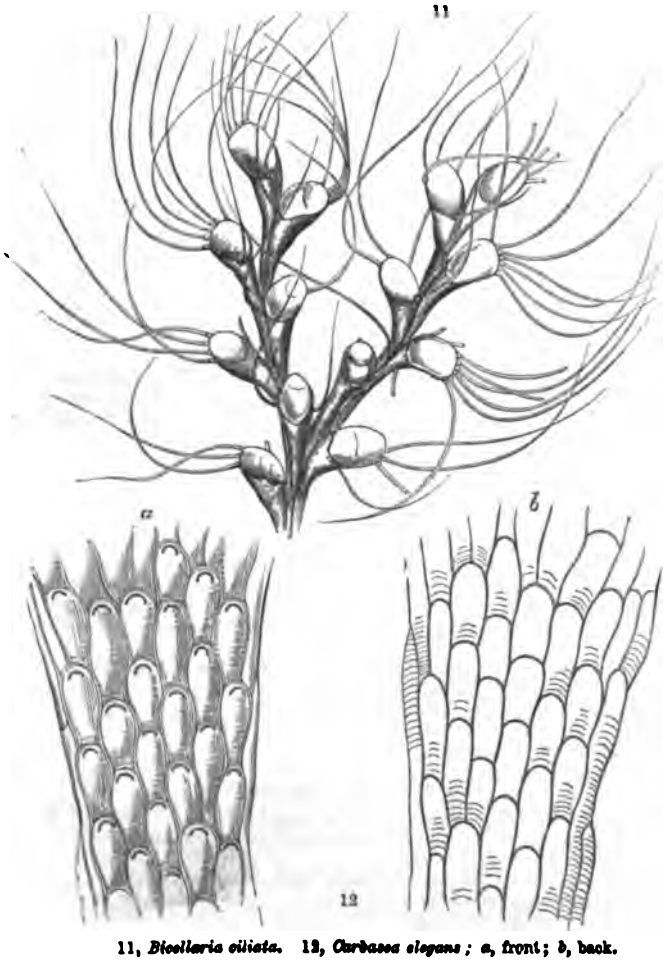
Cells bi-quadriserial; vibracula small, resembling avicularia.
One species.

Family 6. *Bicellariadæ*, Busk.

No vibracula; avicularia, when present, pedunculate.
Bicellariadæ, Busk.; 'Voyage of Rattlesnake.'
Bugulidæ, Gray.

Gen. 1. *Bicellaria*, Blainville. (*Fig.* 11.)

Cells turbinate, distant. Aperture directed more or less upwards. Several spines, marginal or dorsal.
Bicellaria, Blainville; Gray; 'Brit. Mus. Cat.,' p. 41.
Cellularia, Fleming; Pallas (sp.).
Cellaria (sp.), Oken; Lamarck.
Bugula (sp.), Oken.
Four species.



11, *Bicellaria ciliata*. 12, *Carbasea elegans*; *a*, front; *b*, back.

Gen. 2. *Halophila*, Gray.

Cells contiguous, attenuated downwards; much expanded above, with a large plain aperture unarmed.
Halophila, Gray, 'Dieff. New Zealand;' 'Brit. Mus. Cat.,' p. 43.
Bicellaria, Busk., 'Voyage of Rattlesnake,'

Gen. 3. *Bugula*, Oken.

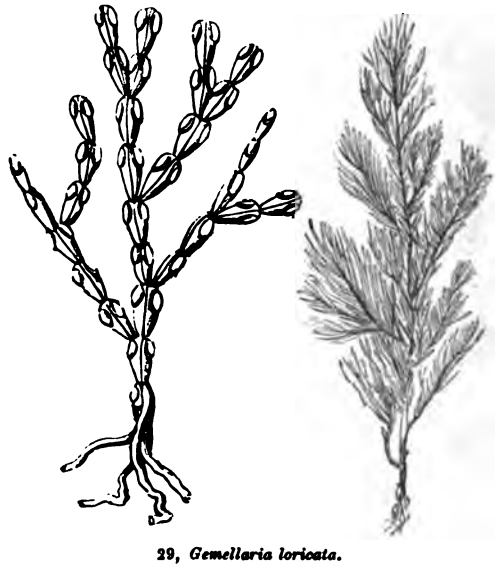
Cells elliptical (behind), closely contiguous, bi-multiserial; aperture very large; margin simple, not thickened.
Bugula, Oken; Gray; 'Brit. Mus. Cat.,' p. 43.
Acamarchis, Lamx.; Blainville.
Crisia (sp.), Lamx.
Cellularia (sp.), Pallas; Johnston (sp.).
Cellaria (sp.), Solander; Lamarck.
Bugulina (sp.), Gray.
Crisularia (sp.), Gray.
Six species.

Family 7. *Gemellariadæ*, Busk.

Cells opposite in pairs. Polyzoary continuous.
Gemellariadæ, Busk; 'Voyage of Rattlesnake;' 'Brit. Mus. Cat.,' p. 33.

Gen. 1. *Gemellaria*, Savigny. (*Fig.* 29.)

Cells joined back to back; all the pairs facing the same way.
Gemellaria, Savigny; Van Beneden; Johnston; Gray; 'Brit. Mus. Cat.,' p. 34.
Gemicellaria, Blainville.
Loricaria, Lamx.
Notamia (pars), Fleming.
Loricula, Cuvier.
Crisia (sp.), Lamx.; Lamarck.
Scruparia (β), Oken.
One species.



29, *Gemellaria loricata*.

Gen. 2. *Didymia*, Busk.

Cells joined side to side; no avicularia.
Didymia, Busk.; 'Voyage of Rattlesnake;' 'Brit. Mus. Cat.,' p. 35.
One species.

Gen. 3. *Dimetopia*, Busk. (*Fig.* 9.)

Cells joined back to back; aperture oblique; each alternate pair of cells looking the same way.
Dimetopia, Busk; 'Voyage of Rattlesnake.'
Two species.

Gen. 4. *Notamia*, Fleming.

A pair of tobacco-pipe shaped avicularia, visible above each pair of cells.
Epistomia (sp.), Fleming; Gray.
Dynamena (sp.), Lamx.; Blainville.
Notamia, Fleming; 'Brit. Mus. Cat.,' p. 36; Johnston.
Gemicellaria (sp.), Blainville.
Sertularia (sp.), Gmelin.
Cellularia (sp.), Pallas.
One species.

Family 8. *Flustradæ*, Gray.

Polyzoary flexible, expanded, foliaceous, erect; sometimes decumbent and loosely attached. Cells multiserial, quincuncial, or irregular.
Flustra, Linn.; Johnston (pars).
Flustradæ, Gray (pars); 'Brit. Mus. Cat.,' p. 46.
Escharidæ (part), Johnston; Gray.
Polypiers à Réseau (pars), Lamx.
Flustrées (pars), Lamx.

Gen. 1. *Flustra*, Linnæus.

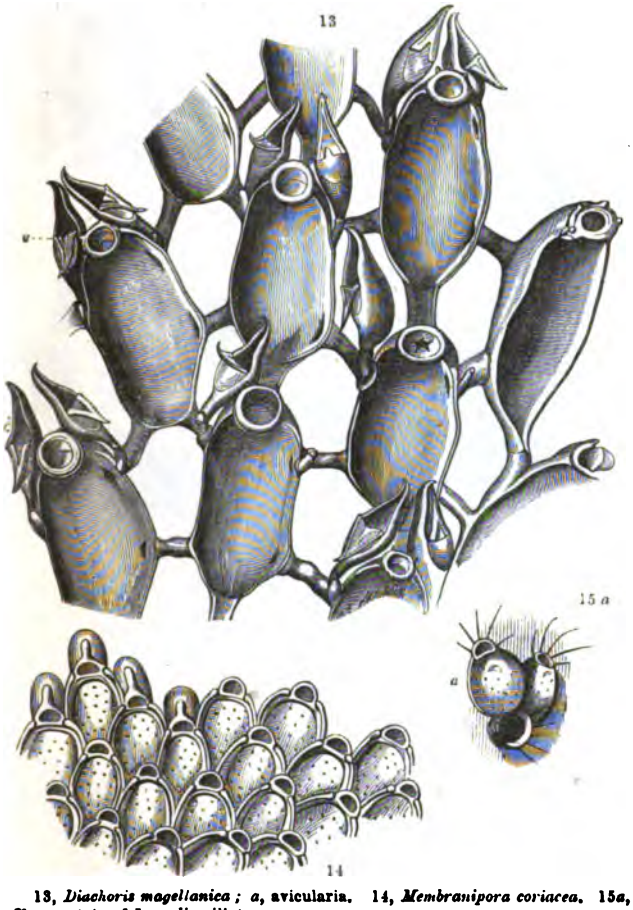
Cells contiguous; on both sides of the frond.
Flustra (sp.), Linn.; Lamarck; Gray.; &c.
Five species.

Gen. 2. *Carbasea*, Gray. (*Fig.* 12.)

Cells contiguous; on one side only of the frond.
Flustra (sp.), Linn.; Johnston.
Carbasea, Gray; 'Brit. Mus. Cat.,' p. 50.
Ten species.

Gen. 3. *Diachoris*, Busk. (*Fig.* 13.)

Cells disjunct; each connected with six others by tubular processes.
Diachoris, Busk., 'Voyage of Rattlesnake.'
Three species.



13, *Diachoris magellanica*; *a*, avicularia. 14, *Membranipora coriacea*. 15*a*, Young state of *Lepralia ciliata*.

Family 9. *Membraniporidæ*, Busk.

Polyzoary membranaceo-calcareous, or calcareous, expanded, encrusting (sometimes foliaceous, contorted, and suberect). Cells horizontal, quincuncial, or serial.
Flustra, Linn. (pars).
Flustradæ (pars), Gray.
Celleporidæ (pars), Johnston.
Membraniporidæ, Busk.; 'Brit. Mus. Cat.,' p. 55.

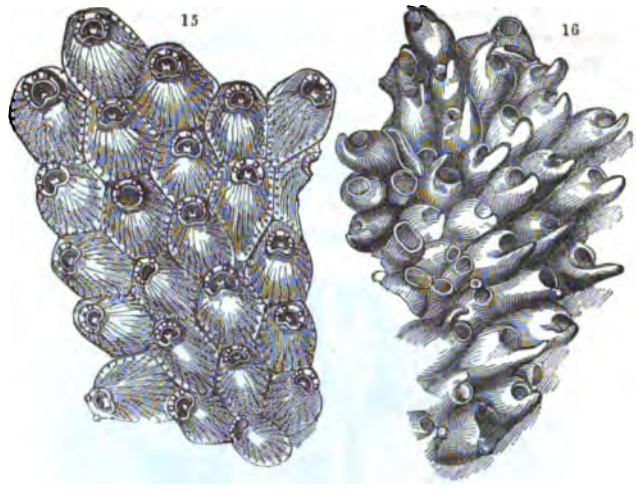
* Cells more or less open in front, with raised margins.

Gen. 1. *Membranipora*, Johnston. (*Fig.* 14.)

Polyzoary encrusting (or suberect, foliaceous, and contorted), spreading irregularly. Cells more or less irregularly disposed or quincuncial, with raised margins; a greater or less extent of the aperture occupied by a thin membrane.
Eschara (pars), Pallas.
Flustra (sp.), Linn.; Esper; Berkeley; Lamarck; Grant; Fleming; Risso; Johnston; Lamouroux.
Membranipora, Johnston; 'Brit. Mus. Cat.,' p. 56; W. Thompson; Hassall.
Discopora (pars), Lamarck.
Annulipora, *Conopeum*, *Callopora*, *Amphiblestrum*, *Micropora*, Gray.
Eighteen species.

** Aperture of cells entirely filled in by a convex calcareous expansion. Cells disposed in more or less regularly radiating lines.

Gen. 2. *Lepralia*, Johnston. (*Figs.* 15 & 15*a*.)



15, *Lepralia Peachii*. 16, *Cellepora pumicosa*.

Polyzoarium adnate, crustaceous, spreading from a centre in a more or less circular form; composed of contiguous, or connected, calcareous, decumbent cells, the wall of which is complete in front.
Eschara (sp.), Moll.; Pallas.
Lepralia, Johnston; Gray; 'Brit. Mus. Cat.,' p. 63.
Berenicea, Fleming (non Lamouroux nor Peron).
Escharina (sp.), Milne-Edwards; Gray.
Escharoides (sp.), Milne-Edwards.
Cellepora (sp.), Oken; Audouin (pars); Lamouroux (pars); Hagenow (pars).
Flustra (varior).
Discopora, Lamarck (pars); Gray (pars); Lamouroux (pars).
Cribrillina, *Herentia*, *Escharella*, *Porella*, *Celleporella* (all sp.), Gray.

1. *Armatæ*. Species provided with either avicularia or vibracula.
   A. Species having avicularia.
      a. Median and single.
         * Superior (above the mouth).
         ** Inferior (below the mouth).
      β. Avicularia double, or azygous and lateral on each cell, or only on some cells in the polyzoary.
   B. Species having vibracula.
2. *Inarmatæ*. Species without either avicularia or vibracula.
   a. With oral spines.
   β. Mouth unarmed.

About fifty or sixty species.

Family 10. *Celleporidæ*, Busk.

Polyzoarium composed of cells, standing more or less vertical to its axis or plane, heaped together, or irregularly overlying each other.
Celleporidæ, Johnston (pars); 'Brit. Mus. Cat.,' p. 58.

Gen. 1. *Cellepora*, O. Fabricius. (*Fig.* 16.)

Polyzoarium calcareous, rigid, adnate or erect, composed of urceolate, suberect, contiguous cells, heaped together irregularly, or arranged quincuncially. An ascending rostrum on one or both sides of the mouth usually furnished with an avicularium.
Cellepora (sp.), O. Fabricius; Johnston; Linnæus; Müller; Berkeley; Stewart; Lamarck; Lamouroux; Fleming; Olivi.
Spongites, Oken.
Tubipora (pars), Linn.
Millepora (pars), Pallas; Ellis and Solander (pars).
Eschara (pars), Pallas.

* Adnate, globose, or spreading.
** Erect.

Eight species.

Family 11. *Escharidæ*, Busk.

Polyzoary erect, rigid, foliaceous and expanded, lobate or reticulate Cells disposed quincuncially in the same plane, on one or both surfaces
Escharidæ (pars), Johnston.
Lepralianæ (pars), Gray.
Reteporanæ, Gray.

Gen. 1. *Eschara*, Ray. (*Fig.* 17.)

Polyzoarium foliaceous and expanded, or contorted, or branched and sublinear. Cells disposed on both surfaces, back to back, immersed, coalescent, horizontal to the plane of the axis.
Eschara, Ray; Fleming; Johnston; Lamarck; Gray; Pallas (pars); Moll (pars); 'Brit. Mus. Cat.,' p. 89.
Nullipora (sp.), Solander.
Cellepora (sp.), Esper.

* Polyzoary more or less expanded, foliaceous.

** Polyzoary subdivided into branching lobes.

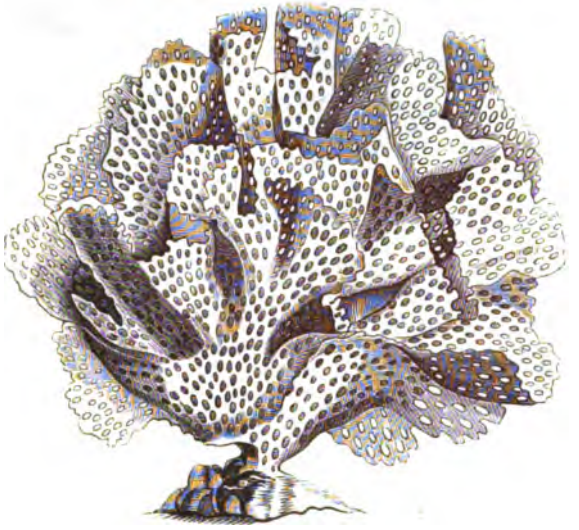
Eleven species.

Gen. 2. *Retepora*, Imperato. (*Fig.* 28.)

Polyzoarium foliaceous, calcareous, reticulated. Cells immersed, opening at one surface only.

Millepora, Linn.(pars); Ellis and Solander; Esper; Marsigli; Cuvier.
Retepora, Imperato; Lamarck; Risso; Fleming; Stark; De Blainville; Couch; Johnston; Goldfuss (pars); Hagenow (pars); 'Brit. Mus. Cat.,' p. 93.
Frondipora, Oken; De Blainville.

Three species.



28, *Retepora cellulosa.*

Family 12. *Selenariadæ*, Busk.

Polyzoary more or less regularly orbicular, convex on one side, plane or concave on the other (probably free). Furnished with large and powerful vibracula, with variously formed setæ (probably locomotive).

Selenariadæ, Busk; 'Brit. Mus. Cat.,' p. 97.

Gen. 1. *Cupularia*, Lamouroux.

(*Fig.* 18; vide also *figs.* in CELLARIÆA.)

Each cell throughout the polyzoary with a vibraculum at the summit.

Cupularia, Lamouroux (proposed); 'Brit. Mus. Cat.,' p. 97.
Lunulites, Lamouroux (pars); Defrance (pars).; Deslongchamps (pars); Goldfuss (pars); De Blainville (pars); Gray; Cuvier and Brongniart; Lonsdale (pars); Michelin (pars).
Fenestella (pars), Lonsdale.

Five species (recent); numerous fossil.

Gen. 2. *Lunulites*, Lamouroux.

Cells arranged in series radiating from the centre and bifurcating as they advance; vibracula in linear series alternate with those of the cells.

As in the preceding species.

Four species (recent); numerous fossil.

Gen. 3. *Selenaria*, Busk.

Only a certain number of cells, dispersed at uniform distances apart, furnished with vibracula. The front of each cell furnished, covered by a cribriform calcareous expansion; the others arched above and contracted below.

Lunulites (pars), Busk, 'Voyage of Rattlesnake.'
Selenaria, 'Brit. Mus. Cat.,' p. 101.

Sub-Order II. *Cyclostomata.*

Cells tubular, calcareous, immersed or exserted; mouth terminal, without any moveable appendage or lip.

Tuburiporina, Milne-Edwards.
Tuburiporidæ, Johnston.
Auloporina (pars), Ehrenberg; Johnston.

A. Erectæ.

Polyzoary erect, free, simple or branched, linear or expanded above; branches articulated or continuous.

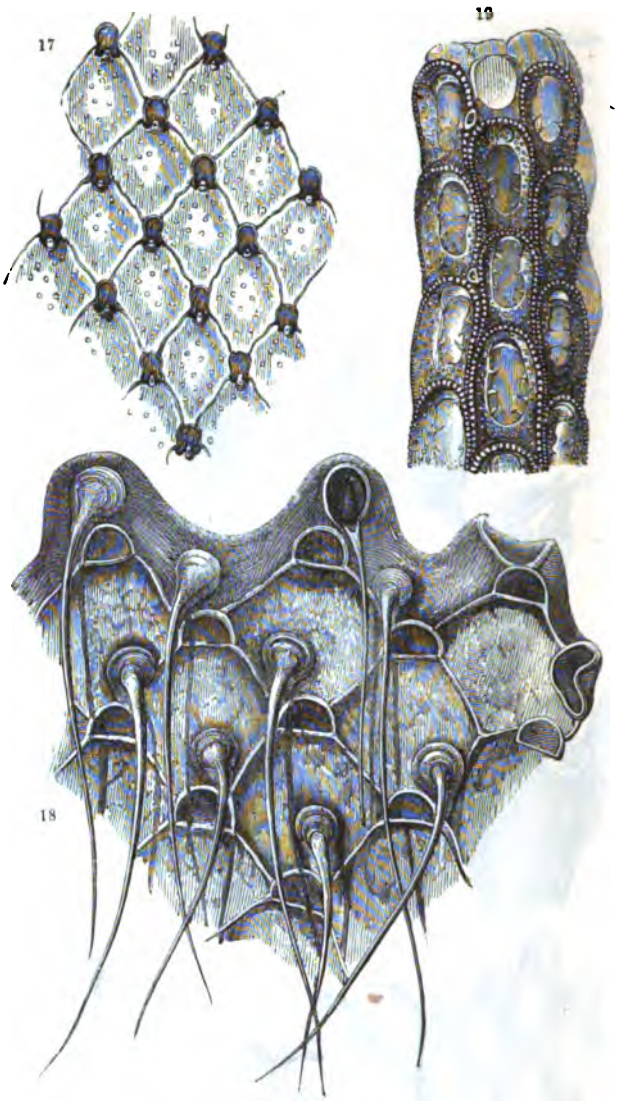
Family 1. *Crisiadæ*, Milne-Edwards.

Polyzoarium divided into distinct internodes, connected by a horny substance.

Gen. 1. *Crisidia*, Milne-Edwards.

A single cell in each internode.

Sertularia (pars), Linn.; Berkeley (pars); Esper (pars).



17, *Eschara foliacea.* 18, *Cupularia Lowei.* 19, *Vincularia ornata.*

Cellularia (pars), Pallas; Hogg.
Cellaria, Ellis and Solander (pars); Lamarck (pars).
Eucratea, Lamouroux (pars); Risso (pars); Fleming (pars); Templeton.
Unicellaria (pars), Blainville.
Crisidia, Milne-Edwards.
Crisia (pars), Johnston; Hassall (pars), &c.

One or two species.

Gen. 2. *Crisia*, Lamouroux. (*Fig.* 20.)

Two or more cells in each internode.

Syn. as above.

Three species recent; several fossil.

Family 2. *Idmoneadæ.*

Polyzoarium continuous throughout, usually polymorphous.

Gen. 1. *Idmonea*, Lamouroux. (*Fig.* 22.)

Openings of cells disposed in transverse or oblique alternate series on each side of the front of the branches of the polyzoary, on which is a raised line or ridge separating the rows of cells.

Retepora (sp.), Lamarck.
Hornera (sp.), Defrance.
Idmonea, Lamouroux; Blainville.

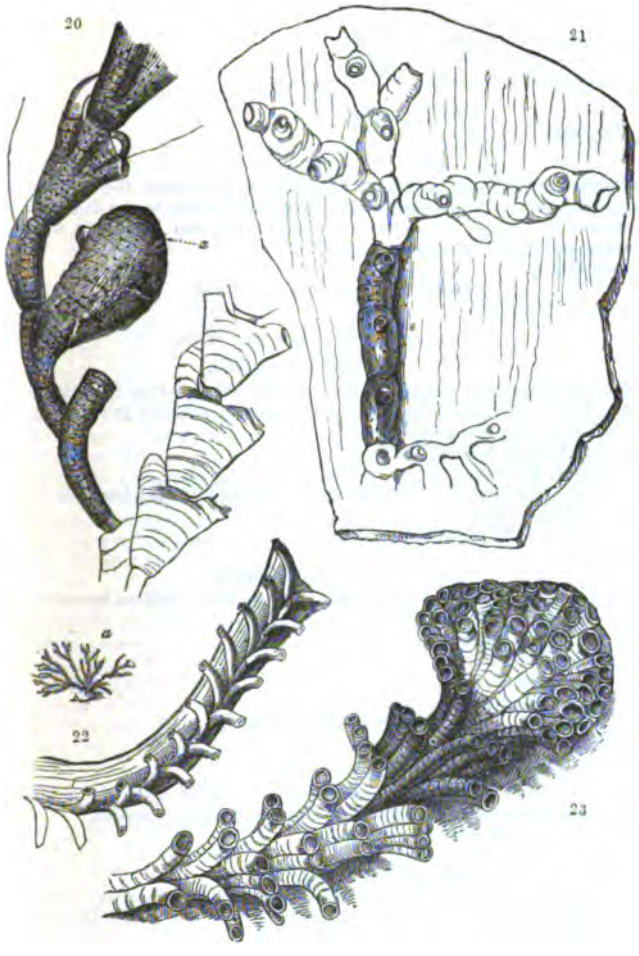
Three or four species recent; many fossil.

Gen. 2. *Pustulipora*, De Blainville. (*Fig.* 26.)

Openings of cells disposed irregularly, on all sides of the cylindrical or compressed branches or lobes of the polyzoary.

Ceriopora (pars), Goldfuss.
Idmonea (sp.), De Blainville.
Pustulipora, Blainville; Milne-Edwards; Johnston.
Tubulipora (sp.), Couch.

Five or six species recent; many fossil.



20, *Orisia bicellata*; *a*, ovicell. 21, *Alecto granulata*. 22, *Idmonea radians*; *a*, natural size. 23, *Tubulipora serpens*.

Gen. 3. *Hornera*, Lamouroux.

Openings of cells disposed irregularly, or in more or less regular opposite transverse series, on one side only of the branches or lobes of the polyzoary.

Millepora (sp.), Esper.
Retepora (sp.), Lamarck.
Hornera, Lamouroux; De Blainville; Milne-Edwards.

Several species recent; many fossil.

B. Adnatæ, *s.* decumbentes.

Polyzoarium adnate or suberect above, decumbent and adnate below.

Family 3. *Tubuliporadæ*.

Polyzoarium divided into linear or sublinear branches or lobes, sometimes more expanded and lobate upwards, always decumbent, and closely adnate.

Gen. 1. *Alecto*, Lamouroux. (*Fig.* 21.)

Polyzoarium composed of a single or of multiple series of cells.

Alecto, Lamouroux; Milne-Edwards; Johnston (pars); De Blainville; Fleming.
Millepora (sp.), Linn.
Aulopora (sp.), Goldfuss, &c.

Three or four species recent; several fossil.

Gen. 2. *Tubulipora*. (*Fig.* 23.)

Polyzoarium arising from a contracted base, and expanding above; either simple or irregularly subdivided; decumbent and adherent below, usually free and suberect above.

Tubulipora, Milne-Edwards (pars); Johnston (pars); Fabricius; Turton; Gmelin; Couch (pars); Fleming (pars); Lamarck (sp.); Risso (sp.).
Tubipora (sp.), Linn.; Jameson; Stewart; Bosc.
Millepora (sp.), Ellis and Soland.
Cellepora (sp.), Esper.
Pherusa (?), Lamouroux, &c.

Five or six species recent; several fossil.

Family 4. *Discoporadæ*.

Polyzoarium in the form of a closely adnate, circular, or irregular disc or patch.

Tubuliporidæ (pars), Milne-Edwards, &c.

Gen. 1. *Discopora*, Lamarck.

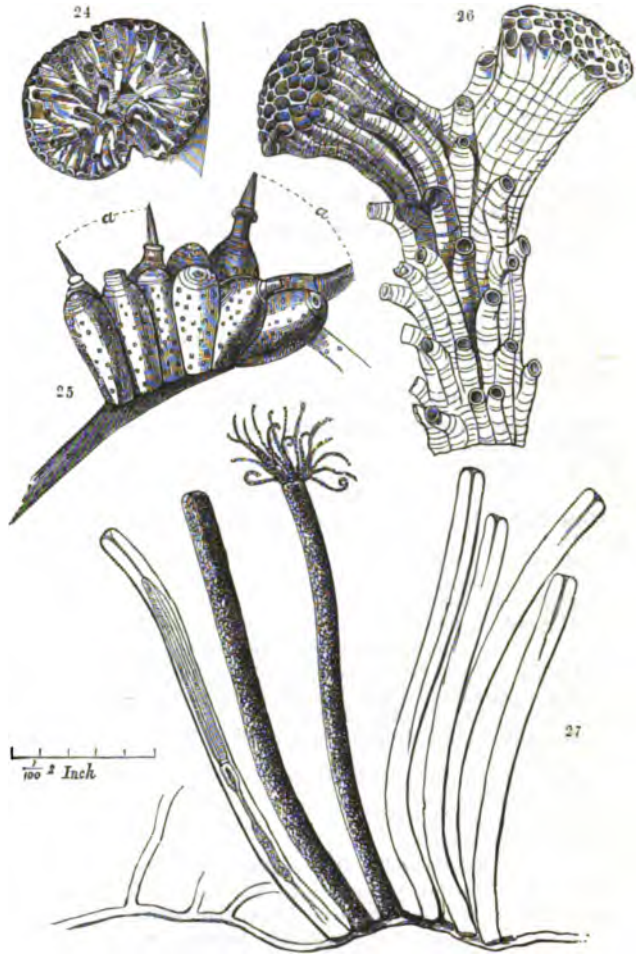
Polyzoarium a circular disc, either flat, concave, or convex in the centre, with the suberect tubes opening irregularly in all parts of the surface, and usually surrounded by a thin calcareous border.

Discopora, Lamarck; Lamouroux; Fleming.
Tubulipora (pars), Johnston.
Melobesia, Audouin.
Obelia, Quoy and Gaimard.
Madrepora, Ellis and Solander; O. Fabricius.

Gen. 2. *Diastopora*, Lamouroux. (*Fig.* 24.)

Polyzoarium more or less depressed, circular, discoid; the cells subalternating, horizontal, immersed; openings elliptical.

Millepora (sp.), Esper.
Mesenteripora, De Blainville.
Diastopora, Milne-Edwards (pars); Johnston (sp.); Hagenow (pars).
Aulopora (sp.), Goldfuss.
Berenicea (sp.), Lamouroux.
Rosacilla, Römer.



24, *Diascopora* (sp. ?); 25, *Serialaria lendigera*; *a*, oral setæ. 26, *Pustulipora*, (sp. ?). 27, *Farrella prælonga*.

Gen. 3. *Defrancia*, Bronn.

Polyzoary either discoid and adnate throughout, or fungiform and attached by a short stem; openings of tubes disposed in lines or rows radiating from the centre.

Pelagia, Lamouroux.
Lichenopora, Michelin.
Tubulipora, Milne-Edwards (sp.); Johnston (sp.)
Ceriopora (auct., pars).
Defrancia, Bronn.; Hagenow; Reuss.

Sub-Order III. *Ctenostomata*.

Cells corneous, or fleshy, tubular or depressed, free or coalescent;

mouth terminal or subterminal, contractile, and when the polypide is exserted, surrounded with a fringe or row of setæ, connected by a delicate membrane.

Vesicularina, Johnston.
Polyzoa cornea, Gray, and including—
Halcyonellea, Johnston.
Polyzoa carnósa, Gray.
Alcyoniadæ and *Alcyonidulæ*, Johnston.

Family 1. *Vesiculariadæ*, Johnston.

Cells tubular or ovate, separate, arising from a basal tube common to all or to several; mouth terminal.

Vesiculariadæ, Johnston.

Gen. 1. *Serialaria*, Lamarck. (*Fig.* 25.)

Cells uniserial or biserial, and unilateral, placed in close sets at stated intervals; basal tube divided into internodes.

Serialaria, Lamarck; Risso; Fleming; Templeton; Couch; De Blainville.
Amathia, Lamouroux, &c.

Three or four species.

Gen. 2. *Vesicularia*, J. V. Thompson.

Cells ovate or subtubular, disjunct, uniserial, and unilateral; polypide with a gizzard.

Valkeria (sp.), Fleming.
Vesicularia, Thompson; Farre; Johnst.; Van Beneden; Couch.

One species.

Gen. 3. *Valkeria*, Fleming.

Cells ovate, clustered in whorls at the joints of the basal tube; polypides without a gizzard.

Valkeria, Johnston; Fleming; Farre; Van Beneden.
Vesicularia (sp.), Thompson.
Cuscutaria, De Blainville.

Gen. 4. *Bowerbankia*.

Cells unilateral, irregularly placed, sessile; polypides with a gizzard (armed with two teeth).

Bowerbankia, Farre; Johnston; Van Beneden.

One species.

Gen. 5. *Farrella*. (*Fig.* 27.)

Cells elliptical, scattered; polypide without a gizzard.

Farrella, Ehrenberg; Johnston.
Lagenella, Farre.
Laguncula, Van Beneden.

Two species.

Gen. 6. *Anguinella*, Van Beneden.

Cells tubular, supported on a common stalk, and branching out in a palmate fashion.

Anguinella, Van Beneden.

Family 2. *Alcyoniadæ*, Johnston.

Cells fleshy, immersed, angular; mouth terminal, simple, contractile.

Halcyonellæ, Johnston.
Polyzoa carnosa, Gray.
Alcyoniadæ, Johnston.
Alcyonidulæ, Johnston.

Gen. 1. *Alcyonidium*, Lamouroux.

Polyzoary variously lobed, massive, fleshy, erect, or adnate.

Alcyonium, Ellis; Baxter; Pallas; Linn.; Olivi; Esper; Müller; Lamouroux; De Blainville; &c.
Alcyonidium, Lamouroux; Gray; Hooker; Johnston; W. Thompson; &c.
Halodactylus, Farre; Van Beneden.
Cyclosum (sp.), Hassall.
Sarchochitum (?), Hassall.

Three or four species.

Sub-Order IV. *P. Pedicellinea*, Gervais.

Lophophore produced upwards on the back of the tentacles, uniting them at their base in a sort of muscular calyx.

Family 1. *Pedicellinidæ*, Johnston.

Gen. 1. *Pedicellina*, Sars.

Polypide not retractile within the delicate closely adnate ectocyst, which is produced downwards into a long tubular pedicle, containing muscular fibres, and rising vertically from a creeping radical tube.

Hydra (sp.), Fleming; Bosc.; Lister; Sharpey.
Pedicellina, Sars; Johnston; Van Beneden.
Lucia, Milne-Edwards; De Blainville; Gervais; Hassall.
Crinomorpha, Van Beneden.

Two or three species.

Sertularia (sp.), Müller; Bosc.; Lamarck.

Three species.

Order II. *Polyzoa hippocrepia*, Gervais.

Tentacles disposed on a crescentic or horse-shoe shaped lophophore; eversion of endocyst only partial.

Polypiaria hippocrepia, Gervais.
Polyzoa hippocrepia, Gray.
Lemniades, Johnston; Allman.
Freshwater *Polyzoa*, Allman.
Freshwater *Bryozoa*, Hancock.
Bryozoaires Fluviatiles, Van Beneden.

Family 1. *Cristatellidæ*, Allman.

Polyzoary free, locomotive.

Gen. 1. *Cristatella*, Cuvier.

Polyzoary sacciform, hyaline, with a common flattened disc adapted for locomotion; orifices placed on the surface opposite to the disc, and arranged in several concentric marginal series; ova lenticular, with annular and marginal spines.

One species.

Family 2. *Plumatellidæ*, Allman.

Polyzoary rooted.

A. Lophophore with two long arms.

Gen. 1. *Lophopus*, Dumortier.

Polyzoary sacciform, hyaline, with a disc which serves for attachment, but not for locomotion; orifices scattered; ectocyst gelatinous.

Polype à Panache, Trembley.
Bell-Flower-Animal, Baker.
Naisa, Lamouroux; Deslongchamps.
Plumatella (sp.), Schweigger; De Blainville; Gervais; Lamarck.
Alcyonella, Raspail; Johnston; Allman.
Lophopus, Van Beneden; Allman.

One species.

Gen. 2. *Alcyonella*, Lamarck.

Polyzoarium tubular; tubes united by their sides; orifices terminal; ectocyst pergamentaceous.

Tubularia, Pallas.
Leucophra, Müller.
Alcyonium, Bruguière.
Spongia, Schmiedel.
Alcyonella, Raspail; Pallas (sp.); Allman, &c.
Plumatella, Gervais.

Three species.

Gen. 3. *Plumatella*, Lamarck. (*Fig.* 30.)

Polyzoary tubular; tubes distinct; ectocyst pergamentaceous.

Tubipora, Linnæus.
Tubularia, Müller; Linnæus; Vaucher; Turton.
Naisa, Lamouroux; Deslongchamps.
Plumatella, De Blainville; Carus; Lamarck; Dumortier; Johnston; Gervais; Allman; Thompson; Van Beneden; Dalzell; Schweigger; Risso, &c.

Ten species.

30, *Plumatella cristata*.

B. Lophophore with the arms obsolete.

Gen. 4. *Fredericella*, Gervais.

Polyzoary confervoid, composed of a membrano-corneous branched tube, with the branches distinct and terminated by the orifices; lophophore nearly circular, tentacular crown campanulate; ova bean-shaped, destitute of annulus or spines.

Tubularia, Blumenbach; Gmelin.
Naisa, Lamouroux.
Diffugia, Meyen.
Plumatella, Fleming Dumortier; Johnston.

Fredericella, Gervais; Van Beneden; Thompson; Allman; Johnston; Hancock.

Family 3. *Paludicellidæ.*

Lophophore orbicular, mouth destitute of valve. (Does not perhaps properly belong to the *P. hippocrepia.*)

Gen. 1. *Paludicella*, Gervais.

Polyzoary membrano-corneous, branched; branches composed of a series of claviform cells, placed end to end, and separated from one another by complete septa; orifices tubular, lateral, placed near the wider extremity of each cell; ova lenticular, with a narrow annulus.

Alcyonella (sp.), Ehrenberg; Nordmann.

Paludicella, Gervais; Van Beneden; Allman; Thompson; Johnston; Hancock.

POMACANTHUS. [CHÆTODON.]

POMA'CEÆ. [ROSACEÆ.]

POMATOMUS. [PERCIDÆ.]

POME, a form of Fruit. [FRUIT.]

POMEGRANATE. [PUNICA.]

POMPILIDÆ, a family of Fossorial Hymenopterous Insects. They are sometimes included with the *Sphegidæ*. [HYMENOPTERA.] They have the collar either transversely or longitudinally square, with the abdomen more or less oval, and attached to the thorax by a very short peduncle. The legs are very long. The fore wings have two or three perfect submarginal cells, and another commenced at the tip of the wings. The species are called Sand Wasps, and are amongst the most ferocious of the insect tribes. The species of the exotic genus *Pepsis* are amongst the largest of the *Hymenoptera*. The genus *Pompilus* is British. The species are very active, running amongst grass and other plants in hot sandy situations. They are quick in their motions, and their wings are constantly agitated. Their long legs give them the appearance of spiders. (Westwood, *Families of Insects.*)

POMPILIUS. [NAUTILIDÆ.]

PO'MPILUS, according to Latreille, a genus of Hymenopterous Insects of the section *Fossores* and family *Sphegidæ*. In the systems of Dr. Leach, Mr. Shuckard, and some others, this group of insects is regarded as a family, *Pompilidæ*, the principal characters of which are as follows:—Posterior legs at least as long as the head and thorax taken together; antennæ of the female formed of long joints, generally distinct and often curved; prothorax at least as broad again as long; its posterior margin arched; abdomen obovoid, without any long petiole at the base.

The *Pompilidæ* are extremely active: they run and fly with great rapidity; are for the most part of moderate size, and often adorned with red and black colours; at least those species which belong to the genus *Pompilus*. These insects burrow in the ground, preferring sandy situations, and store their cells with spiders, which constitute the food of their larvæ.

In the genus *Pompilus* the superior wings have one marginal cell, which is semicircular, and sometimes nearly triangular; and three submarginal cells; the first of these is as long or longer than the two following cells; the second receives the first recurrent nervure about its centre; and the third, which is either triangular or subquadrate, receives the second recurrent nervure. A fourth submarginal cell is sometimes traceable.

This genus contains numerous species. Mr. Shuckard, in his work on the indigenous Fossorial *Hymenoptera*, describes 18 species.

Besides *Pompilus* proper, the genera *Ceropales* and *Aporus* are included in the present family.

PONERA (Latreille), a genus of Insects belonging to the family *Formicidæ*. In this genus the neuters and females are armed with a sting. The peduncle of the abdomen is formed of a single knot; antennæ in these individuals thickened at the tip; mandibles triangular; head subtriangular. *P. contracta* is a small species, a native of England.

PONGO. [CHIMPANZEE.]

PONTEDERA'CEÆ, *Pontederads*, a natural order of Plants belonging to the class of Endogens. It has a 6-parted tubular coloured perianth, more or less irregular, with a circinate æstivation. The stamens arising from the calyx 6 or 3 opposite the petals, the anthers turned inwards, opening lengthwise. The ovary is free, more or less completely, 3-celled, many-seeded; one style, the stigma simple. The capsule 3-celled, occasionally acquiring an adhesion to the perianth, 3-valved with loculicidal dehiscence; the seeds are indefinite, attached to a central axis; ascending hilum small; the embryo with its radicle rather enlarged, orthotropal in the axis of somewhat mealy albumen. The species are aquatic or marsh plants. The leaves sheathing at the base, with parallel veins in the larger species, arrow-headed, cordate, or dilated. The flowers are either solitary or in spikes or umbels, spathaceous; frequently blue, sometimes yellow. The aquatic plants comprehended in this order are distinguished by the divisions of their flowers being rolled inwards after flowering, to which may be added mealy albumen and an indefinite number of seeds. They are natives exclusively of North and South America, the East Indies, and tropical Africa. Very little is known of their uses. Some of the species are employed by the native Indian practitioners in liver complaints and diseases of the stomach.

Rubbed down in butter and drank, they are said to remove redness of the eyes; powdered and mixed with sugar, to relieve asthma; and when chewed, to remove tooth-ache; brayed with milk, some are administered in fever and some eaten as pot-herbs.

(Lindley, *Vegetable Kingdom.*)

PONTO'PHILUS, a genus of Shrimps. (*Egeon*, Risso.)

PONTOPORIA. [CETACEA.]

POONAHLITE, a Mineral occurring crystallised in long slender crystals. Primary form a right rhombic prism. Fracture uneven. Colourless. Hardness 5·0 to 5·5. Transparent, translucent. Lustre vitreous. Found at Poonah in the East Indies.

The following is an analysis by Gmelin:—

Silica	45·120
Alumina	30·446
Lime	10·197
Soda, with a trace of potash	00·657
Water	13·386
	99·806

POPINJAY. [PICIDÆ.]

POPLAR. [POPULUS.]

POPPY. [PAPAVER.]

POPULUS (from the Latin *Populus*), a genus of Plants belonging to the natural order *Salicaceæ*. It is characterised by possessing dioecious cylindrical many-flowered catkins; wedge-shaped single-flowered jagged bracteæ or scales; turbinate calyx, tubular below, and dilated in the border. The barren flowers have eight or more capillary very short filaments, and large drooping quadrangular anthers. The fertile flowers have an ovate pointed ovary, no style, 4-8 awl-shaped stigmas; ovate capsule, with two concave valves and one cell; numerous small ovate seeds, each crowned with a tuft of fine hairs. All the species of this genus are deciduous trees, mostly of a large size, and growing in Europe, North America, Asia, and the north of Africa. The Poplar has long been valued as an ornamental tree, and the various species have been extensively cultivated in Europe. As they are dioecious plants, much difficulty has arisen in determining the number of the introduced species; and it is probable that when the plants with male and female flowers shall have been carefully examined, a considerable reduction in the present number of acknowledged species will take place.

P. alba, the White Poplar, or Abele Tree, has roundish, cordate, lobed, and toothed leaves, glabrous above, downy and very white beneath; fertile catkins, ovate; 4 stigmas; creeping roots; branches very white, downy when young. This tree is a native of Great Britain and most parts of Europe, in woods and thickets in a moist soil.

P. canescens, the Gray Poplar, is by some writers considered only a variety of *P. alba*. It is known by its leaves being roundish, deeply waved, toothed, downy, and hoary beneath; fertile catkins cylindrical; stigmas 8. This tree is of slower growth than *P. alba*, and the wood is finer, and more adapted for the purposes to which timber is applied. The Abele, as well as the Black Poplar, was known to the Romans, and was recommended by Pliny as props for the vine. ('Hist. Nat.,' xvi. 23.) It is much planted in some parts of Holland, Flanders, France, and Germany. The principal use to which the Abele is put in England is that of making flooring boards, for which purpose it should be seasoned eighteen or twenty months previous to use. It is also employed by the cooper for making wooden dishes, casks, &c. The Gray Poplar possesses the whitest wood of any of the species, and is used in France and Germany for carving and the lighter kinds of architecture.

P. tremula, the Trembling Poplar, or Aspen. Leaves nearly orbicular, broadly toothed, glabrous on both sides; stalks compressed; stigmas 4, erect, cased at the base. Ten or twelve varieties of this plant are found in the nurseries, and some writers refer several other species to this as varieties. The aspen, like all the genus, is a rapid-growing tree. It has horizontal branches, which become pendulous by age. It is a native of moist woods in Great Britain, and in Scotland is found at an elevation of 1500 feet above the level of the sea. It is also found in the whole of the south of Europe, in the Caucasus, in Lapland, and is very abundant in Russia. The wood of this tree is used for much the same purposes as the last.

The trembling leaves of the Aspen have always excited attention, and have frequently been the subject of superstitious belief and poetical allusion.

P. trepida, the American Aspen, is by some looked upon as a variety of *P. tremula*. The leaf is suborbiculate, with an abruptly acuminate point, toothed, with two glands at the base on its upper surface; silky whilst young, glabrous afterwards. It is found in North America.

P. nigra, the Black Poplar. Leaves twice the length of their footstalks, deltoid or unequally quadrangular, serrated with glandular teeth, glabrous; the base more entire, the under side palest; catkins cylindrical, pale, lax. It is a native of Great Britain, and has a geographical range nearly the same as that of *P. alba*. It attains a height of from 70 to 80 feet, and, on account of its rapid growth, has been much cultivated. The wood is used for the same purpose as that of *P. tremula*; it is however softer, and more easy to work, and splits more easily than any other of the species. The cotton from the seeds has been used in France and Germany as wadding, and has been also manufactured into cloth-hats and paper; but the expense

of cultivating the tree for this purpose was too great, and consequently the manufacture has been given up.

P. Canadensis, the Canadian Poplar, is an American species. It has angular branches, a compressed petiole; leaves roundish ovate, deltoid, acuminate, subcordate at the base, where there are glands serrated with unequal teeth, glabrous. It attains a height of 70 or 80 feet, and is found wild in the rocky districts of North America between Canada and Virginia.

P. monilifera, the Black Italian Poplar. Shoots more or less angular; branches round; petiole slender, compressed in the upper part; disc deltoid, glands at the base, subacute, serrate, glabrous; bracteæ glabrous; stamens 16; stigmas 4. It is doubtful of what country this tree is a native. It appears to have been introduced into England by Messrs. Dickson, from North America. In America however it is called Italian Poplar, and in France Peuplier Suisse. It is probably a variety of an European species that has been introduced into America. It is the most rapid-growing of all the poplars, and in this country the timber is considered equal if not superior to that of any other species.

P. fastigiata, the Lombardy Poplar. Leaf deltoid, wider than long, crenulated, glabrous, in the bud involutely folded, petiole compressed. This tree is readily distinguished among the species by its peculiar conical cypress-like form, and the total absence of horizontal branches. It grows to the height of 100 and 120 feet, and sometimes 150 feet. It is a native of Italy on the banks of the Po, and also of Persia and the Himalaya.

P. balsamifera, Balsam-Bearing Poplar, or Tacamahac-Tree. Leaves ovate-oblong, quite smooth, with fine glandular serratures, deep-green above, almost white but smooth underneath. Sometimes two glands at the apex of the petiole. Buds covered, in the spring, with an abundance of fragrant, viscid, balsamic juice. It is a native of North America, Datiria, and the Altai, and attains a height of 80 feet. It is remarkable for its balsamic secretion, which was formerly collected in Canada in shells, and under the name of Baume Focot, was sent in considerable quantities to various parts of North America.

P. betulifolia, *P. heterophylla*, *P. angulata*, and *P. candicans*, American species, have also been cultivated in this country, and deserve a place in all collections of these plants.

PORCELLANA. [PORCELLANIDÆ.]

PORCELLA'NIDÆ, a tribe of Anomurous *Crustacea*, placed by M. Milne-Edwards next to the *Paguri*, and immediately preceding the section of Macrurous Decapods.

Porcellana (Lam.)—The general form resembling that of the *Brachyura*. Carapace ordinarily as wide as it is long, suborbicular and depressed above. Front advanced above the insertion of the internal antennæ, and even capable of covering them completely when they are bent back, without there being, nevertheless, antennary fossets. Eyes small and lodged in a sort of orbit, the upper wall of which is well formed, but the limits of which are not determined externally and internally except by the antennæ, and whose inferior border is very short and scarcely projecting: this last border is prolonged externally, and there is between the kind of crest thus formed and the border of the carapace a deep furrow, from which the external antenna springs; these appendages are inserted consequently outside the eyes; their basilary portion is composed of three cylindrical joints, the second of which is the greatest, and their terminal stem is very long.

M. Milne-Edwards divides this genus into the following sections:—

1. Species whose front is entire and does not present lateral teeth.

a. Front triangular.

P. violacea. Length about an inch. It inhabits the coasts of Chili.

aa. Front straight or slightly rounded.

P. sculpta. Colour reddish with great white spots. Length about three lines. It inhabits the coasts of Java.

Two other species are recorded, one of them from the China seas: the other is *P. viridis*, Gray, 'Zool. Misc.,' *Pisidia viridis*, Leach.

§ 2. Species whose front is divided into three or five teeth or lobes.

b. Hands very wide and flattened. Pincers triangular.

Porcellana platycheles. *a*, Tail unfolded.

P. platycheles. Length about seven lines. Colour brownish. It is a native of the coasts of England and France.

bb. Hands long, narrow, and thick; pincers slender.

P. longicornis (*Pisidia longicornis*, Leach; *Cancer longicornis*, Pennant, 'Brit. Zool.'). Length about 3 lines. It is found on the coasts of England and France.

M. Milne-Edwards thinks that the division of this genus into two, under the name of *Pisidia*, as well as *Porcellana*, by Dr. Leach, has been effected without sufficient reason. M. Desmarest, though he adopts it, shows that the former genus is established upon insufficient characters; therefore M. Milne-Edwards thinks that it ought to be abandoned.

Æglea. Leach.—Carapace depressed and much longer than it is wide, divided into two portions by a furrow which separates the stomachal from the cardial and branchial regions; these last are dilated, and terminated externally by a trenchant border. The front is armed with a rostrum, at the base of which is seen on each side a notch which represents the orbit. Ocular peduncles very short and directed forwards. Internal antennæ inserted below the ocular peduncles, and their very short stem bent back between those organs and the base of the rostrum; their basilar joint globular. External antennæ inserted on the same line as the internal ones, in the lateral angle of the carapace; their peduncle composed of four joints, the first three of which are extremely small, and the fourth cylindrical and more elongated.

M. Milne-Edwards remarks that this genus, in his opinion, approaches the *Porcellanæ* more nearly than the *Galatheæ*, next to which they had been hitherto placed; but the conformation of the abdomen of the *Æglææ* seems to him to indicate that their natural position is in the section of *Anomura*. [GALATHEIDÆ.]

Æ. lævis. Length about 2 inches. It is a native of the coasts of Chili.

Æglea lævis.

Megalopa, Leach.—M. Milne-Edwards observes that the small crustaceans designated by this generic name have much analogy with the *Galatheidæ* as well as the *Porcellanidæ*; and if they be really animals arrived at their entire development, they would seem to establish the passage between the Anomurous and Macrurous Decapods; for their abdomen, though it does not present at its extremity five blades united into a fan-shape, as in the last, is very much developed, and serves for natation. But he is led to believe that they are only the young of some anomurous crustacean; and that, when the form has been better studied, it will be erased from the list of genera which compose the order of Decapods, or at least will be assigned a different place and other characters. [MEGALOPA.]

Monolepis, Say.—M. Milne-Edwards is inclined to believe that this genus ought not to be retained, and that it has only been established on young crustaceans not arrived at their complete development; but not having himself observed them, he cannot form a decisive opinion on this point. They appear, he adds, to have the greatest analogy with *Megalopa* and young *Dromiæ*. The reader is referred to Mr. Say's paper on the subject, in the 'Journal of the Academy of Philadelphia;' to M. Desmarest's work ('Considération sur les Crustacés'); and to the 'Histoire Naturelle des Crustacés' of M. Milne-Edwards. The species recorded are both American.

PORCE'LLIA, a genus of Fossil *Molluscs*.

PORCE'LLIO. [ISOPODA.]

PORCUPINE. [HYSTRICIDÆ.]

PORE. [SKIN.]

PORES OF PLANTS. [STOMATES.]

PORITES. [MADREPORIDÆ; POLYPIFERA.]

PORO'DRAGUS (De Montfort), a genus of *Belemnites*.

PORPESSE. [CETACEA.]

PORPHYRA. [ALGÆ; LAVER.]

PORPHY'RIO. [RALLIDÆ.]

PORPHYRY. A large number of rocks of igneous origin, both very ancient and comparatively modern, are thus designated, yet this use of the term is neither accurate nor convenient. Properly speaking, a particular structure is indicated by it, and not a definite rock or family of rocks.

Felspar of a granular texture, without crystals imbedded, is Claystone; with imbedded crystals of felspar it is Porphyry. Hornblende mixed with uncrystallised felspar makes some Greenstones; with imbedded crystals of felspar this becomes Greenstone-Porphyry. Hence, by this mode of designation, we have Pitchstone-Porphyry, Greenstone-Porphyry, Basaltic-Porphyry, Felspar-Porphyry, and even so vague a term as Trap-Porphyry; and, on the other hand, more correctly, Porphyritic Pitchstone, Porphyritic Claystone, Porphyritic Greenstone, Porphyritic Basalt, and Porphyritic Granite.

Among volcanic rocks, Porphyritic Trachytes are common.

Fine examples of porphyry (crystals of felspar in a base of uncrystallised felspar) occur in Scotland, at Inverary and in Ben Nevis; in Cumberland, on Armboth Fell; and in Cornwall, commonly under the title of Eurite.

PORPITA. [ACALEPHÆ.]

PORPOISE. [CETACEA.]

PORTLAND OOLITE, a term in Geology, synonymous with Epioolite of Brongniart, and Upper Oolite of some English geologists. [OOLITE.]

PORTULA'CEÆ, *Purslanes*, a small natural order of Polypetalous Exogenous Plants with hypogynous stamens; distinctly characterised by having two sepals, five petals, and a central placenta, whose seeds contain a curved embryo, lying upon mealy albumen. Their fruit is commonly 1-celled, but the edges of the carpels are sometimes so much inflected as to press upon the placenta and divide the interior into cells. They are annual, perennial, half-shrubby or shrubby plants, with entire more or less succulent leaves, rarely furnished with stipules, and with flowers which are often very showy, although more frequently inconspicuous. Their prevailing colour is purple or scarlet. They occur in all the hotter or milder parts of the world, especially in dry exposed situations, for which their succulent leaves render them well suited. About a fourth of the order inhabit the Cape of Good Hope; rather more than another fourth are found in South America; two inhabit Australia; and the remainder are natives of Europe and other parts of the world.

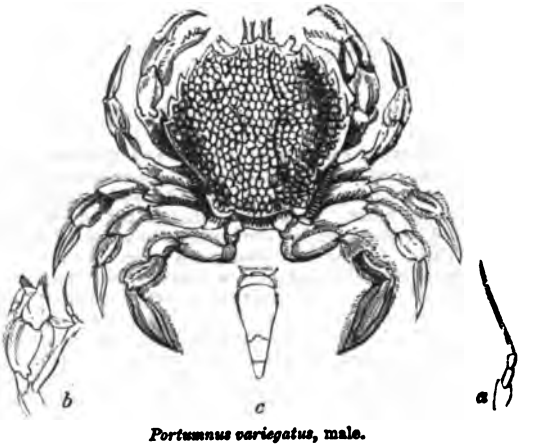
Claytonia Virginica.

1, calyx, stamens, and pistil; 2, capsule, with the two permanent sepals; 3, a transverse section of a capsule; 4, a vertical section of a seed.

Common Purslane (*Portulaca oleracea*), a potherb, now disused, indicates the harmless quality of such plants. The Talinums and Calandrinias, and a few species of *Portulaca*, are well known as gay garden-flowers.

PORTUMNUS (Leach), a genus of Brachyurous *Crustacea*. It has the following characters:—External antennæ setaceous, very short, having their first two joints larger than the others, inserted at the internal canthus of the eyes. External jaw-feet having the third joint of their internal branch elongated, nearly conical, and notched internally. First pair of feet large, equal, with the fingers of their pincers rather long; fifth pair of feet terminated by a flattened foliaceous and nearly lanceolate joint. Carapace rather flat above, with the anterior border arched and semicircular, and the posterior border nearly truncated, having its longitudinal diameter equal to the transversal diameter; orbits without fissures; eyes moderate.

P. variegatus may be taken as an example. It is found in the Adriatic Sea, the Mediterranean, and the ocean.



Portumnus variegatus, male.

a, External Antenna; *b*, External Jaw-Foot; *c*, Tail or Abdomen.

It appears to be identical with *Platyonychus latipes* of Milne-Edwards; nor does there appear to be any sufficient reason for distinguishing the form generically from *Platyonychus*. [PORTUNIDÆ.]

PORTU'NIDÆ, a family of Brachyurous *Crustacea*, nearly allied to the Cancerians. The species are generally known by the name of Paddling Crabs.

The general form of the *Portunidæ* does not ordinarily differ much from that of the greater part of the Cancerians; but the carapace is always but little elevated, and sometimes has a lozenge-shape. The orbits are directed upwards and forwards. The internal antennæ are bent back transversely, or at least very obliquely outwards, and the basilary joint of the external antennæ is partially lodged in a gap of the internal orbitary angle. The third joint of the external jaw-feet is always wider than it is long, and sharply truncated or notched at its anterior and external angle for the insertion of the fourth joint.

Orbits, Antennæ, Jaw-Foot, &c., of *Portunus*.

The sternal plastron is always very wide, and in general the last thoracic segment is much more developed than all the others, even than that which carries the anterior feet; the suture which separates this segment from the preceding is directed very obliquely forwards and inwards; the vault of the sides is generally nearly horizontal, and the posterior sella turcica very narrow. The anterior feet are in general very elongated, the succeeding feet are somewhat natatory, and the posterior feet always so, their tarsus being lamellar; the second pair of feet are ordinarily more than once and a half as long as the carapace.

The Crustaceans of this group are for the most part essentially swimmers, and live often out at sea. They are vulgarly called Paddlers. The following genera are arranged under the tribe by M. Milne-Edwards:—

Carcinus (Leach).—Carapace approaching in general form that of *Panopeus*, but little convex, although sufficiently elevated, and remarkably wider than it is long. The latero-anterior borders, which are deeply dentated, form with the orbital border a regular curvature, which does not reach beyond the level of the middle of the genital region; latero-posterior borders very long and moderately oblique. The branchial regions very much developed and rounded anteriorly. Front advanced, horizontal, of moderate width. Orbits oval and directed forwards; there is a fissure at their upper border and one at their lower border; the gap at their internal angle lodges the base of the external antenna, the first joint of which is narrow and cylindrical, and reaches to the front; their moveable stem is very long, and inserted in the orbital gap. The internal antennæ are bent back in

their nearly circular fossets obliquely outwards. The buccal frame is a little wider backwards than it is in front, and the third joint of the jaw-feet is much dilated externally, and notched at its two internal angles. The sternal plastron is similar to that of the *Portuni*, and so would be the feet, if it were not that the tarsus of the posterior feet is not much enlarged, and is of a flattened lanceolate form, though narrow, whilst that of the preceding feet is styliform. The abdomen of the male is only composed of five segments. (Milne-Edwards.)

C. Mœnas (*Cancer Mœnas* of authors; Crâbe Enragé of the inhabitants of the coast of Normandy), the small Common Crab hawked about London and eaten by the poorer classes. Length rather more than two inches.

Feet of *Carcinus*.

This species is very common on the coasts of England and France, where it is found at low tide between stones and buried in the sand. This species runs on the beach with rapidity, and can sustain a long absence from the water. It is edible, though not much used as an article of food in England; but during the summer a great many are brought to Paris. Colour dirty green; red when boiled.

Platyonychus (Latreille).—Carapace narrower and more regularly convex than that of the other Portunians, often much longer than it is wide, and sometimes circular. Front very narrow and dentated. Latero-anterior borders a little curved and directed backwards, and like those of the *Carcini*, the *Polybii*, and the greater portion of the *Portuni*, divided into five teeth. Orbits not deep, and directed forwards. Internal antennæ bent back obliquely forwards, with their fossets very imperfectly separated from the orbits. Disposition of the external antennæ different from that in the *Carcini*, the *Portuni*, the *Thalamitæ*, and the *Lupeæ;* their first joint, which is very small, is not soldered to the front, but is moveable, like the succeeding ones, and is inserted between the lower orbital border and the antennary fosset.

M. Milne-Edwards divides the genus into the following sections and subsections:—

α. Species having the frontal teeth unequal in number, one of them occupying the median line, and a single fissure at the superior orbital border.

α. Tarsi of the posterior feet of lanceolate form.

P. latipes (*Cancer latipes*, Penn.; *Portumnus variegatus*, Leach, Malac.; *Platyonychus depurator*, Latreille). Length about an inch. It is a native of the coasts of England and France. [PORTUMNUS.]

αα. Tarsi of the posterior feet oval and obtuse at the end.

P. ocellatus (*Cancer ocellatus*, Herbst; *Portunus pictus*, Say; *Platyonychus ocellatus*, Latreille). Length about two inches.

β. Species having the frontal teeth equal, and consequently not one on the median line, and two fissures at the superior orbital border.

P. bipustulatus. Length from two to five inches. It is found in the Indian Ocean.

Platyonychus bipustulatus.

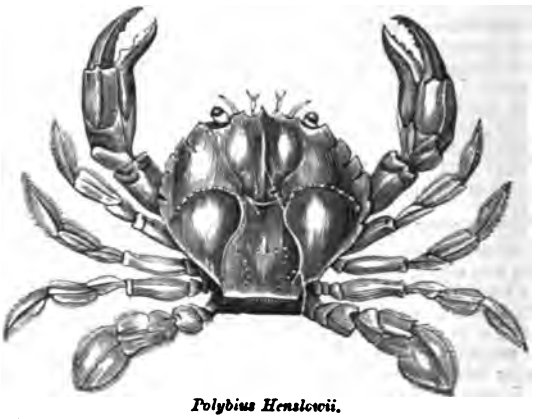
γ. Species having the front advanced in form of a triangular muzzle, and simply undulated on its borders.

P. nasutus (*Portunus biguttatus*, Risso, 'Crust. Nice.'), very small. It is found on the coasts of the Mediterranean.

Polybius (Leach).—Very nearly allied to *Platyonychus*, from which it hardly differs, except in the form of the feet, which are all natatory; those of the second, third, and fourth pairs are very much flattened, and terminated by a very large and lanceolate joint, which has the same form throughout. The posterior feet have the same form as

those of *Platyonychus bipustulatus*, excepting that their third joint is extremely short and nearly globular. The sternal plastron is wider, especially posteriorly, than in *Platyonychus*, but presents the same disposition as to the median suture. The abdomen of the male has the ordinary number (five) of joints. (Milne-Edwards.)

P. Henslowii. Length about two inches; colour brown. It is found in the British Channel, where it appears to haunt at a distance from the coast.



Polybius Henslowii.

Portunus (Fabr.).—Carapace nearly of the same form as in *Carcinus*, wider than it is long, but with its longitudinal diameter at least equal to two-thirds of its transversal diameter, and the contour of its anterior portion ordinarily more curved than it is in that genus. The fronto-orbital border occupies hardly more than the half of the transversal diameter of the carapace, and the front, which is narrow, advances always much beyond the insertion of the external antennæ, and reaches in a remarkable manner beyond the level of the inferior border of the orbit, and the external angle of this cavity. The latero-anterior border of the carapace is delicate, and armed with four or five large teeth: the orbits are oval. The antennary fossets are placed on the same level with the eyes, are transversal, and are separated from each other by a partition, the border of which is never prolonged into the form of a spine. The basilary joint of the external antennæ is but little developed, but completely separates the antennary fosset from the orbit, and is soldered to the front; the moveable stem which succeeds to this joint would seem to spring from the internal angle of the orbit. The structure of the mouth presents nothing remarkable, but it is to be borne in mind that the third joint of the external jaw-feet is at least as wide as it is long, and that its anterior and internal angle is much truncated.

The *Portuni*, though essentially aquatic and swimming with much ease, are not met with far out at sea like the *Lupeæ*. Their haunts are near the shore, and at spring-tides they are often found during the ebb hidden under stones, in the small pools of water left by the sea. Some species inhabit still greater depths, on oyster-beds, &c., and they are never seen to run, like the *Carcini*, on the shore. When withdrawn from the water, they perish in a few hours. They are eminently carnivorous, feeding mostly on the dead bodies of animals which they find in the sea. Many of the species are eatable, and all, with a single exception, inhabit the coasts of England and France. (Milne-Edwards.)

Milne-Edwards divides the species into the following sections and sub-sections.

α. Species having the front armed with very distinct teeth.

α. Front armed with at least 10 teeth or spines.

P. puber (*Cancer puber*, Linn.; *Cancer velutinus*, Penn.). Length about 2½ inches.

Portunus puber.

It is a native of the coasts of England and France. This is the Crâbe à Laine, Crâbe Espagnol, &c., of the French.

aa. Front armed with three or five teeth.

*aa**. Carapace wrinkled, unequal, rather granulous, and covered with hair.

P. plicatus (*Cancer Depurator*, var. Penn.; *Portunus Depurator*, Leach; *Portunus lividus* (var.?), Leach, 'Malac.'). Length about 18 lines. Colour reddish. Found on the coasts of England and France.

*aa***. Carapace nearly united, and without hairs.

P. marmoreus (*Cancer Depurator*, Pennant). Found on the coasts of England and France. The last joint of the posterior feet in this species terminates in a point.

β. Species having the front entire or divided only into rounded lobes.

b. Latero-anterior borders of the carapace armed with five teeth.

*b**. Front divided into three lobes, of which the median lobe is more advanced than the lateral lobes.

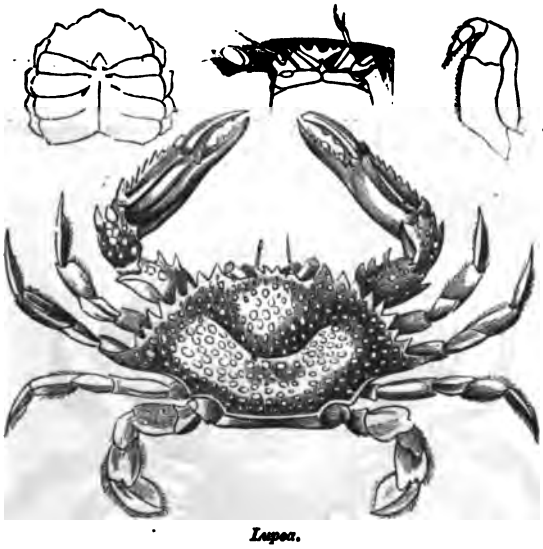
P. corrugatus (*Cancer corrugatus*, Penn.; *Portunus puber*, Blainv.). Length about two inches. Colour reddish. Found on the coasts of England and France; very common in the Mediterranean.

*b***. Front entire, or divided only into two symmetrical lobes.

bb. Latero-anterior borders of the carapace armed with four teeth only.

P. integrifrons (*Cancer Navigator* (?), Herbst.). Carapace pubescent. Length about two inches. It is a native of the Indian Ocean.

Lupea (Leach).—The greater part of the *Lupeæ* are remarkable for the flatness and great transversal extent of their carapace, the diameter of which in that direction is more than double its length. Front nearly always narrow, and much less projecting than the lower border or external angle of the orbit; the latero-anterior border of the carapace very long, forming generally, with the anterior border, a very regular and open segment of a circle, and each of them armed with nine teeth, more or less projecting and spiniform; of these spines the last is in general much greater than all the others, and is directed straight outwards, though sometimes it does not differ from that which precedes it. Orbits oval, and directed obliquely forwards and upwards; their lower wall does not reach to the front, and there is, at the internal canthus, a large notch, which the basilary joint of the external antenna fills; at the upper border of these cavities are two fissures. The fossets which lodge the internal antennæ are not deep, and hardly covered by the front; the vertical lamina which separates them is armed with a spiniform point, which is often prolonged beyond the anterior border of the carapace. Externally, these cavities are completely separated from the orbits, and the stem of the antennæ, which are there inserted, is sufficiently short to be bent back there entirely. The basilary joint of the external antennæ is soldered to the inferior border of the superior and external angle of the front; it is not wide, and gives insertion, by the extremity of its internal border, to the moveable stem formed by the succeeding joints, so that this stem, the length of which is considerable, would seem to spring from the internal canthus of the eye, and nothing prevents its being bent backward outwards to conceal itself in the orbital cavity. The epistome is extremely narrow, and the buccal frame is very nearly square, but in general wider forwards than it is behind. The third joint of the external jaw-feet is rather abruptly truncated forwards and inwards.



Lupeæ.

The *Lupeæ* are Pelagic Crustaceans, living in the ocean, where they have been seen by many voyagers, and where they have no other apparent place of repose than the floating *Fuci*. Their swimming powers are great, and Bosc remarked that they have the faculty of sustaining themselves at the surface of the water, in a state of repose, without the execution of any visible movement.

This genus is divided by M. Milne-Edwards, who gives the above summary of their habits, into the three following groups:—

AA. Species with the body very thick and convex above; first pair of feet stout, and not much elongated; the hand considerably shorter than the carapace.

Convex *Lupeæ*.

L. Tranquebarica (*Cancer olivaceus*, Herbst; *Cancer serratus* (?) Forsk.; *Portunus serratus*, Rüpp.; *Portunus Tranquebaricus*, Fabr.) This, the largest Portunian known, is six or eight inches in length, of a grayish green, and inhabits the seas of Asia.

A. Species having the body very much compressed; the first pair of feet stout, and but little elongated; the hand remarkably shorter than the carapace. Tarsi of the second, third, and fourth pairs flattened, lamellar, and nearly lanceolate.

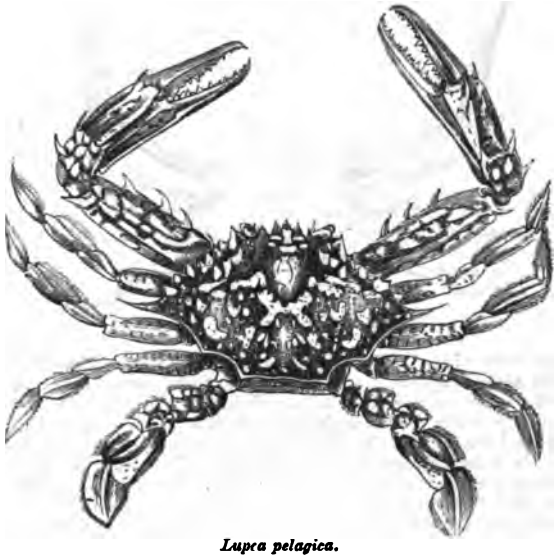
Swimming *Lupeæ*. (Second sub-genus.)

* Species having the last lateral spine at least twice as large as the preceding, and the front projecting but little.

a. Median teeth of the front projecting but little, and sometimes hardly visible.

*a**. Upper border of the orbit armed with a spine.

L. pelagica (*Cancer pelagicus*, Linn.; *Cancer reticulatus* and *Cancer Cedo Nulli*, Herbst; *Portunus pelagicus*, Fabr.) Length from three to four inches. Colour grayish-green with yellow spots. Found in the Red Sea and the whole Indian Ocean.



Lupea pelagica.

*a***. Upper border of the orbit without any spiniform prolongation.

L. sanguinolenta (*Cancer sanguinolentus*, Herbst; *Cancer pelagicus*, var. and *Portunus sanguinolentus*, Fabr.). Length about two inches. Carapace with three large bright red spots on the back part of the carapace. Found in the Indian Ocean.

*a****. Median teeth of the front small, but projecting.

L. cribraria (*Portunus cribrarius*, Lam.). Length three inches. Colour yellow, with numerous whitish spots. It is a native of the coasts of Brazil.

B. Species having the last spine of the latero-anterior border of the carapace scarcely longer than the others.

b. External border of the arm without spines.

L. spinimana (*Portunus pelagicus* and *Portunus spinimanus*, Latr.). Length from three to four inches. Found on the coasts of Brazil.

bb. External border of the arms spined.

L. lobifrons. Length one inch. It is a native of the East Indies.

C. Tarsi of the second, third, and fourth pair of feet narrow and styliform.

Walking *Lupeæ*. (Third sub-genus.)

a. Species having the last tooth of the latero-anterior border of the carapace resembling the others.

a. Teeth of the latero-anterior borders alternately large and small.

L. rubra (*Ciri apoa*, Marc.; *Portunus ruber*, Lam.). Length about two inches. General colour reddish; extremity of the claws black. Found on the coasts of Brazil.

a*. Teeth of the latero-anterior borders of the carapace resembling each other.

L. granulata. Length about an inch. Found in the Mauritius.

b. Species with the last tooth of the latero-anterior border of the carapace at least twice as large as the preceding.

b. Median teeth of the front much more projecting than the lateral teeth.

L. Sebæ (*Cancer marinus scutiformis*, Seba, 'Mus.,' iii., pl. 20, f. 9, copied by Latreille, in 'Encycl.,' pl. 272, f. 6, under the name of *Portunus sanguinolentus*). Size about the same as *L. granulata*. A native of the coasts of Brazil. (Milne-Edwards.)

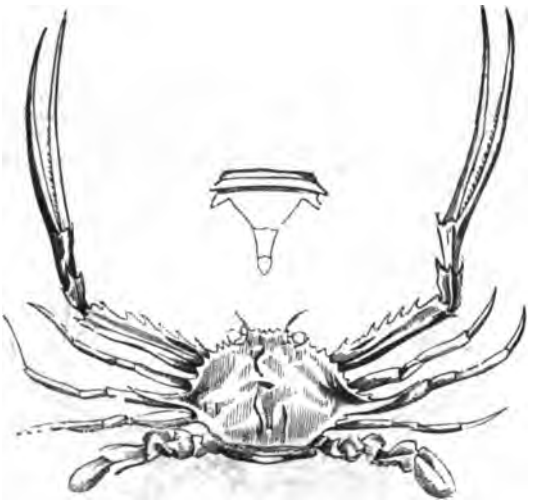
bb. Median teeth of the front less projecting than the others.

*bb**. Hands large, of the ordinary form, and shorter than the transversal diameter of the carapace.

L. hastata (*Cancer hastatus*, Linn.; *Portunus hastatus*, Latr.; *Lupa Dufourii*, Desm.). Length about two inches. It is a native of the Mediterranean.

*bb***. Hands filiform and of great length, being nearly one and a half the tranversal diameter of the carapace.

L. Forceps (*Lupa Forceps*, Leach; *Portunus Forceps*, Latr.). Length about an inch. It is a native of the Antilles.



Lupea Forceps.

Thalamita (Latr.).—Carapace in most of the species characteristic; but in some it gradually approximates to that of the *Lupeæ;* in fact, sometimes it has the form of an elongated square; its transversal diameter is nearly double the length, and its fronto-orbital border forms with the latero-anterior borders a nearly right angle; in other cases it is nearly hexagonal, its six borders form nearly equal angles, and its width only exceeds about half of its length. The front is always very wide, projecting, and at least as much advanced as the inferior border and external angle of the orbit, a disposition which is never observable in the *Lupeæ*. The latero-anterior borders of the carapace are more or less oblique, but always form with the fronto-orbital border a very strong marked angle, where there are from four to seven teeth, the last of which is never remarkably larger than the others. The eyes are stout and short; the orbits oval, and completely separated from the antennary fossets; the upper border of the latter presents two small fissures, and their angle is often nearly as distant from the median line as the angle which terminates behind the latero-anterior border. The internal antennæ bend back completely in their fossets, and the inter-antennary partition projects but little. The basilary joint of the external antennæ is in general very wide, and always soldered to the front throughout the whole extent of its anterior border, presenting externally a more or less considerable projection which separates the orbit from the point of articulation of the moveable stem of those appendages, and which is very long, and inserted sometimes very far from the orbital cavity. The epistome is very distinct and of a lozenge-shape.

M. Milne-Edwards divides the genus into the following sections:—

1. Fronto-orbital border not occupying more than two-thirds of the width of the carapace, and forming a rather open angle with the latero-anterior borders, which are armed with six or seven teeth.

Hexagonal *Thalamitæ*.

2. Fronto-orbital border occupying nearly the whole width of the carapace, and forming a nearly right angle with the latero-anterior borders, which are armed with four or five teeth.

Quadrilateral *Thalamitæ*.

The latter form the first sub-genus in M. Milne-Edwards's arrangement.

a. Species having the front entire or divided into lobes, but with no teeth.

T. Chaptalii (*Portunus Chaptalii*, Aud., 'Crust. Sav. Egypte.'). Length about an inch. It is a native of the Red Sea.

Thalamita Chaptalii.

b. Species whose front is armed with deeply cut and flattened teeth.

T. crenata (*Portunus crenatus*, Latr.; *Thalamita Admete*, Guerin 'Icon. Cr.,' pl. 1, f. 4).

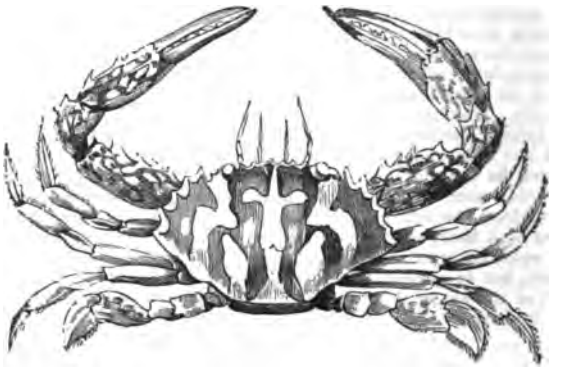
2nd Sub-Genus. Hexagonal *Thalamitæ*.

a. Species having the latero-anterior border of the carapace armed with six teeth.

a. Last lateral tooth nearly the same size as the preceding.

a*. Anterior feet armed with spines, but without elevated granulations.

T. crucifera (*Portunus cruciferus*, Fabr. and Latr.; *Cancer serdentatus*, Herbst?). Length from three to four inches; colour reddish with yellow spots and bands, the median markings resembling a cross. Found in the Indian Ocean.



Thalamita crucifera.

a**. Anterior feet presenting between the spines with which they are armed, a great number of tubercles or elevated granulations.

T. Natator (*Cancer Natator*, Herbst; *Portunus sanguinolentus*, Bosc.). Found in the Indian Ocean.

Thalamita Natator.

aa. Last lateral tooth stouter and much more projecting than the others.

T. Callianassa (*Cancer Callianassa*, Herbst). Length about an inch. Found in the Indian Ocean.

b. Species having the latero-anterior border of the carapace armed with seven teeth, two of which are rudimentary.

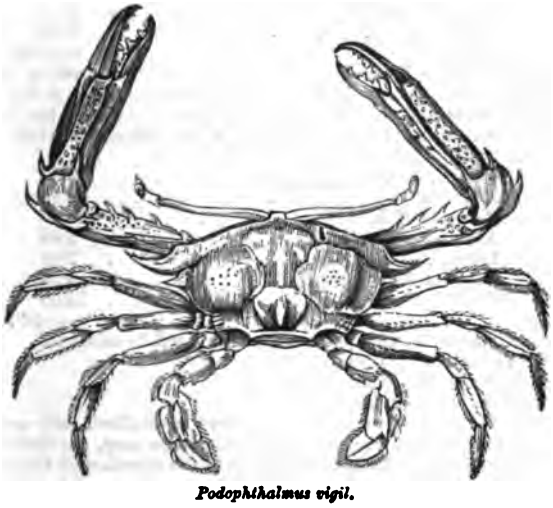
T. erythrodactyla (*Portunus erythrodactylus*, Lam.). Length 2½ inches. Found in Australasia.

Podophthalmus (Lam.).—M. Milne-Edwards justly observes, that of all the Portunians the *Podophthalmi* have the most remarkable aspect, and characters the most easy to seize. The enormous length of their ocular peduncles, which are very short in the other Swimming *Brachyura*, is sufficient to distinguish them at first sight.

Eye, Orbit, Jaw-Foot, &c. of *Podophthalmus*.

The eyes are carried on delicate peduncles of extreme length; and these osseous stems are inserted near the median line of the front, and carry at their extremity the second ocular piece, whilst in the Ocypodians, where the eyes are also very much developed, it is on the development of this second piece, and not the first, that the length depends. The ocular bulb is not very large, and reaches the lateral extremity of the carapace. The internal antennæ are situated below the origin of the eyes, a disposition which is met with in no other Portunian, and their stem cannot bend itself back into the cavity where they are lodged. The external antennæ are also below the eyes; they are placed between the antennary fossets and the orbits, at the external side of the first, and their basilary joint is soldered with the borders of these two cavities, so as to complete their walls and to separate them from each other; the moveable stem which terminates these antennæ is formed of two small peduncular joints and of a slender and rather short multiarticulate filament.

P. vigil (*Portunus vigil*, Fabr.; *Podophthalmus spinosus*, Lam.). The only species known. Length from two to four inches. Found in the Indian Ocean.



Podophthalmus vigil.

POSIDO'NIA. [Malleacea.]

POSIDONOMY'A, synonymous with *Posidonia*. [Malleacea.]

PO'SYDON, a genus of *Crustacea*.

POTADO'MA (Swainson), a sub-genus of Fluviatile Shells, belonging to the genus *Melania*, and the sub-family *Melaniana*, and the family *Turbida*.

POTAMIANS. [Chelonia.]

PO'TAMIS, a genus of Fresh-Water Shells.

POTAMO'BIA (Leach), a genus of *Crustacea*.

POTAMO'GETON (from ποτάμος, a river, and the termination γετον, which probably means 'produced'), a genus of Plants belonging to the Endogenous class, and the natural order *Potamacea*. It has a perfect flower, a 4-parted perianth, 4 sessile anthers opposite to the divisions of the perianth, 4 ovaries, and 4 drupes or nuts. The species are water-plants.

P. natans is a British plant, with floating ovate stalked leaves, the petioles plano-concave above, the nuts large, rounded on the back when fresh, keeled; when dry the peduncles are equal. There is a creeping rhizoma at the bottom of the water. The roots are sometimes eaten in the wilds of Siberia by men, but in more temperate regions are fed on only by swans, who devour them with avidity.

P. crispus has a compressed stem, pellucid oblong linear leaves, sessile and wavy, the nuts with long beaks, keeled on the back; when dry the peduncles are equal. It is a native of Great Britain.

P. densus has its leaves all opposite, pellucid, clasping, elliptical-lanceolate, or lanceolate; the spikes shortly stalked, ultimately reflexed; the spike is 4-flowered. It is found in ditches and ponds of water in England. Ducks feed on the seeds and leaves of both these species, but they serve a more important purpose in giving out oxygen, and rendering the water respirable for fish and other aquatic animals. There are twenty British species of *Potamogeton*, and Haller says that in the Swiss lakes *P. serratum* grows to the length of from 10 to 20 fathoms, forming extensive sub-aquatic forests.

(Burnett, *Outlines of Botany*; Babington, *Manual of British Botany*.)

POTAMOMY'A, a genus of Fresh-Water Shells.

POTAMOGETONEÆ, same as *Juncaginaceæ*.

POTAMON (Savigny), a genus of *Crustacea*.

POTAMO'PHILA (Sowerby), a genus of *Conchifera*.

POTAMO'PHILUS (Latreille), a genus of *Crustacea*.

POTASH. [Potassium.]

POTASSIUM, a Metal, the base of the alkali Potash, in which it exists, combined with Oxygen. Potash is in fact an oxide of potassium. On account of its intense affinity for oxygen, potassium is not found pure in nature. In a mineral form it occurs in a great number of minerals. It is present in considerable quantities in Mica [Mica] and Felspar [Felspar], which enter, with quartz, into the composition of granite. Its most abundant form in nature is what is called Nitre.

Nitre is a nitrate of potash, and occurs in modified right rhombic prisms; usually in thin white subtransparent crusts, and in needle-form crystals on old walls and in caverns. Its taste is saline and cooling. It has the following composition:—

Potassa	46·56
Nitric Acid	53·44
	——100

It burns vividly on a live coal. It is distinguished readily by its taste; and from nitrate of soda, which it most resembles, by its not becoming liquid on exposure to the air.

Nitre, called also Saltpetre, is employed in making gunpowder, forming 75 to 78 per cent. in shooting powder, and 65 per cent. in mining powder. The other materials are sulphur (12 to 15 per cent.), and charcoal (9 to 12½ per cent. for shooting, and 20 per cent. for mining powder). It is also extensively used in the manufacture of nitric and sulphuric acids; also for pyrotechnic purposes, fulminating powders, and sparingly in medicine. [Nitre, in Arts and Sc. Div.]

It occurs in many of the caverns of Kentucky and other Western States of America, scattered through the earth that forms the floor of the cave. In procuring it the earth is lixiviated, and the lye, when evaporated, yields the saltpetre. India is its most abundant locality, where it is obtained largely for exportation. It readily dissolves in water, lowering its temperature, and is used in India as a frigorific agent.

Spain and Egypt also afford large quantities of nitre for commerce. This salt forms on the ground in the hot weather succeeding copious rains, and appears in silky tufts or efflorescences; these are brushed up by a kind of broom, lixiviated, and after settling, evaporated and crystallised. In France, Germany, Sweden, Hungary, and other countries, there are artificial arrangements called 'nitriaries,' or nitre-beds, from which nitre is obtained by the decomposition mostly of the nitrates of lime and magnesia which form in these beds. Refuse animal and vegetable matter putrified in contact with calcareous soils produces nitrate of lime, which affords the nitre by re-action with carbonate of potash. Old plaster lixiviated affords about 5 per cent. This process was employed extensively in France, when the French were prevented from obtaining nitre from foreign sources during the last war with England. Nitre is also employed in the manufacture of glass, and a large consumption of it takes place in this country for this purpose.

Carbonate of Potash is obtained from the ashes of land plants, just as carbonate of soda is obtained from the ashes of sea-shore plants and sea-weeds. When the ashes are purified they form first the potash of commerce, and when further purified, pearlash.

Sylvine is a chloride of Potassium, which has been found as a mineral. For the further compounds of Potassium, see Potassium, in Arts and Sc. Div.

(Dana, *Manual of Mineralogy*.)

POTATO. [Solanum.]

POTATO, SWEET. [Batatas.]

POTENTILLA ('potens,' powerful, from the supposed medical qualities of some of the species), a genus of Plants belonging to the natural order *Rosacea*. It has a concave calyx, 4-5-parted, with 4-5-bractlets; there are 4-5-petals, numerous stamens, a lateral or nearly terminal style. The fruit consists of numerous small nuts placed on a flattish dry receptacle; the seeds pendulous or ascending, the radicle superior; the flowers white or yellow, rarely red.

P. reptans, Creeping Cinquefoil, is a common British species: it is found likewise in other parts of Europe. The stem is filiform, procumbent, and creeping; the leaves quinate and stalked; the leaflets obovate, serrated; the peduncles solitary; carpels granulate, scabrous. The flowers are large, bright yellow, and on long hairy axillary stalks.

It appears to have been the officinal plant of the ancients, and is the Πεντάφυλλον of Theophrastus, ix. 19, and of Dioscorides, iv. 42. Pliny mentions it as *Quinquefolium*, 25, 9; 27, 10. It is still used as a febrifuge by some practitioners.

P. Tormentilla has a procumbent or ascending stem, ternate sessile leaves, and longitudinally wrinkled carpels; the leaflets are acute and somewhat hairy. The flowers are bright-yellow, small, with the parts of the calyx and corolla in fours on slender hairy stalks much longer than the leaves. It is the *Tormentilla erecta* of Linnæus. It abounds in Great Britain. The roots are very astringent, and have been used medicinally. In the Western Isles of Scotland and the Orkneys they are used for tanning leather, and are preferred even to oak-bark. They are also used for dyeing a red colour. We are told that pigs are fed on them in Killarney, and they are also thought to be serviceable in some diseases to which sheep are subject.

P. anserina has a creeping stem, interruptedly pinnate leaves; the leaflets numerous, oblong, acutely serrate, silky beneath; the peduncles solitary. The flowers are large and yellow, and the leaves form a favourite food with geese: they are sometimes used as pot-herbs. Its roots are eaten both by hogs and men; they taste like a parsnep, but are small; the common people roast or boil them for food. In the islands of Tiray and Col they answer in some measure the purposes of bread, and have been known to support the inhabitants for months together during a time of scarcity.

The leaves of *P. fruticosa* and *P. rupestris* are employed in Siberia as a substitute for tea.

P. hirta has a pilose erect few-flowered stem; the leaves with 5-7-leaflets, pilose, and cut at the apex; the stipules lanceolate, entire; the petals obcordate, longer than the calyx. It is native of the Pyrenees, South of France, Silesia, &c., and is the Πεντάφυλλον of Hippocrates. ('Ulc.,' 880.)

(Lindley, *Vegetable Kingdom*; Lindley, *Flora Medica*; Babington, *Manual of British Botany*; Burnett, *Outlines of Botany*; Fraas, *Synopsis Floræ Classicæ*.)

POTE'RIUM (from ποτήριον, a drinking-vessel, or cup, one of the species being infused in drink), a genus of Plants belonging to the natural order *Rosaceæ*. It has monœcious or polygamous flowers; a 4-cleft calyx, with three external scales at its base; and a quadrangular tube. The petals are wanting, the style terminal, stamens numerous, and the seed suspended.

P. sanguisorba, Lesser Burnet, is an herbaceous plant, with a slightly angular stem, the calyx of the fruit quadrangular and hardened. The leaves are pinnate, with numerous small ovate coarsely serrate leaflets, glabrous or slightly hairy beneath. It is found on dry calcareous soils in Great Britain. It forms a useful fodder for cattle, and at one time was extensively cultivated for that purpose, but is now generally superseded by Sainfoin and other artificial grasses. On the continent, and occasionally in this country, the young leaves are eaten as salad, and it is said to form one of the ingredients of the favourite cool tankard. It is said to give the name to the species, from the custom of infusing it in liquors. The common people of Siberia eat the roots. There are about nine species of Burnet described, which are distributed over Europe, Africa, and America.

(Lindley, *Vegetable Kingdom*; Babington, *Manual of British Botany*; Burnett, *Outlines of Botany*.)

POTERIOCRINITES. [Encrinites.]

POTSTONE. [Talc.]

POTTO. [Viverridæ.]

POULTRY. [Phasianidæ.]

PRÆPEDI'TUS. [Scincoidæ.]

PRANGOS, a genus of Plants of the natural family of *Umbelliferæ*, tribe *Smyrneæ*, so named by Dr. Lindley from the name by which the only species is known in its Tartarian habitat, where it was discovered by Mr. Moorcroft, in the neighbourhood of Imbal or Drox, and which he visited for the purpose of examining into the reputed qualities of this plant, of which the accounts seemed to border on exaggeration. Almost all the knowledge which we possess respecting the plant, is derived from the observations of that lamented and enterprising traveller.

The Prangos Hay-Plant is herbaceous and perennial, having a large fleshy root-stalk, usually measuring at the top from 18 to 22 inches in circumference, and formed by the aggregation of an infinite number of crowns or winter-buds, clustered together at or above the surface of the ground. These crowns being closely covered by the fibrous remains of the old leaves, are thus protected from the frosts of winter. The crop consists of the leaves, which rise in abundance from each crown, are finely cut, about two feet in length, and have a highly fragrant smell, extremely similar to that of very good new clover hay.

This Mr. Moorcroft considered as a most important and interesting object of rural economy, and says that the properties of Prangos as a food appear to be heating, producing fatness in a space of time singularly short; it is also destructive to the *Fasciola hepatica*, or Liver-Fluke, which in Britain, after a wet autumn, destroys some thousands of sheep by the rot. The last-mentioned property, of itself, if it be retained by the plant in Britain, would render it especially valuable to our country. But this, taken along with its highly nutritious qualities, its vast yield, its easy culture, its great duration, its capability of flourishing on land of the most inferior quality and wholly inadapted to tillage, impart to it a general character of probable utility unrivalled in the history of agricultural productions. When once in possession of the ground, for which the preparation is easy, it requires no subsequent ploughing, weeding, manuring, or other operation, save that of cutting and of converting the foliage into hay. Of its duration he relates that its seeds, having been carried westward along with those of yellow lucerne, above 40 years ago, and sown on the eastern frontier of Cashmere, vegetated, and that the plants of the first growth still remain in a flourishing condition. He conceived that by the cultivation of this plant, moors and wastes hitherto uncultivated may be made to produce large quantities of winter fodder, and that the yield of high lands and downs enjoying a considerable depth of soil may be trebled.

Dr. Falconer, in his visit to Cashmere and Tibet, found it in the latter, as well as on a low trap hill in the former, but not so vigorous in the Cashmerian as in its Tibetan habitat. He states that though abundant in various directions, the Cashmerians do not esteem it of any value.

Arrian, in describing Alexander's expedition across the mountains which he calls Caucasus and Paropamisus (iii. 28), says, nothing but *Silphium* and the Turpentine-Tree grow there, notwithstanding which it is very populous, and multitudes of sheep and neat cattle are seen, for they feed upon *Silphium*, of which the sheep especially are very fond. This bears so close a resemblance to the *Prangos*, both in locality and properties, that it is as likely to have been the *Silphium* of the ancients, as the assafœtida plant, which it is supposed to be by others. [Silphium.]

PRANI'ZA. [Isopoda.]

PRASE. [Quartz.]

PRASEOLITE, an imperfectly crystallised Mineral, occurring in prisms of several sides, with the edges rounded. Cleavage in one direction. Colour light or dark green; streak clear green. Fracture splintery and flat conchoidal. Hardness 3·5. Lustre weak. Specific gravity 2·754. It is found near Brevig, Norway. Its analysis by Erdmann gives—

Silica	40·94
Alumina	28·79
Protoxide of Iron	6·96
Protoxide of Manganese	0·32
Magnesia	13·73
Titanic Acid	0·40
Oxide of Lead, Copper, and Cobalt with Lime	0·50
Water	7·38
	——99·02

PRASILITE, a Mineral, occurring massive. Composed of loosely adhering fibres. Colour dark leek-green. Hardness not sufficient to scratch selenite, and may be crumbled to powder between the fingers. Specific gravity 2·311. It is found on the Kilpatrick Hills. Its analysis, by Dr. Thomson, gives—

Silica	38·55
Magnesia	15·55
Peroxide of Iron	14·90
Alumina	5·65
Lime	2·55
Oxide of Manganese	1·50
Water	18·00
	——96·7

The loss, amounting to 3 per cent., is attributed to an alkali.

PRATI'COLA. [Sylviadæ.]

PRATINCOLA. [Charadriadæ.]

PRAWN. [Palemonidæ.]

PREHNITE, a Mineral, which occurs crystallised and massive. Primary form a right rhombic prism. Cleavage easy, parallel to the base of the primary form, and less so in the direction of the lateral faces. Fracture uneven. Hardness, scratches glass easily. Becomes electric by heat. Colour white, gray, and various shades of green and greenish-yellow. Lustre vitreous. Transparent, translucent. Specific gravity, 2·926. The variety which occurs in small thin crystals is called *Koupholite*. The crystals of this substance have a remarkable tendency to exhibit rounded faces.

Massive varieties botryoidal, globular, and stalactitic, structure broad fibrous; amorphous, structure granular, compact, with rough surfaces. It occurs also in rolled masses.

Before the blow-pipe it is converted into a white scoria, and fuses into a compact globule; with borax it readily becomes a clear glass.

This mineral was first found at the Cape of Good Hope; it has since been met with in many places in different quarters of the globe, as Scotland, Cornwall, France, &c. Koupholite occurs at Barèges in the department of Hautes-Pyrénées. It is composed of silica, alumina, lime, oxide of iron, potash, soda, and water.

The following forms of *Prehnite* are given by Dana:—

Stellite. In fibrous stellar groups like mesole; lustre silky and shining. It fuses to a white enamel. Gelatinises with muriatic acid. It comes from Kilsyth, Scotland.

Antrimolite. A stalactitic zeolite, from Antrim, Ireland.

Diphanite. In six-sided prisms with a distinct basal cleavage; vitreous lustre, transparent. A silicate of alumina and lime, and near prehnite. From the Ural, with emerald.

Hydrous Anthophyllite. In divergent fibres having a silky lustre. Colour white, greenish-yellow, or bluish. Occurs in a talcose rock at Fishkill, New York, and also above New York city.

Zeuxite. A hydrous silicate of alumina and iron, in small brown prismatic crystals, of a vitreous lustre. From Cornwall, in the Huel Unity mine.

Damourite. Occurs in lamellar pearly crystals, a little harder than talc. It is a hydrous silicate of alumina and potash. Reported from Leiperville, Pennsylvania, and Chesterfield, Massachusetts.

Masonite. Near chloritoid; coarsely foliated or tabular; colour dark gray. Lustre nearly pearly; folia brittle and often curved. Fuses with difficulty on the edges. From the vicinity of Natic village, Rhode Island.

Other forms of *Prehnite* will be found mentioned under EPISTILBITE; EDINGTONITE; CARPHOLITE; FAUJASITE; GLOTTALITE; and CHLORITOID.

PREMNA, a genus of Plants of the natural family of *Verbenaceæ*, which is characterised by a cup-shaped calyx, a 5-cleft bilabiate corolla. Stamens 4, didynamous. Drupe pea-shaped, with a 4-celled nut. The species consist of shrubs and small trees, which are indigenous in Asia and Australia, having opposite leaves, inflorescence in terminal cymes, with small flowers.

The majority of the species are remarkable for the fetid odour of their leaves; though those of *P. cordifolia* are somewhat fragrant, and those of *P. esculenta* are employed as diet by the natives of Chittagong. *P. integrifolia* has roots of a burning taste, with leaves of a hircine odour. The leaves, applied to the head, are said to cure headache, and a decoction of the roots is employed as a stimulant in fevers, flatulence, &c. *P. latifolia* has wood of a white colour and firm texture, employed for various economical purposes, in which it agrees in character with the teak tree, *Gmelina arborea*, and others which belong to the same natural family.

PRENANTHES, a genus of Plants belonging to the natural order *Compositæ*. Its only British representative is the *Lactuca muralis*, the *P. muralis* of Smith. [LACTUCA.]

PRIMA'TES, the name given by Linnæus to the first order of *Mammalia*, and thus characterised by him:—Dentes primores incisores, superiores iv., paralleli. Mammæ pectorales ii.

The order contains the following genera:—

Homo, of which Linnæus records two species, namely, *H. sapiens* and its varieties (Man), and *H. Troglodytes* (*H. sylvestris*, Orang Outang, Bout.).

Simia, 33 species.

Lemur (including *Lemur volans*.) [PLEUROPTERA; LEMURIDÆ.]

Vespertilio, 6 species. [CHEIROPTERA; MAMMALOGY.]

PRI'MNOA. [POLYPIFERA.]

PRI'MULA, a genus of Plants belonging to the natural order *Primulaceæ*. It has a tubular 5-cleft calyx, a salver-shaped regular corolla, as long as the calyx, or longer; a spreading limb in five rather deep inversely heart-shaped obtuse segments; a free 1-celled ovary, with a free central placenta. It has a capitate stigma and one style. The fruit is a capsule with numerous roundish seeds.

P. vulgaris, the Primrose, is one of our commonest British plants. It has oblong, ovate, wrinkled crenate leaves; single flowered scapes and a tubular calyx; linear, lanceolate, attenuated teeth, very acute; the limb of the corolla flat. It is found in woods and thickets, and is one of the earliest of our spring flowers.

P. elatior, the Ox-Lip, has ovate leaves contracted below, wrinkled and denticulate, many-flower umbellate scapes, a tubular calyx; lanceolate acute teeth; the limb of the corolla concave, with cordate ovate segments; nodding flowers and erect fruit. It is found in woods and meadows, but rarely in England. The *Polyanthus* is a variety of this species.

P. veris, the Cowslip, has ovate wrinkled crenate leaves, contracted below, many-flowered umbellate scapes; a bell-shaped calyx, rather downy, with short ovate teeth; the limb of the corolla concave, or cup-shaped, of a deeper yellow on the upper side, with five orange spots. It is found plentifully in meadows and pastures in England. The flowers possess well-marked sedative and diaphoretic qualities, and make a pleasant soporific wine. The fresh root has also a smell resembling anise, and was formerly employed as a tonic medicine and also as a diuretic.

P. farinosa is distinguished by its mealy obovate lanceolate leaves, oblong ovate calyx, linear teeth, and obcordate segments rounded below, distant, and as long as the tube. It is found in the north of England and Scotland, and is called the Bird's-Eye Primrose.

P. Scotica is found only in the north of Scotland. It is known by its swollen calyx, with short ovate obtuse teeth; the limb of the corolla is flat, with broadly obcordate approximate segments half the length of the tube. The flowers are of a bluish purple colour with a yellow centre.

The leaves of *P. auricula* are used in the Alps as a remedy for coughs. Swine are the only animals that feed upon any of these species as their especial sustenance. They are valuable chiefly on account of their beautiful appearance and their early blossoming.

(Lindley, *Vegetable Kingdom*; Lindley, *Flora Medica*; Burnett, *Outlines of Botany*; Babington, *Manual of British Botany*.)

PRIMULA'CEÆ are Monopetalous Exogenous Plants, peculiarly distinguished by the stamens being opposite to the lobes of the corolla, and a superior capsule with a free central placenta. In most respects they correspond with *Myrsinaceæ*, but the latter are known by their being trees or shrubs with an indehiscent fleshy fruit. The *Primulaceæ* consist of herbaceous plants inhabiting the temperate parts of the world, in moist situations, such as meadows, morasses, and alpine stations, or in the damp parts of woods, which they adorn with their lively flowers. The *Primula*, *Anagallis*, *Soldanella*, *Cyclamen*, and *Lysimachia*, of various species and under many forms, are the gayest of the genera, some of whose species are found in almost all gardens. The Cowslip is slightly narcotic, but the order is of no known utility. [PRIMULA; ANAGALLIS; SOLDANELLA; CYCLAMEN; LYSIMACHIA.]

PRI'NIA (Horsfield), a genus of Birds. It has the following generic character:—Bill rather lengthened, much compressed, entire; rictus smooth, wings rounded, tail broad and cuneate; feet large, strong. (Swainson.)

P. familiaris may be taken as an example. It is the Prinya of the Javanese, Familiar Creeper of Latham.

It is abundant in many parts of Java, near villages and gardens, in the confines of which, among trees and shrubs, it builds its nest. It is a sprightly bird, sporting among the branches in short and rapid flights, and has received its native name from its lively and pleasant notes. (Horsfield.)

Familiar Creeper (*Prinia familiaris*).

Mr. Swainson ('Classification of Birds') thinks that *Prinia* may be a subordinate type or sub-genus of *Drymoica*. [SYLVIADÆ.] He observes that the *Priniæ* have all the activity and familiarity of the true Wrens (*Troglodytes*), and so much resemble them in general appearance, in their short sweet song, and the throwing up of the tail, that it is not very surprising that they should have been classed with the Scansorial Creepers.

PRINOS. [AQUIFOLIACEÆ.]

PRINSE'PIA, a genus of Plants of the natural family of *Chrysobalanaceæ*, so named by Dr. Royle in honour of James Prinsep, secretary of the Asiatic Society of Calcutta. The genus consists of only a single species, remarkable for its thorny appearance, but it may be considered typical of the labours of the individual whom it is designed to commemorate, as, early in the season, it is conspicuous for the abundance of its inflorescence, and, later, for that of the purple-coloured berries with which it is loaded. The seeds are large, and yield by expression an oil which is highly esteemed by the mountaineers of the Himalayas, where it is indigenous, and which by Europeans is thought a good substitute for salad oil.

PRI'ODONTES. [ARMADILLO.]

PRION. [PROCELLARIDÆ.]

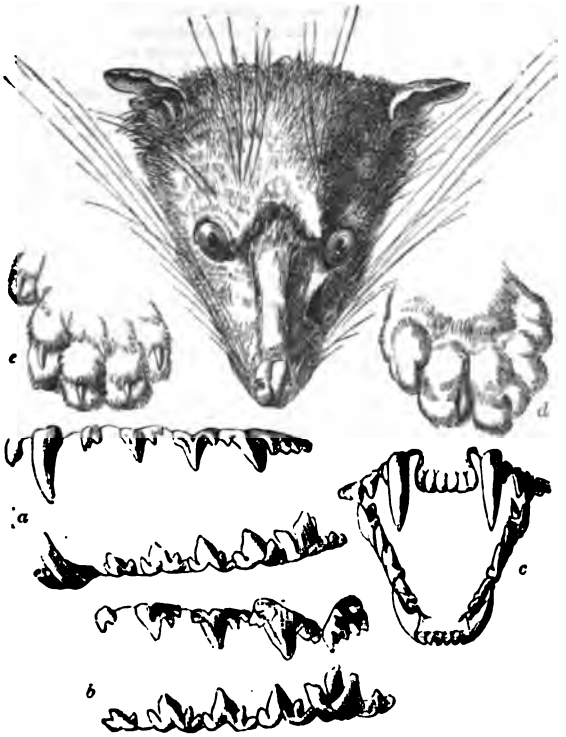
PRIONITES. [MOMOTS.]

PRIO'NODON, Dr. Horsfield's name for a feline form (*Felis gracilis*, Delundung of the Javanese), and placed by him in a separate section under the name of *Prionodontidæ*, between *Felis* and *Viverra*. ('Zoological Researches in Java.')

Mr. Swainson remarks ('Classification of Quadrupeds'), that of the genus *Prionodon*, at present, but one species has been found, in Java. As a familiar appellation, expressive, in all probability, of its analogy to the *Sorecidæ*, he terms it the Shrew Cat.

Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{6-6} = 38$.

P. gracilis has the tail elongated, annulated, cylindrical; body pale flavescent, with four very wide dorsal bands and two narrow anal



Head, teeth, and feet of *Prionodon*.

Head two-thirds of natural size.

a, lateral view (external) of the teeth; *b*, lateral view (internal); *c*, front view; *d*, fore foot, covered with fur; *e*, hind foot, fur removed: these last figures about one-fourth larger than natural size. (Horsfield.)

bands; two broad lateral striæ, the narrow cervical striæ, the numerous humeral and femoral spots, and the seven caudal rings very deep brown. (Horsfield.)

Prionodon gracilis. (Hors., Java.)

Dr. Horsfield discovered this animal in 1806, during the early period of his researches in the district of Blambangan, situated at the extremity of Java; the natives distinguish it by the name above given. Dr. Horsfield was not able to ascertain that it is found in any other part of the island, or that it has another name; but he states that even in Blambangan it is rarely met with. He notices it as inhabiting the extensive forests which, with the exception of the capital of Banyuwangi and a few small villages, cover that district. He obtained but little information as to its habits and manners, and records nothing on the subject beyond what we have mentioned.

PRI'ONOPS. [LANIADÆ.]

PRISTACANTHUS, a genus of Fossil Placoid Fishes, from the Oolite of Stonesfield. (Agassiz.)

PRISTIDACTYLIS, the name assigned by Messrs. Duméril and Bibron to a group of Cælodonts, being the second of their Lézards Lacertiens ou Autosaures. The Lacertians of this group are those which have the toes either dentilated laterally or carinated on their inferior surface, or provided both with carinations below and dentilations along their edges. None of them have the temples covered with plates or large scales. In the greater part of the species the plates which surround the nostrils are more or less convex, the palpebral disc is nearly completely surrounded with a cordon of granules, and the ventral lamellæ, as well as the preanal scales, are smaller and more numerous than in the Leiodactylous Cælodonts.

The following genera are arranged by Messrs. Duméril and Bibron under this group:—

Psammodromus, Fitz. (*Notophilis, Aspistis*, Wagl., Bonap., Wiegm.; *Psammodromus*, Wiegm.); *Ophiops*, Ménestriés (*Amystes*, Wiegm.); *Calosaura*, Dum. and Bibr.; *Acanthodactylus*, Fitz. (*Podarcis*, part, Wagl.); *Scapteira*, Fitz.; *Eremias*, Fitz. (*Podarcis*, part, Wagl.).

PRISTIS. Three species of this genus of Fishes are mentioned as fossil in the tertiary strata of England. (Morris's 'Catalogue.')

PRIVET. [LIGUSTRUM.]

PROBOSCI'DIANS. [PACHYDERMATA.]

PROBOSCIS-MONKEY. [NASALIS.]

PROCAPRA. [ANTILOPIDÆ.]

PROCELLARIDÆ, a family of Oceanic Birds belonging to the order *Natatores*. They are well known to the seamen when far from land, and with which his superstition was once more busy than it is now; but even at the present day they are not unfrequently regarded as ominous, and many a hard-a-weather old quarter-master still looks upon 'Mother Carey's Chickens' as the harbingers of a storm.

Though zoologists have differed as to the genera to be included in this extraordinary group, they have been pretty well agreed as to the forms which should be congregated in it.

The genus *Procellaria* of Linnæus was formed by that great zoologist for the Petrels, and it is closely followed by his genus *Diomedea* (Albatrosses), between which and the Petrels there are many points of resemblance both in their structure and their pelagic habits. [DIOMEDEINÆ; LARIDÆ.]

Prince Bonaparte ('Geographical and Comparative List,' 1838) makes the *Procellaridæ* the thirty-fourth family of the birds, and places them between the *Laridæ* and the *Colymbidæ*. It includes the genera *Diomedea, Procellaria, Puffinus*, and *Thalassidroma*.

Mr. G. R. Gray ('List of the Genera of Birds,' 1840) makes the *Diomedeinæ* the first sub-family of the *Laridæ*. This sub-family comprehends the genera *Pelecanoides, Puffinus, Daption, Thalassidroma, Wagellus, Procellaria, Diomedea*, and *Prion*.

M. Temminck, in his 'Manuel' (2nd part, 1820), arranges all the Petrels under the generic name *Procellaria*, Linn., but divides them into the following sections:—

1. Petrels properly so-called, *P. glacialis*.
2. *P. Puffinus, P. Anglorum*, and *P. obscura*.
3. Swallow-like Petrels (Pétrels Hirondelles), *P. Pelagica* and *P. Leachii*.

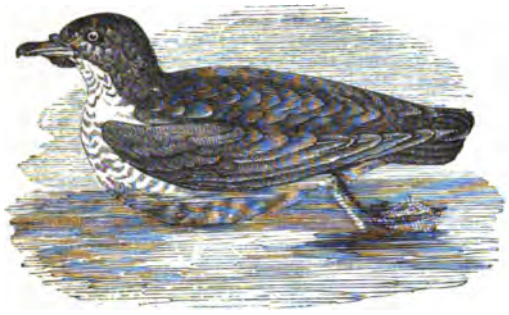
In the 4th part of his 'Manuel' (1840), Temminck admits the genera *Procellaria, Puffinus*, and *Thalassidroma*.

Pelecanoides (Lacépède), *Haladroma* of Illiger, *Puffinaria* of Lesson. —Bill enlarged, composed of many pieces soldered together, the edges smooth and re-entering; the upper demi-bill composed of two pieces, furnished with feathers at the base up to the nostrils, which are very open, forming an oval circle, the aperture of which is above, separated one from the other by a simple internal partition; this partition supports a slight ledge which divides each nasal fossa in half; the enlarged portion of the upper demi-bill goes beyond the lower mandible, and terminates at the contraction of the bill, which is narrow, convex, very much curved, and very robust. The lower mandible is formed equally of two soldered pieces; that of the edge is narrow, inserted in the upper demi-bill; that below is formed by two branches, slightly convex, separated outwards, where the space is filled by a very small and rather indistinct naked skin; the extremity of the mandible is convex on the edges, concave below, and sharp. First and second quills, which are the longest, equal; third and fourth rather shorter. Tail small, nearly equal, pointed, formed of twelve feathers. Tarsi moderate, weak, furnished with small areolated scutella; three anterior toes enveloped in an entire membrane; hind toe wanting. (Lesson.)

P. Urinatrix, the Blue Petrel. Size from the extremity of the bill to the tail, 8½ inches. The plumage has no brilliancy; a blackish-brown on the upper part of the back glazed with a slight tint of blue and a lustrous white on all the foreparts of the body, are the two colours which it presents. Beneath the wings, as well as on the sides, the hue is grayish-white.

The head approaches a little that of the Pelagic Petrel; the bill is articulated and hooked like that of the Puffins, but differs from that genus in the aperture of the nostrils, which is turned upwards in the form of a heart on a playing card; a partition separates the two nasal conduits; the colour is black; the palmated feet, which want the hind toe, are of the same colour, and are placed very near the tail, which is intermediate between that of the Petrels and the Grebes. The eye,

which is situated a little above the level of the commissure of the mandibles, has the iris of a red-brown. Total length 8 inches 6 lines.



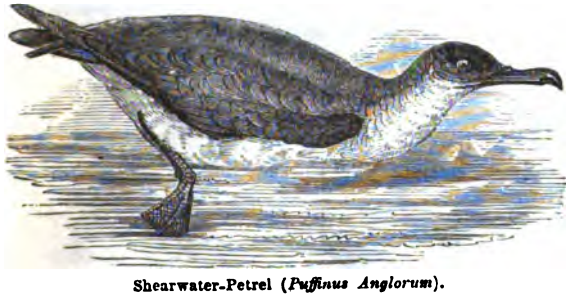
The Grebe-Petrel (*Pelecanoides Urinatrix*).

This species is found in great flocks along the coast of Peru, flying moderately well in a precipitous manner, and skimming the sea; but it prefers repose on the surface, and dives very frequently, like the Grebes, doubtless for the purpose of capturing the small fish which form its food. M. Garnot thinks that it is intermediate between the Petrels, whose bill and feet it very nearly possesses, and the Grebes, whose port and habit of diving it has; and hence he proposes for it the name of the Grebe-Petrel. The parts between Sangallan and Lima are the localities mentioned by M. Garnot.

Puffinus, Ray (*Thiellus*, Gloger; *Thalassidroma*, Sw.; and *Nectris*, Klug.)—General characters those of the true Petrels, from which *Puffinus* is distinguished by the bill being longer; by the extremity of the lower mandible, which follows the curvature of the upper; and by the tubular nostrils opening not by a common aperture, but by two distinct orifices.

P. Anglorum. This is the *Procellaria Puffinus* of Brunnich and Latham; *Puffinus Arcticus* of Faber; Der Nordische und Englische Sturmtaucher of Brehm; Pétrel Manks of Temminck; Pwffingen Fanaw of the Welsh; and Shearwater-Petrel, Manks-Puffin, and Manks Shearwater, of the English.

Summit of the head, nape, and all the upper parts of the body generally, the wings, the tail, the thighs, and the borders of the lower tail-coverts, of a lustrous black; all the lower parts of a pure white; the black and white of the sides of the neck are in demi-tints which produce a kind of crescents; bill blackish-brown; feet and toes brown, membranes yellowish. Length nearly 13 inches. Male and female. (Temminck.)



Shearwater-Petrel (*Puffinus Anglorum*).

In the fourth part of his 'Manuel,' M. Temminck observes that the natural colour of the feet being badly indicated, he gives it from Graba. The trenchant posterior border of the tarsi and the external toe are deep brown; the other parts of the tarsus are flesh-coloured, and the membranes of a livid tint with brown streaks. Iris deep brown.

Young of the Year.—All the lower parts of a more or less deep ash-colour.

Willughby says:—"At the south end of the Isle of Man lies a little islet, divided from Man by a narrow channel called the Calf of Man, on which are no habitations, but only a cottage or two lately built. This islet is full of conies, which the Puffins, coming yearly, dislodge, and build in their burroughs. They lay each but one egg before they sit, like the Razor-Bill and Guillem, although it be the common persuasion that they lay two at a time, of which the one is always addle. They feed their young ones wondrous fat. The old ones early in the morning, at break of day, leave their nests and young, and the island itself, and spend the whole day in fishing in the sea, never returning or once setting foot on the island before evening twilight; so that all day the island is so quiet and still from all noise as if there were not a bird about it. Whatever fish or other food they have gotten and swallowed in the day-time, by the innate heat or proper ferment of the stomach is (as they say) changed into a certain oily substance (or rather chyle), a good part whereof in the night-time they vomit up into the mouths of their young, which, being therewith nourished, grow extraordinarily fat. When they are come to their full growth, they who are intrusted by the lord of the island (the earl of Darby) draw them out of the cony-holes; and that they may the more readily know and keep an account of the number they take, they cut off one foot and reserve it, which gave occasion to that fable that the Puffins are single-footed. They usually sell them for about ninepence the dozen, a very cheap rate. They say their flesh is permitted to be eaten in Lent, being for the taste so like to fish. We are told that they breed not only on the Calf of Man, but also on the Scilly Islands. Notwithstanding they are sold so cheap, yet some years there is thirty pounds made of the young Puffins taken in the Calf of Man, whence may be gathered what number of birds breed there." Speaking of the flesh, the same author says, that from its extraordinary fatness, it is esteemed unwholesome meat, unless it be well seasoned with salt. Pennant states that they are salted and barrelled, and when they are boiled, are eaten with potatoes. He further says that they quit the isle the latter end of August or beginning of September; and from accounts then lately received from navigators, he observes that he has reason to imagine that, like the Stormfinch, they are dispersed over the whole Atlantic Ocean. He says it inhabits also the Orkney Isles, where it makes its nest in holes in the earth near the shelves of the rocks and headlands; it is, he says, called there the Lyre, and is much valued, both on account of its serving as food and for its feathers. The inhabitants, he adds, take and salt them in August for winter provisions, when they boil them with cabbage; they also take the old ones in March; but they are then poor, and not so well tasted as the young, and he makes their first appearance to be in February.

Mr. Selby says, on the authority of Sir William Jardine, that they are no longer to be found on the Calf of Man.

Mr. Gould remarks that during the summer months it is nearly as abundant on the coasts of South Wales as it formerly was in the Calf of Man. Four dozens, apparently captured by hand, were sent to Mr. Gould from this locality, with an intimation that he could have as many more. It appeared from the information obtained by him, that the birds visit these localities for the purpose of incubation during the early part of the spring, when they resort to deserted rabbit-burrows, crevices of the rocks, &c., wherein they deposit their single white egg, and the birds then fall an easy prey to the fishermen and others. He further says that they retire southwards, after the breeding season, even beyond the Mediterranean, where, in consequence of the increased temperature, they find a greater supply of food. The coasts of Norway and the shores of the Baltic, he adds, although not without the presence of this species, appear to be much less frequented by it than our own island. Mr. Gould figures three species in his great work ('Birds of Europe'): the bird above described; the Dusky Shearwater (*P. obscurus*); and the Cinereous Shearwater (*P. cinereus*), Stephens.

P. cinereus, according to Mr. Darwin, is common to Cape Horn and the coast of Peru, as well as Europe, and generally frequents the inland sounds. "I do not think," adds Mr. Darwin, "I ever saw so many birds of any other sort together, as I once saw of these behind the island of Chiloe; hundreds of thousands flew in an irregular line for several hours in one direction. When part of the flock settled on the water the surface was blackened, and a noise proceeded from them, as of human beings talking in the distance. At this time the water was in parts coloured by clouds of small *Crustacea*. At Port Famine, every morning and evening, a long band of these birds continued to fly with extreme rapidity up and down the central parts of the channel. I opened the stomach of one (which I shot with some difficulty, for they were very wary), and it contained a small fish and seven good sized prawn-like crabs." ('Journal and Remarks.')

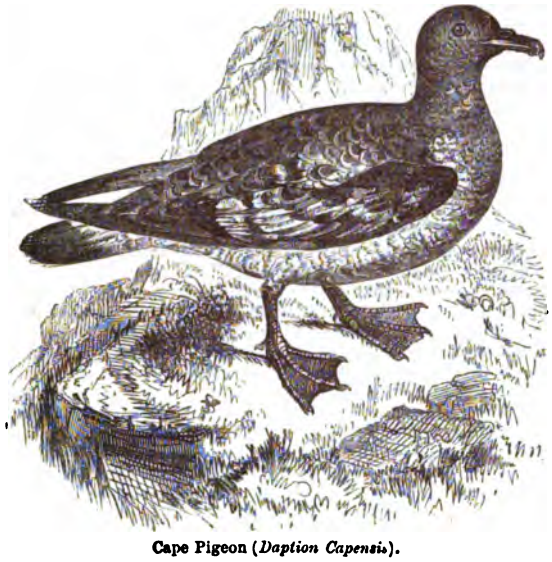
Mr. Gould describes a species, *P. affinis*, from New South Wales. ('Zool. Proc.,' 1837.) It is closely allied to *P. obscurus*, but somewhat smaller.

Thalassidroma.—Bill shorter than the head, much compressed in front of the nasal sheath, with the tip of the upper mandible suddenly curving and hooking downwards, and that of the lower one slightly angulated and following the curve of the upper; nostrils contained in one tube or sheath, but showing two distinct orifices in front. Wings long and acuminate, with the first quill shorter than the third, the second being the longest. Tail square or slightly forked. Legs having the tarsi rather long and slender, reticulated. Feet of three toes united by a membrane; hind toe represented by a small straight dependent nail. (Gould.)

The group generically sub-divided as above, or rather the most of them, have been regarded as the indicators of storm and tempest. Rapidly spurning the billows as they skim along the undulating waves, they are ever on the watch for what the troubled water may offer to them, and they congregate in the wake of the sea-going ship not so much perhaps for shelter as for what is turned up from the furrow ploughed by the keel. Mr. G. Bennett, during his voyage, observed that the Cape Petrels, Albatrosses, and other birds followed the ship during the whole of the night, reposing for a short period on the water, but seldom remaining long on the waves. They usually alighted for food, and soon resumed their flight. Marked birds were seen about the ship for days together when the strong gales carried the vessel at a rapid rate through the water. Cape Petrels and Albatrosses were seen flying near the stern as late as midnight, and it was not unusual to hear the twittering note of the Stormy Petrel (*T. pelagica*) under the stern during the night. ('Wanderings in New South

Wales,' vol. i.) This genus includes the true Petrels, and is divided into the sub-genera *Daption*, *Thalassidroma*, *Wagellus*, and *Procellaria*, of which we proceed to give examples.

Daption.—*D. Capensis*, Stephens; *Procellaria Capensis*, Linn.; Cape Pigeon of the English; Peintada of the Portuguese, may be taken as an example of this form. Its plumage is variegated with brown and white. The total length of one measured by M. Lesson was 13 inches, that of the tube of the nostrils 6 lines. The testicles were rather deep-gray, the larynx had two muscles proper to it, and the total length of the intestinal tube was 47 inches. M. Garnot communicated to M. Lesson a species which the latter believed to be new, with an elaborate description and anatomical details, which M. Lesson quotes at length.



Cape Pigeon (*Daption Capensis*).

Thalassidroma, Vigors (*Hydrobates* of Boie.).—Mr. Selby remarks that the members of this genus, which are all of small size, have been very properly separated by Mr. Vigors from the rest of the Petrel group. They are, he observes, birds of nocturnal or crepuscular habits, and are seldom seen except in lowering weather, or during storms, when they frequently fly in the track of ships. At other times, and in clear weather, they remain concealed during the day in the holes of rocks, rat-burrows, &c., and only come forth at nightfall in search of food, consisting of marine crustaceans, small molluscs, and other oily animal matter which they find floating on the surface of the ocean. Their flight equals in swiftness that of the Swallow tribe, which they resemble in size, colour, and general appearance. All the known species are of a dark hue, more or less relieved with white, and are widely distributed, some being found in both hemispheres, and in a variety of climate. They breed in the crevices of rocks, caverns, &c., and, like the Fulmars and Shearwaters, lay but one egg, which is white, and comparatively large. ('Illustrations of British Ornithology,' vol. ii.)

T. pelagica. This species is considered to be the smallest of the webfooted birds; it is the *Procellaria pelagica* of Linnæus; Uccello delle Tempeste of the Italians; Oiseau de Tempête, Petrel, and Petrel Tempête, of the French and Temminck; Ungewitter Vogel, Kleinster Sturmvogel, and Meer Peters Vogel, of the Dutch; Storm Zwalu of the Netherlanders; Stromwaders Vogel of the Swedes; Soren Peder, St. Peders Fugl, Vestan-Vinds, or Sonden-Vinds Fugl, and Uveurs Fugl, of the Norwegians; Cas Gan Longwr of the Welsh; Common Storm Petrel, Stormy Petrel, and Storm-Finch, of the English, who call the species also (provincially) Little Petrel, Mitty, Assilag, Spency, Sea-Swallow, Allamouty, Witch, and (mariners especially) Mother Carey's Chickens, a title which is not confined to *Procellaria pelagica*, but is shared by, and more generally applied to, the more oceanic species, such as *Thalassidroma Wilsonii*, &c.

Head and foot of *Thalassidroma pelagica*.

It has the head, back, wings, and tail dull-black; lower parts sooty black; a large transverse band of pure white on the rump; scapulars and secondary quills terminated with white; tail and quills black, the first quill not the longest, but shorter by four lines than the second and third, which is the longest; bill and feet black; iris brown. The tail is square, and the tips of the wings reach but very little beyond its point. The length of the tarsi is 10 lines. Total length 5 inches 6 lines. (Male and female.)

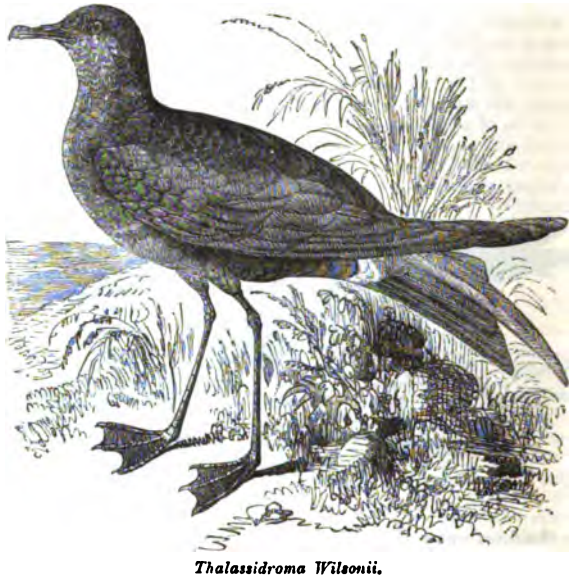
Young of the Year.—These have the tints less deep, and the edges of the feathers sooty or rusty: in other respects they resemble the adults.

It is more common in North America than in Europe; found on the coasts of England and Scotland; rather common at the Orcades and Hebrides; more abundant in the island of Saint Kilda; wanders rarely on the coasts of the ocean, and very accidentally on the lakes of the centre of Europe. (Temminck.)

This, or some other species of *Thalassidroma*, is in all probability the *Cypselus* of Pliny, who describes ('Nat. Hist.,' x. 39) the swallow-like appearance of his *Cypseli*, their nesting in rocks, their wide spread over the sea, and says that however far ships go from land, these birds fly around them.

The habits of this species very much resemble those of the other Petrels.

T. Wilsonii. This species appears to be the *Procellaria pelagica* of Wilson; *P. oceanica* of Banks; *P. Wilsonii* of Prince Bonaparte; L'Oiseau Tempête of Buffon, 'Enl.,' 998; and Pétrel Échasse of Temminck. Head and all the lower parts sooty black; back, scapulars, and wings black; some of the great wing-coverts bordered with whitish; all the upper tail-coverts, and, in some individuals, a part of the feathers of the thighs also, or some of the lower coverts, pure white; tail nearly square, only slightly emarginate, the three lateral feathers white at their base; wings exceeding the tail more than an inch; bill and feet (tarsi 15 lines long) black; on the membranes a long yellow stain and the edges of the toes finely bordered with that colour; iris black; extremity of the nasal tube turned up. Total length of the bird 6 inches 3 or 4 lines. (Both sexes in perfect plumage.)



Thalassidroma Wilsonii.

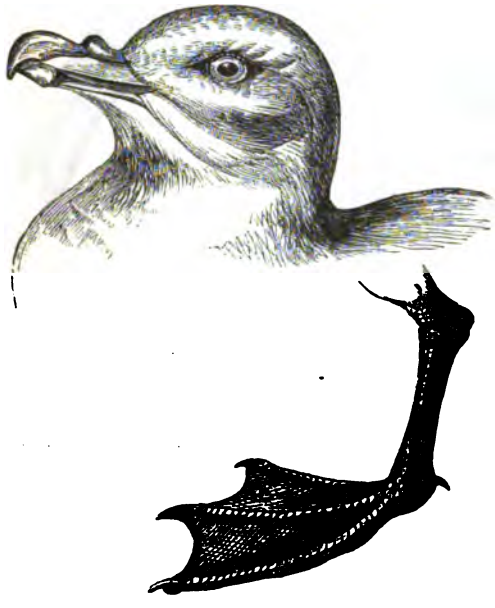
M. Temminck, who gives the above description, observes that the young birds doubtless differ but little from the adults; but they are not as yet exactly known. ('Manuel,' 4th part, 1840.)

It inhabits the coasts of America to Cape Horn: common on the coasts of Chili, the United States, and Brazil; more rare at the Cape of Good Hope than *P. pelagica;* shows itself accidentally on the coasts of Spain and in the Mediterranean. (Temminck, 'Manuel,' 4th part.)

Nuttall, who enumerates their vulgar names of Stormy Petrels, Devil's Birds, and Mother Carey's Chickens with remonstrance, well describes their habits in his 'Manual of the Ornithology of the United States and of Canada.' Temminck states that their food consists of the seeds of some marine plants, small testaceans, molluscs, &c.; Wilson says that they feed on the gelatinous spores of the Gulf-Weed (*Fucus natans*), as well as small fish, barnacles, &c. Nuttall informs us that these Petrels breed in great numbers on the rocky shores of the Bahama and the Bermuda islands, and along some parts of the coast of East Florida and Cuba. Mr. Audubon informed him that they also breed in large flocks on the mud and sand islands off Cape Sable in Nova Scotia, burrowing downwards from the surface to the depth of a foot or more. They also commonly employ the holes and cavities of rocks near the sea for this purpose. "The eggs," says Nuttall, in continuation, "according to Mr. Audubon, are three, white and translucent. After the period of incubation they return to feed

their young only during the night, with the oily food which they raise from their stomachs. At these times they are heard through most parts of the night, making a continued cluttering sound like frogs. In June and July, or about the time that they breed, they are still seen out at sea for scores of leagues from the land, the swiftness of their flight allowing them daily to make these vast excursions in quest of their ordinary prey; and hence, besides their suspicious appearance in braving storms, as if aided by the dark ruler of the air, they breed, according to the vulgar opinion of sailors, like no other honest bird, for taking no time for the purpose on land, they merely hatch their egg under their wings, as they sit on the water!"

Fulmarus (Leach).—Mr. G. R. Gray gives *Wagellus* (Ray) as the generic name of this form, and Linnæus quotes *Wagellus Cornubiensium* as a synonym of the species which we are about to illustrate.



Head and foot of Fulmar.

F. glacialis. This is the *Procellaria glacialis* of Linnæus and authors; Le Pétrel Fulmar and Pétrel de l'Ile de Saint Kilda of Buffon; Havhest of the Norwegians, by whom it appears to be also called Mallemoke, or Mullemoke; Gwylan y Graig of the Welsh; Fulmar and Fulmar Petrel of the English, by whom it is also named (provincially) Mallemuck, Malmoke, and Mallduck.

This species has been considered the type of the restricted genus *Procellaria*, Linn., by those who confine the subdivision of that genus to the genera *Procellaria*, *Puffinus*, and *Thalassidroma*. The bill of the Fulmar is stout, thick, with the upper mandible considerably hooked at the tip (where it is also dilated) and sulcated. The lower mandible is straight and slightly truncated. The nostrils are united in a single tube. The legs are moderate, and a sharp claw exists in the place of a hind toe.

Fulmar Petrel (*Fulmarus glacialis*).

The head, neck, all the lower parts, rump, and tail pure white; back, scapulars, wing-coverts and secondaries, pure bluish-ash; quills bright-gray brown; tail well rounded, conical; bill bright-yellow tinged with orange on the nasal tube; iris and feet yellow. Length 16 inches. (Both sexes, summer plumage.)

Young of the Year.—The whole body bright-gray clouded with brown; feathers of the wings and tail terminated by a deeper brown; the quills and caudal feathers have only a tinge of gray-brown; in front of the eyes an angular black spot; bill and feet yellowish-ash. (Temminck.)

It inhabits the Polar Regions principally during summer. Mr. Gould ('Birds of Europe') observes, that although the Polar Regions constitute its native locality, it is nevertheless found, but in much less abundance, in more temperate climates, such as the northern seas of Europe and America, extending itself throughout the lengthened coast of Norway, and not unfrequently Holland and France. It frequents also, he adds, the northern isles of Great Britain, resorting to the Orkneys and Hebrides for the purpose of breeding, but particularly to the island of St. Kilda.

Temminck states that the Fulmar never comes to the coast except for the purposes of nesting, or when driven there by gales. Its flight is easy and buoyant. Besides the flesh and blubber of dead whales or seals, for penetrating whose thick skins their trenchant and hooked upper mandible is admirably formed, barnacles and other parasites which attach themselves to the whales, molluscs, &c., form their food. The Fulmar attends the fishing-vessels on the banks of Newfoundland, where it is called John Down, for the offal of the cod-fish, and is often taken with a hook baited with a piece of cod's liver or flesh. At St. Kilda they breed gregariously in the caverns and holes of the rocks; a single white large egg, with a very brittle shell, is deposited by the female, and the young, which are hatched about the middle of June, are fed with oily matter disgorged by the parents. As soon as they are fledged they are eagerly sought by the cragsmen, who scale the precipitous cliffs for them at the risk of their lives for the sake of their down, feathers, and oil.

Procellaria (Linn.).—The type of this genus, as restricted by Mr. G. R. Gray, is *P. æquinoctialis* (Linn.), the Great Black Petrel of Edwards.

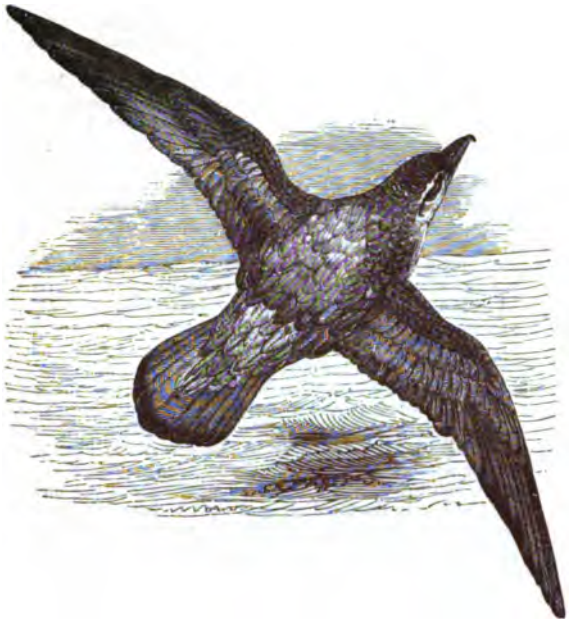
Great Black Petrel (*Procellaria æquinoctialis*).

Mr. Darwin, in his valuable 'Journal and Remarks' ('Voyage of Adventure and Beagle'), observes that the southern seas visited by the expedition are frequented by several species of Petrels. The largest kind, *P. gigantea*, or Nelly (Quebrantahuesos, or Break-Bones, of the Spaniards), is, he observes, a common bird, both in the inland channels and on the open sea. "In its habits and manner of flight," continues Mr. Darwin, "there is a very close resemblance with the Albatross, and, as with the latter bird, a person may watch it for hours together without seeing on what it feeds, so it is with this Petrel. The Break-Bones is however a rapacious bird, for it was observed by some of the officers at Port San Antonio chasing a diver. The bird tried to escape, both by diving and flying, but it was continually struck down, and at last killed by a blow on its head. At Port St. Julian also these great petrels were seen killing and devouring young gulls." The same author adds, that the Spaniards were probably aware of the rapacity of this petrel, for Quebrantahuesos means properly an osprey. These large petrels are called Mother Carey's Geese by the sailors.

The species of the genus *Diomedea*, the Albatrosses, will be found under the articles DIOMEDEINÆ and ALBATROSS. Remains of a fossil bird having the characters of an Albatross have been found in Great Britain. [BIRDS.]

Prion (Lacépède), *Pachyptila* of Illiger.—Bill strong, stout, wide, very much depressed, the upper mandible convex on its sides, terminated by a compressed hook; the edges furnished internally with cartilaginous lamellæ; the lower mandible very much depressed,

formed of two arcs soldered at the point, and forming in their interval a guttural pouch; nostrils opening by two distinct orifices and disposed in the form of a short tube. A very small claw in place of a hind toe. First quill longest.



Blue Petrel (*Prion vittatus*).

The type of this genus is the Blue Petrel (*Procellaria vittata* and *P. cærulea*, Gmelin) discovered by Forster. Many individuals were taken during the voyage of the 'Coquille,' in 58° S. lat. The following is from M. Garnot's description of an individual of this species, which, in the form of its bill at least, appears to be leading the way towards the Lamellibranchiate Palmipedes. It is distinguished from the other Petrels by the disposition of its bill. The mandibles are hooked at their extremity; their base is very much widened. The edges of the upper mandible are directed a little outwards; they present within a projecting border striated transversely; the interval which separates them exhibits a small groove. The tongue is very thick and the mouth very dilatable. Total length, from the bill to the extremity of the tail, 11 inches (French). Length of the nasal tube 3 lines. Extent of wings 20 inches. Size a third larger than *Thalassidroma pelagica;* upper part of the body ashy-blue or gray-blue, deepest on the head and on the wings. A blackish band cuts across the wings and the lower part of the back near the origin of the tail. This portion is deepest in colour; the extremity of the tail has the same blackish deep-blue tint; lower part of the body and wings white; above the tail a line of a blue tint; bill and eyes plumbeous blue; middle of the upper mandible and tube of the nostrils blackish. The middle tail-feathers are rather the longest, which gives the tail a rounded appearance. The same author gives an interesting detail of the anatomy of the bird.

PROCERUS. [Carabus.]

PROCHI'LUS. [Bear.]

PRO'CNIAS, a genus of Birds placed by Mr. Swainson and others under the sub-family *Bombycillinæ*, Swallow Chatterers. It has the following generic characters:—Bill very broad; the sides inflected; the tip not hooked. Nostrils nearly naked. Wings pointed; the three first quills longest. Inner toe shorter than the outer. Tail slightly forked. (Sw.)

P. ventralis, the Swallow Fruit-Eater. Male.—Blue; front, throat, and temples, black; middle of the body beneath white, the sides with blackish transverse striæ. Length about 5¼ inches.

Female.—Green; chin and temples gray; body beneath yellowish, transversely striated with dusky-green.

Mr. Swainson ('Zoological Illustrations,' 1st series) remarks that the birds of this genus are remarkable for the enormous width of their mouths, which in some species exceeds that of the Swallow family, thus enabling them with ease to swallow the large *Melastoma* berries and those of other tropical shrubs, on which alone they subsist; not on insects, as Cuvier asserts. Although, he adds, they perfectly resemble the swallows in the construction of their bills; their wings are not formed for rapid flight; and their feet are much stronger, and calculated for searching among branches for their food, in which situations Mr. Swainson frequently saw them. The species noticed is, he observes, a scarce bird; he met with it only three times in Bahia; but he says that it appears more frequent in the southern provinces of Brazil, specimens having been sent to him from Minas Geraës and Rio de Janeiro.

Swallow Fruit-Eater (*Procnias ventralis*). (Sw., 'Zool. Ill.')

PROCRUSTES. [Carabus.]

PROCTOTRETUS. [Iguanidæ.]

PRO'CYON. [Ursidæ.]

PRODUCTA. [Productidæ.]

PRODUCTIDÆ, a family of Brachiopodous *Mollusca*, including the genera *Producta*, *Strophalosia*, and *Chonetes*. The shell is concavo-convex with a straight hinge-line; valves rarely articulated by teeth; closely adpressed, furnished with tubular spines; ventral valves convex; dorsal concave; internal surface dotted with conspicuous funnel-shaped punctures; dorsal valve with a prominent cardinal process; brachial processes (?) subcentral; vascular markings lateral broad and simple; adductor impressions dendritic, separated by a narrow central ridge; ventral valve with a slightly-notched hinge-line; adductor sac central, near the umbo; cardinal impressions lateral, striated.

Producta has the shell free, auriculate, beak large and rounded; spines scattered; hinge area in each valve linear, indistinct; no hinge-teeth; cardinal process lobed, striated; vascular impressions simple, curved; ventral valve deep, with two rounded or subspiral cavities in front.

The species are all fossil. There are about sixty species. They are found ranging from the Devonian to the Peruvian rocks of North and South America, Europe, Spitzbergen, Tibet, and Australia.

Strophalosia has its shell attached by the umbo of the ventral valve. There are 8 species.

Chonetes contains 24 species, which are found fossil from the Silurian to the Carboniferous rocks.

(Woodward, *Treatise of Recent and Fossil Shells.*)

PROITHERA. [Goat-Suckers.]

PROMEROPIDÆ. [Upupidæ.]

PRONG-BUCK. [Antilopæ.]

PROPITHE'CUS (Bennett), a genus of *Mammalia* allied to the *Lemuridæ*, and thus characterised:—Muzzle moderate. Hinder extremities longer than the anterior ones. Index abbreviated. Tail long, hairy.

Dental Formula:—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, —; (upper) two first cuspidate, the third elongated, externally bituberculated, the fourth like the preceding; (lower) first unicuspidate, second and third plurituberculate.

P. Diadema. Face nearly naked, with short blackish hairs about the lips, and equally short yellowish-white hairs in front of the eyes. Above the eyes, the long, silky, waved, and thickly-set hairs which cover the body commence by a band of yellowish-white crossing the front and passing beneath the ears to the throat. This is succeeded by black, extending over the back of the head and neck, but becoming freely intermingled with white on the shoulders and sides, the white gradually increasing backwards so as to render the loins only slightly grizzled with black. At the root of the tail fulvous, that colour gradually disappearing until the extreme half of the tail is white, with a tinge of yellow. The under surface white throughout, except the hinder part of the throat, where it is of the same colour with the sides of the body.

Hairs generally long, silky, waved, erect, and glossy; shorter and more dense on the crupper, where they offer a sort of woolly resist-

ance. General character of those on the tail, that of the body hair, but shorter.

Thumb of anterior hands slender, placed far back, and extremely free; length one inch and half, extremity of its penultimate phalanx ranging slightly beyond the end of the metacarpal bone of the index. Index one inch and a half in length, its extremity ranging with the middle of the penultimate phalanx of the second finger. Length of second finger 3 inches; that of third finger 3¼ inches. Length of carpus and metacarpus 2 inches.

Thumb of hinder hands very strong, placed forwards and ranging with the fingers, 2 inches long; index 2½ inches, the pointed nail extending half an inch beyond: length of second finger, 3¼ inches; of tarsus and metatarsus, 3 inches.

Length of body and head, measured in a straight line, 1 foot 9 inches; of the tail, 1 foot 5 inches. Anterior limbs, exclusive of hands, 7½ inches in length from the body; posterior limbs, 15½ inches.

Muzzle shorter than in the Lemurs generally; the distance from the anterior angle of the orbit to the tip of the nose (one inch and a quarter) being equal to that between the eyes. Ears rounded, concealed in the fur: length one inch; breadth one inch and a half.

Propithecus Diadema.

Mr. Bennett remarks that *Propithecus* is essentially distinguished from *Lemur*, the genus to which it most nearly approaches, by the number and form of its teeth, and especially by the form of the incisors of the upper jaw, which constitute apparently a regular series, a structure unknown in any other Lemuridous animal. It is a native of Madagascar.

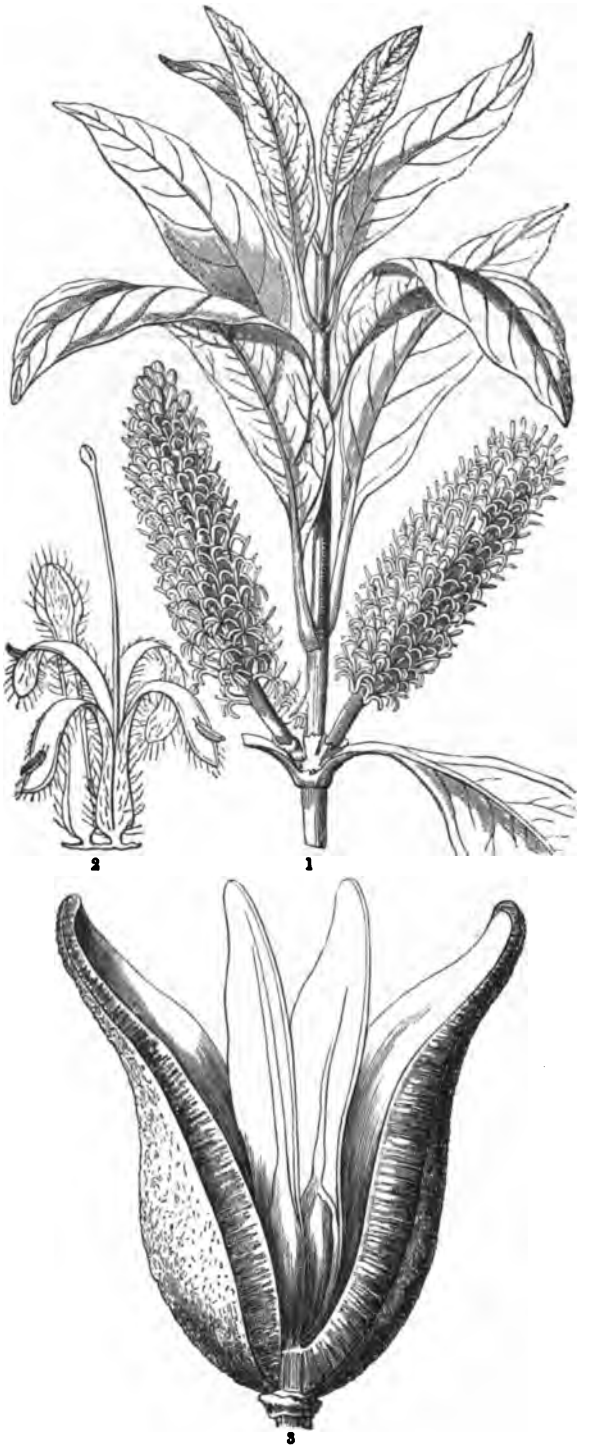
PROPOLIS. [Bee.]

PROSI'MIA, the name given by Brisson and Storr to some of the Lemurs. [Lemuridæ.]

PROTEACEÆ, a natural order of incomplete Exogenous Plants. It possesses the following characters:—The perianth or calyx is 4-leaved, the sepals distinct, or cohering into a tube with a 4-cleft limb; the sepals subcoriaceous, coloured, pubescent externally, and valvate in æstivation; the stamens definite, opposite the lobes of the calyx, and generally exserted with very short filaments from just below the edges of the sepals; the anthers adnate, 2-celled, linear, and dehiscing longitudinally; the pollen is normally triangular, sometimes elliptic or cunate, rarely spherical; occasionally there exist four hypogynous scales or glands, or barren stamens, alternating with the lobes of the calyx and prefiguring a corolla; the germen is free, often stipulate, formed of a single carpel, the style simple and terminal, and the ovules 1, 2, or many; the fruit is variable, either dry or succulent, and either dehiscent or indehiscent, 1, 2, or more seeded; the seeds without albumen, often winged, and furnished with a chalaza; the embryo straight and white, with two or more cotyledons, the plumule scarcely visible, and the radicle inferior and short.

The species are shrubs or small trees, with usually umbellate branches, and hard, dry, divided or undivided, opposite or alternate leaves without stipules, and the cuticle often covered on both sides with stomates.

This order is very easily distinguished by the hard, dry, woody texture of the leaves, by the irregular perianths having a valvate æstivation, the stamens placed on the lobes of the perianth, and by its dehiscent fruit. Another character by which it is distinguished from those which are allied to it is that the radicle points towards the base of the fruit.



Wooden Pear (*Xylomelum pyriforme*).

1, Branch with leaves and flowers; 2, flower separated; 3, fruit split open.

The following is an arrangement of the genera of this order, from Brown's 'Memoir.'

* Indehiscent Fruit.

** Distinct Anthers.

*** Anthers free from the Calyx.

**** Dioecious Flowers.—*Aulax, Leucodendron.*

**** Hermaphrodite Flowers.—*Pterophila, Isopogon, Protea, Leucospermum, Serruria, Mimetes, Nivenia, Sorocephalus, Spatalla, Adenanthos, Guevina, Brabejum, Cenarrhenes, Agastachys, Symphionema, Bellendena.*

*** Anthers adnate with the Calyx.—*Franklandia.*

*** Coherent Anthers.—*Simsia, Conospermum, Synaphea.*

* Dehiscent Fruit.

** Unilocular.

*** Ovary 2-seeded.—*Anadenia, Grevillea, Hakea, Lambertia, Xylomelum, Orites, Ropala.*

*** Ovary 4-seeded.—*Knightia.*

*** Ovary many-seeded.—*Embothrium, Oreocallis, Telopea, Lomatia, Stenocarpus.*

** Bilocular.—*Banksia, Dryandra.*

A great many of these genera are named after botanists and patrons of botany.

Nivenia was named in honour of Mr. James Niven, an intelligent botanist, to whom we are indebted for the discovery of many new species of South African plants. *Simsia* was named after Dr. John Sims, for many years editor of the 'Botanical Magazine.' *Franklandia* was named in honour of Sir Thomas Frankland, Bart., who has studied very successfully the submarine flora of this country. *Persoonia* was named by Sir J. S. Smith after C. H. Persoon, who wrote several papers on Cryptogamic Botany, and published a complete edition of the 'Systema Vegetabilium' of Linnæus. *Bellendena*, named after John Bellenden Ker, who has published many valuable papers on botany in the 'Annals of Botany,' and the 'Botanical Magazine.' *Grevillea* was named by Brown in honour of the right honourable Charles Francis Greville, a lover of natural history, and formerly a vice-president of the Royal Society. This name will also be always associated by every botanist with that of Dr. Greville of Edinburgh, the author of the 'Scottish Cryptogamic Flora.' *Lambertia* was named by Smith in honour of A. B. Lambert, a good botanist and a distinguished patron of the science of botany. *Knightia* is a genus which was discovered by Sir Joseph Banks, and, at his suggestion, named by Brown in honour of Thomas Andrew Knight, author of many valuable papers on various departments of vegetable physiology. *Banksia* was named by the younger Linnæus in honour of Sir Joseph Banks. *Dryandra*, a genus closely allied to *Banksia*, was named in honour of Mr. Dryander, a Swede, librarian to Sir Joseph Banks, and a learned and talented botanist.

The geographical distribution of these plants is interesting. They are almost entirely confined to the southern hemisphere, an observation first made by Mr. Dryander. Their diffusion is very extensive in this hemisphere, not merely in latitude and longitude, but also in elevation. They cover not only the larger southern continents, but are also found in New Zealand and New Caledonia; but they have not hitherto been found in Madagascar or the lesser islands of the South Seas. In America they have been found in Tierra del Fuego, in Chili, in Peru, and even Guyana. The American species have more affinity with those of Australia than of Africa. It may be inferred that this family of plants is diffused over Africa, as they are abundant at the Cape of Good Hope, and Bruce found a genuine species of *Protea* in Abyssinia. Wherever the shores of Australia have been explored, an abundance of Proteaceous Plants have been found, the great mass of the order existing here in about the same latitude as the Cape of Good Hope. On the south-west coast of Australia this order forms a much more decided feature of the vegetation than on the east. From the parallel of the mass the order diminishes in both directions, but the diminution towards the north appears to be more rapid on the east than on the west coast. The most numerous genera are those which are the most widely diffused. *Grevillea, Hakea, Banksia*, and *Persoonia* contain the largest amount of species, in the order in which they are mentioned, and are found spread nearly in the same proportion. Those genera which consist of one or very few species, and which exhibit the most remarkable deviations from the structure of the order, are the most local, and are found either in the principal parallel or in the highest latitude. The range of the species of the order is very limited, and there has been no instance recorded of a species of this family common to the eastern and western shores of Australia. *Banksia integrifolia* is probably the most widely extended species; but although its range of latitude is very considerable, its extension in longitude is very small.

None of the plants belonging to the natural order *Proteaceæ* are remarkable for their medicinal properties. The fruit of a species of the genus *Guevina* is said to be sold in the markets of Chili under the name of *Avellano*. At the Cape of Good Hope the plants of this order are most frequently made use of as fire-wood. For this purpose the dry woody character of their leaves peculiarly fits them. They are most of them handsome evergreen shrubs, and are much prized by gardeners, and form a part of every good collection of plants. One of the finest collections of these plants in this country is at the Royal Gardens at Kew, where a great variety of this singular and interesting group of plants may be seen. The genera most commonly found in this country are *Grevillea, Banksia*, and *Dryandra*. The fruit of the *Xylomelum pyriforme*, which the cut accompanying this article represents, is very hard, and is known in Australia under the name of Wooden Pear.

(Brown, 'On the Proteaceæ of Jussieu,' in vol. x. of *Linn. Trans.*; Jussieu, art. 'Protées,' in *Dictionnaire des Sciences Naturelles*; Burnett, *Outlines of Botany*; Lindley, *Natural System.*)

PROTEIN (from πρωτεύω, to stand first), a substance first described by Mulder, and obtained from animal and vegetable substances containing nitrogen. Although the existence of Protein as an independent substance has been doubted, the theory of its existence and its relation to animal and vegetable compounds generally has had the most important influence on vegetable and animal physiology. It was through his researches on Protein that Mulder came to the conclusion that certain vegetable and animal compounds, as fibrin, albumen, legumin, gluten, &c., were identical, and that these bodies are first formed in the vegetable before they are appropriated by the animal. Liebig, who was the first to adopt Mulder's views, now denies the independent existence of Protein. Whether however this substance exists as a chemical compound or not, there can be no doubt of the close resemblance in chemical composition and vital properties of albumen, fibrin, and casein, and of their elements being united in the relations in which they are represented in the formula for Protein.

This substance was obtained by Mulder from Albumen, Casein, Horn, and Animal and Vegetable Fibrin. When any one of these is dissolved in a solution of potash, and the filtered solution is mixed with a slight excess of acid, a copious grayish-white flocculent precipitate is formed, and a slight smell of hydrosulphuric acid is perceived. This white substance is Protein, so called from its occupying the first or most important place in relation to the albuminous principles.

Its properties are:—While moist the white flocculi are diaphanous, but by drying they become yellowish, hard, and brittle. It possesses neither smell nor taste, attracts moisture rapidly from the air, and loses water at 212°. It is insoluble in water, alcohol, ether, and essential oils. By long continued boiling in water it undergoes some change of properties, and is rendered soluble.

Acetic and phosphoric acids, whatever may be their state of concentration, dissolve it; hydrochloric acid also dissolves Protein, and acquires an indigo tint. When heated the solution blackens. With concentrated sulphuric acid it produces a jelly which contracts in water, and which, after being washed with water and alcohol, though it does not redden litmus-paper, contains 8·34 per cent. of sulphuric acid. Mulder calls this compound Sulphoproteic Acid. When Protein is boiled in dilute sulphuric acid, it acquires a purple tint.

Protein is precipitated from its acid solutions by the ferro- and ferrid-cyanide of potassium, by tannin, and by neutralisation with an alkali. When strongly heated, Protein is decomposed with the production of ammonia and a charcoal which burns with difficulty, but leaves no residue.

Protein consists entirely of carbon, hydrogen, nitrogen, and oxygen; and it will be observed, that whether obtained from Albumen (1), Casein (2), Horn (3), Animal Fibrin (4), or Vegetable Fibrin (5), the statements of its composition differ so slightly, as to show that it must be the same from whichsoever of the sources named it is procured.

	(1)	(2)	(3)	(4)	(5)
Carbon . . .	55·30	55·16	55·408	55·44	54·99
Hydrogen . .	6·94	7·17	7·238	5·95	6·87
Nitrogen . . .	16·02	15·86	15·593	16·65	15·66
Oxygen . . .	21·34	21·81	21·761	21·36	22·48

These analyses may be represented by $C_{40}\ H_{31}\ N_5\ O_{12}$.

When Protein, or the substances which yield it, are boiled in a concentrated solution of potash as long as ammonia is evolved, and the solution is afterwards neutralised by sulphuric acid, evaporated to dryness, and the residue treated with boiling alcohol, three products of the decomposition are dissolved, one of which, Erythroprotide, separates in oily drops as the solution cools; Leucin is deposited in small crystalline scales by spontaneous evaporation; whilst the mother water contains Protide and Formiate of Ammonia in solution.

Binoxide and Tritoxide of Protein are produced by the long continued action of boiling water upon fibrin in contact with air. They are the chief ingredients of the buffy coat of the blood in a state of inflammation, being produced at the expense of the fibrin.

Protein is undoubtedly the most important of all known substances in the organic kingdom. It is present in all parts of plants, in roots, stems, leaves, fruits, and in their several juices; in the animal body it is the chief constituent of the blood, the muscles, and many other parts, and is the original source of numerous other compounds. In plants it assumes three different forms, being soluble in water, insoluble in water, or soluble in alcohol; in animals it may be either soluble or insoluble in water. It is one of the substances directly prepared for the food of plants, and is found in the youngest roots; whether it is only formed there, and afterwards conveyed to the other parts, or whether it is produced in any other part of the plant, is uncertain. Its property of being readily soluble in water facilitates its transference to the various organs. It may however assume the solid state and become deposited in cells; in this form it occurs in many seeds, occasionally being their principal constituent. This deposition is effected in a very simple manner. Most acids render it insoluble, and therefore the mere presence of an acid is usually sufficient to accomplish the transformation: again, the insoluble Protein may be redissolved by alkalies, and hence, after it has been deposited in the cells in a solid state, it may be removed to another part of the plant through the medium of an alkaline solution.

Whether Protein can be formed within the animal body is uncertain, but it cannot be doubted that the Protein compounds in vegetables are imparted to animals in their food, and as the compounds form the principal component parts of the animal body, this constituent must be supplied either wholly or in part by plants.

The Protein compounds existing in plants were till quite recently known as Soluble Albumen, Coagulated Albumen, Legumin, and Gluten; Liebig has however applied to the three first the names Vegetable Albumen, Vegetable Fibrin, and Vegetable Casein, asserting that they are identical in their physical properties and in their chemical compositions with the corresponding principles in the animal kingdom. Mulder, the discoverer of Protein, denies the accuracy of this statement. "The special character of these animal substances is," he remarks, "determined by the small portions of sulphur and phosphorus they contain, by which they differ from each other and from pure Protein. The proportions of sulphur and phosphorus in the three vegetable substances are still unknown; and therefore the names proposed by Liebig cannot be applied to them. Moreover both vegetable albumen and legumin differ so much from animal fibrin and casein, both in form and appearance, that they ought not to have a similar name."

Soluble Vegetable Albumen is that substance which, being soluble in water, is precipitated from the juices of plants by heat, alcohol, or acids. It is soluble in weak alkaline fluids, from which it is precipitated by acids, and, independently of the sulphur and phosphorus, has the same composition as Protein. Coagulated Vegetable Albumen is the compound of protein, sulphur, and phosphorus, which is insoluble in water; it exists in the seeds of the *Cerealea*, in almonds, &c. Glutin is the substance which can be extracted by alcohol from the ordinary gluten by washing away the starch from flour.

The Protein-compounds contained in the animal body correspond to these in the vegetable. Thus we have Fibrin, Albumen, and Casein.

The bodies of animals contain Fibrin both in a fluid and a solid state; in the former it exists in the blood, and in the latter form in muscular fibre, but that of venous differs from that of arterial blood. To obtain the former, human blood is to be triturated in a mortar with one and a half times its weight of water, and one-third of its weight of nitre; and the mixture is to remain, during at least twenty-four hours, exposed to a temperature of about 100° to 120° Fahr.; by this it is rendered slimy and gelatinous, and at length it becomes liquid, exhibiting the properties of albumen which has been treated with acetic acid. When largely diluted with water, a flocculent substance is thrown down, which closely resembles coagulated albumen. When arterial blood is employed in the same way similar changes are not produced, and the fibrin of venous blood loses the property if it has absorbed oxygen.

Solid Fibrin is procured by washing thin portions of muscular flesh in cold water until they are rendered quite white, or in a purer state by stirring fresh blood with a stick to which the fibrin adheres: it is to be rendered pure by washing first with cold water, and afterwards by treatment with ether. Fibrin, when fresh, exists in the state of long, white, elastic filaments; it is inodorous, tasteless, and insoluble in water whether cold or hot, but by long-continued boiling a portion is dissolved. When dried at a gentle heat it loses about four-fifths of its weight, which loss is water, and it becomes then horny and translucent, and very much resembles albumen which has been coagulated; acetic acid and fresh fibrin when kept for some hours in contact, form a transparent gelatinous mass which is soluble in water; solution of potash dissolves fibrin, and the compound possesses many of the characters which belong to albumen.

According to Mulder dried fibrin consists of

Carbon	54·56
Hydrogen	6·90
Azote	15·72
Oxygen	22·13
Phosphorus	·33
Sulphur	·36
	100

If it be admitted that the phosphorus and sulphur are in definite combination, the formula of this substance will be $C_{400}\ H_{310}\ N_{80}\ O_{120}$ PS, which certainly includes a very unusual amount of equivalents. Its composition is precisely similar to that of coagulated albumen, and, as already remarked, they have several properties in common. [FIBRIN.]

Albumen is found very extensively in the human body, forming the chief ingredient in the serum of the blood, chyle, lymph; and enters largely into the composition of the brain and nerves. The white of eggs is liquid albumen. It unites with alkalies and metallic oxides, forming albuminates. It is precipitated from its solutions by nitric acid, heat, corrosive sublimate, and metallic oxides generally. The following is its composition:—

	From Actual Analysis.	Calculated Atoms.
Carbon	54·38	54·44—C. 48
Hydrogen	7·14	6·99—H. 37
Nitrogen	15·92	15·88—N. 6
Oxygen	22·56	22·69—O. 15
	100	100

Casein is the basis of the various kinds of cheese, and closely resembles albumen in many properties. It is insoluble in water, but a small portion of alkali renders it soluble; it may be prepared by adding dilute phosphoric acid to fresh milk warmed; a coagulum is produced, which after being washed is to be dissolved in a weak solution of carbonate of soda, and this is to be kept in a warm place to allow of the separation of the butter; these re-solutions in carbonate of soda and precipitations are to be repeated several times, and the insoluble casein is then to be washed with boiling water, and treated with ether, to remove any remaining butter or fatty matter.

Casein thus prepared is a curdy white substance, insoluble in water or alcohol, but soluble by water containing an alkali or its carbonate; dilute acids also dissolve a small portion of it. When moist, it reddens litmus-paper, and leaves about 0·3 per cent. of ashes by incineration. Casein is coagulated by certain animal membranes, as is shown in the process of making cheese, in which, by the action of a piece of the stomach of the calf, milk is separated into a yellowish liquid termed whey, and a solid white coagulum which contains all the casein of the milk with portions of some of its other principles.

According to the analysis of Mulder, casein consists of

Carbon	54·96
Hydrogen	7·15
Azote	15·80
Oxygen	21·73
Sulphur	·36
	100

The following are also formula for these substances:—

Fibrin from blood 10 $(C_{40}\ H_{31}\ N_5\ O_{12}) + SP$, or 10 $\overline{Pr} + SP$; that is to say, every atom or equivalent of fibrin contains 10 atoms or equivalents of Protein with one each of sulphur and phosphorus.

Albumen from the serum of the blood is represented by 10 $(C_{40}\ H_{31}\ N_5\ O_{12}) + S_2P$, or 10 $\overline{Pr} + S_2P$; that is to say, it differs from fibrin in containing one atom more of sulphur.

Casein from cow's milk, 10 $(C_{40}\ H_{31}\ N_5\ O_{12}) + S$, or 10 $\overline{Pr} + S$.

Crystallin, the substance that forms the principal constituent of the lens, 15 $(C_{40}\ H_{31}\ N_5\ O_{12}) + S$, or 15 $\overline{Pr} + S$.

These are all the Protein-Compounds of the animal body yet known. The muscular fibre is for the most part composed of a Protein-Compound, fibrin, which likewise exists in the circulating fluids; and albumen occurs in the brain, liver, kidney, and many other organs, as well as in the blood. The above compounds of Protein enter into some very important combinations, a few of which, from their physiological bearings, we shall here notice. The combinations of the leading Protein-Compounds, fibrin, albumen, and casein, with alkalies, acids, and salts, are especially remarkable. Protein is soluble in weak alkalies, and according to Mulder it exists in the blood as a proteate of soda with sulphur and phosphorus. Enderlin and the Giessen school, on the other hand, deny that it exists in that fluid as proteate of soda. They assert that the cause of the alkalinity of the blood is the presence of the ordinary tribasic phosphate of soda—a salt which has the power of dissolving the Protein-Compounds: the question whether Mulder or Enderlin be correct is still undecided.

On neutralising a weak alkaline solution of Protein by an acid, its solubility is greatly diminished; a fact which Mulder regards as elucidating the medical properties of certain acids. The sulphuric and phosphoric acids, for instance, possess the property of stanching blood; acetic acid, on the contrary, by which Protein is readily dissolved, is destitute of that property. Very dilute hydrochloric acid occurs in the stomach, and as it possesses the property of dissolving Protein, it doubtless renders the food (at least the portion consisting of Protein-Compounds) tender, and thus assists digestion. Some acids enter into combination with the Protein-Compounds, producing comparatively insoluble bodies. For this reason certain acids (sulphuric and hydrochloric) are very efficacious in putrid fevers, scurvy, &c. As an illustration of the combinations of the Protein-Compounds with salts, we may notice that of bone-earth with casein. Bone-earth is a phosphate of lime whose composition is represented by the formula $3\ P_2\ O_5 + 8\ Ca\ O$. In casein, and therefore in milk, it exists in great quantity, and this seems to supply a large amount of earthy matter to the tender bones of young animals.

In addition to albumen and fibrin, a third Protein-Compound exists in the blood, constituting the cell-wall of the corpuscles. It is termed Globulin. Its real composition is unknown; Simon regards it as casein. All these Protein-Compounds contain more or less phosphate of lime, which thus finds its way to the bones.

Two other very important Protein-Compounds exist in the animal body, namely the binoxide and tritoxide of Protein. They both exist to a large amount in the blood in inflammatory diseases, and to a small amount in healthy blood. The latter is soluble in water, the former is not. At every respiration a small amount of them is produced in the blood, and Mulder (who must be regarded as the highest authority in all that relates to Protein) believes that they form around the blood-corpuscles a thin layer, having the same composition as the buffy coat or inflammatory crust. Gelatin is a degraded form of Protein. [GELATIN.]

(Lehmann, *Physiological Chemistry*; Sharpey, in *Quain's Elements of Anatomy*; Bowman, *Medical Chemistry*; Gregory, *Organic Chemistry*.)

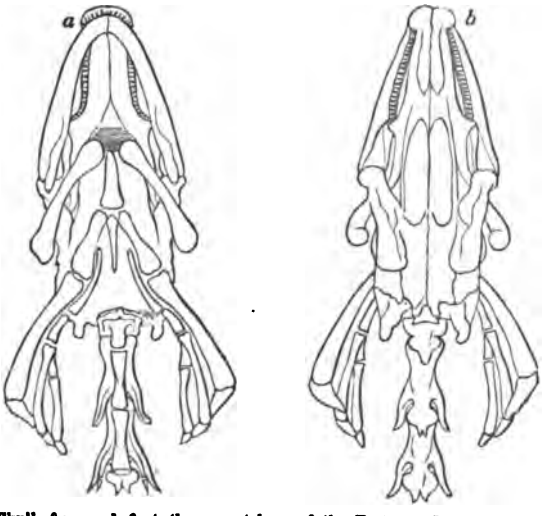
PROTELES. [AARD-WOLF.]

PROTEOSAU'RUS. [ICHTHYOSAURUS.]

PROTEUS, Laurenti's name for one of the genera of Perennibranchiate Batrachians, namely, those Batrachians which preserve their branchiæ throughout life, whereas the Caducibranchiate Batrachians only possess them during their early or tadpole state. [AMPHIBIA.] This preservation of the branchiæ does not interfere with the presence of true lungs, so that these *Perennibranchiata* may, as Cuvier observes, be regarded as the sole vertebrated animals that are truly amphibious. Cuvier says, "The simultaneous existence and action of branchial tufts and lungs in these animals can no more be contested than the most certain facts of natural history; I have before me the lungs of a *Siren* of three feet in length, where the vascular apparatus is as much developed and as complicated as in any reptile: nevertheless this *Siren* had its branchiæ as complete as the others." [SIREN.] Cuvier further observes that whilst the branchiæ subsist, the aorta, in coming from the heart, is divided into as many branches on each side as there are branchiæ. The blood of the branchiæ returns by the veins, which unite towards the back in a single arterial trunk, as in the fishes; it is from this trunk, or immediately from the veins which form it, that the greatest part of the arteries which nourish the body, and even those which conduct the blood for respiration in the lung, spring. But in the species which lose their branchiæ naturally, the branches which go there become obliterated, except two which unite in a dorsal artery, and of which each gives off a small branch to the lung. "It is," adds Cuvier, "the circulation of a fish metamorphosed into the circulation of a reptile."

The *Proteus* of Laurenti (*Hypochton* of Merrem) has four feet. There are three toes on the anterior feet and two only on the posterior feet. The skeleton bears considerable resemblance to that of the Salamanders; indeed, Cuvier, we believe, has somewhere termed the fossil *Salamandra gigantea*, the *Homo diluvii testis* of Scheuchzer, Protée Gigantesque [AMPHIBIA]; but *Proteus* has many more vertebræ than the Salamanders, and less of the rudiments of ribs, and its bony head is entirely different from theirs in its general conformation.

But one species of *Proteus* appears to be known, the *Proteus anguinus* of authors, *Hypochton Anguinus*. Cuvier describes it as more than a foot long, of the size of a human finger, with a tail vertically compressed, and four little legs; the muzzle elongated and depressed; both of its jaws furnished with teeth; the tongue with but little motion, but free in front; the eyes excessively small and hidden by the skin, as in the Rat-Mole (*Spalax*); the ears covered by the flesh, as in the Salamander; its skin smooth and whitish.

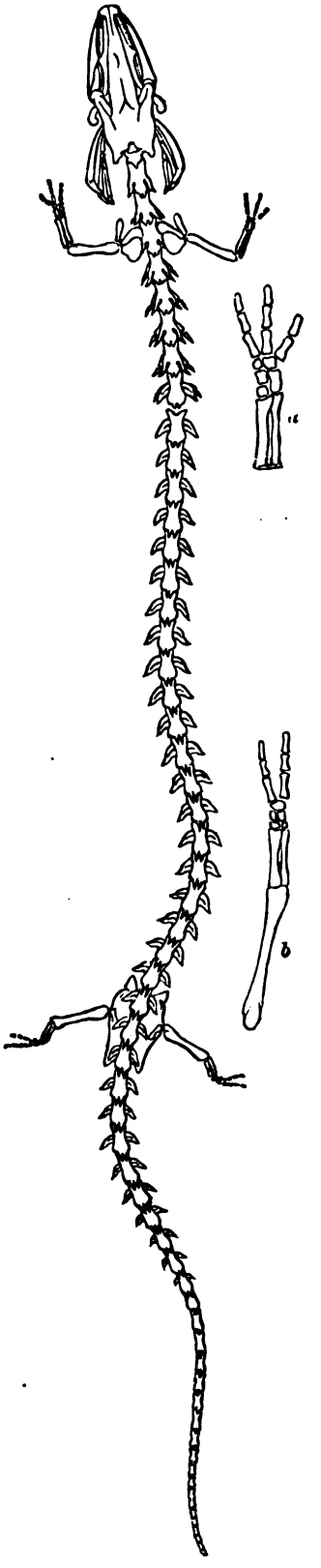


a, Skull, &c., and first three vertebræ, of the *Proteus*. *b*, Same seen from above, eight times larger than nature. (Rusconi.)

Several specimens of these animals have been brought to this country.

In November, 1837, Dr. Martin Barry exhibited one living, to the Zoological Society of London, and read the following communication from Professor Rudolph Wagner, of Erlangen in Bavaria:—

"I was so fortunate," says Professor Wagner, "at the end of last summer, as to obtain three living *Protei*; of which I have examined two, just killed, that proved to be a male and female, and have given the third, alive, to my friend Dr. Barry, who may perhaps have an opportunity of bringing it forward at a meeting of the Zoological Society. The results of my examination correspond perfectly with the statements of Cuvier, R. Owen, J. Müller, and others, on the *Proteidea*; but are opposed to several of the views lately put forth by Rusconi. ('Observations sur la Sirène,' 1837.) I have, for instance, no doubt that the pulmonary sacs or vesicles really perform the function of lungs. Each lung contains a large artery and a still larger vein, which are connected together by means of large and



Skeleton of *Proteus*, seen from above. *a*, bones of interior foot, magnified. *b*, bones of posterior foot, magnified. (Rusconi.)

numerous vessels. To me the most important point was the examination of the blood-gobules and the generative organs. I conjectured, on various grounds, that the *Proteidea* would be found to have, of all

Proteus anguinus.

animals, the largest blood-globules:—first, because the size of the latter in the naked *Amphibia* in general is the largest in the animal kingdom; secondly, because, remarkable as it is, the blood-globules are here (in the naked *Amphibia*) so much the larger, the longer the gills continue in the larval state; hence the land and water salamanders have much larger blood-globules than the frog. I conjectured also that the *Protei* (probably also the *Siren*, &c.), because they permanently have both gills and lungs—being therefore permanently larvæ—would be found to have the largest blood-globules. The latter are indeed gigantic; flat, oval, resembling those of the salamander, and from 1-30th to 1-40th of a Paris line in length; hence, as minute points, visible to the naked eye. They are from once to twice the size of the blood-globules of the salamander, nearly three times as large as those of the frog, and about twelve or fifteen times the size of those of man. In a female I found the ova very beautifully developed; their structure, as well as that of the ovary, corresponding perfectly with that of the other naked *Amphibia*, especially the *Triton*. The smallest ova consist of a delicate chorion, yellow yolk, large germinal vesicle, and a manifold germinal spot. I regret to say that in the otherwise tolerably developed testes of the male there were no spermatozoa. I conjecture however that the spermatozoa of this animal resemble those of the *Triton*. I would just remark, that the form and size of the blood-globules, the formation of the ova, and the form of the spermatozoa, in different animals, have a great zoological and physiological interest. Already is it in my power from a drop of blood or semen placed before me, to determine with the microscope, not only the class, but frequently the genus and the species from which these fluids have been taken."

Sir Humphrey Davy, in his 'Consolations in Travel,' gives a very graphic account of finding these subterranean animals in Illyria. [SIREN.]

PROTOCOCCUS, a genus of Plants belonging to the natural order *Confervaceæ*. It is made the type of a tribe *Protococcidæ*, belonging to the sub-order *Palmellaceæ*. The *Palmellaceæ* are plants of the simplest kind, consisting of single cells somewhat globose or elliptical, and either free or connected together by a slimy mucus or frond. The latter forms constitute the tribe *Coccochloridæ*, whilst the former are the *Protococcidæ*. In this tribe are included the genera *Protococcus*, *Hæmatococcus*, *Chlorococcum*, *Pleurococcus*, *Hormospora*, and *Stereococcus*. Of these genera *Protococcus* is the most interesting, as affording the red cells, which, frequently occurring on snow, have got for it the name of the Red-Snow Plant. The genus is thus defined:—Plant consisting of aggregated naked globules filled with minute granules, and sessile on a gelatinous transparent mass. [SNOW, RED.]

PROTOMEDÆA. [ACALEPHÆ.]

PROTONOPSIS. [AMPHIBIA.]

PROTO'PTERIS, a genus of Fossil Plants, from the coal formation, including *Sigillaria punctata* of Brongniart. (Presl.)

PROTO'PTERUS. Under this name Professor Owen, in the manuscript catalogue of the Museum of the College of Surgeons, in June, 1837, recorded the principal characters of an extraordinary animal which he supposed to belong to the Malacopterygious Fishes. In the same year, Dr. Natterer published an account of a nearly allied animal under the name *Lepidosiren paradoxa*. This account appeared in the annals of the Museum of Vienna, and is drawn up from two specimens discovered by the author of the paper in South America. The memoir of Dr. Natterer on the South American Lepidosiren was followed by one from Professor Owen, in the 'Linnæan Transactions' (vol. xviii. part 2, p. 327), in which that anatomist describes in detail both the external characters and internal anatomy of the *Protopterus* above mentioned; and as he found this animal must be referred to the same genus as that discovered by Dr. Natterer, he adopted his generic term, and applied the name of *Lepidosiren annectens* to the species. The last-mentioned animal, says Professor Owen, "was presented to the Royal College of Surgeons, June, 1837, by Thomas C. B. Weir, Esq., together with a smaller dried specimen inclosed in indurated clay baked hard by the sun. Several species of insects peculiar to the Gambia, or African forms, accompanied these specimens. It is a female, with the ovaria well developed, and measures twelve inches eight lines in length; its greatest circumference is four inches and a half. The head commences by an obtuse muzzle, and gradually enlarges in all its dimensions to the gill-openings, which are situated immediately anterior to the base of the pectoral extremities: the length of the head, from the snout to the gill-opening, is one inch eleven lines. The anus, or rather the cloacal vent, is a small elliptical aperture marked with radiating lines, which is situated three lines behind the ventral filaments, and offers the same peculiarity as does that of the *Lepidosiren paradoxa* in not being situated on the median plane; in the present specimen it was on the right side of a longitudinal fold of integument which occupied the middle line. The distance from the vent to the end of the tail is five inches. The trunk gives a wide elliptical transverse section, and maintains a pretty uniform size, slightly decreasing in breadth to the ventral filaments. Beyond these the tail becomes more rapidly compressed, and after a short distance diminishes also in vertical dimension, till it ends in a thin point. A membranous dorsal fin commences at the distance of four inches from the snout, and, gradually increasing to the height of five lines, is thus continued into the caudal membranous expansion.

Lepidosiren annectens.

This fin is supported by numerous soft, elastic, transparent rays, articulated to the extremities of the superior and inferior peripheral spines of the caudal vertebræ; the under part of the caudal fin commences about one inch behind the vent. The entire body is covered with cycloid scales, which are relatively larger, but have the same general structure and disposition as in the *Lepidosiren paradoxa*. They present a subcircular form, with a diameter of about three lines; their posterior margin adheres to the strong cuticle with which they are removed, as in other fishes; the anterior lies freely in a corresponding groove of the chorion. The disposition of the mucous pores and ducts upon the head is very similar in the two species of the *Lepidosiren*, judging from the figure given by Dr. Natterer. A linear series of mucous pores encircles each eye, and from the posterior angle of this series the lateral line commences. This line extends backwards nearly parallel with the dorsal line, situated a little more than one-fourth of the vertical diameter of the body of that line, until it nearly reaches the ventral extremities, where it bends down to midway between the dorsal and ventral margins, and so continues to the end of the tail. The rudimentary filamentary fins, the analogues of the four ordinary extremities in the *Vertebrata*, permanently represent in the present singular animal the earliest embryonic condition of the pectoral and pelvic members. They are round, filiform, gradually attenuated to an undivided point, resembling tentacles or feelers rather than fins or legs, and doubtless restricted to their tactile functions. Each filiform member is supported by a single-jointed, soft, cartilaginous ray. The pectoral tentacles are somewhat shorter and more slender than the ventral ones; the former are two inches, the latter two inches four lines in length. The branchial apertures are narrow vertical slits four lines in extent. The eyes appear externally as two small round flat spots of a lighter colour than the surrounding integument; they are situated seven lines from the end of the snout, and nearly the same distance apart from one another. Each of these simple visual organs measures one line and a half in diameter; it is not defended by any palpebral folds of the skin; the cornea is thin, sufficiently transparent to allow the lens to be visible even in the specimen preserved in spirits. The nostrils are situated at the under part of the upper lip, within the opening of the mouth. They appear as two small perforations leading to blind sacs. About a line behind the lower lip, between it and the teeth, there project six soft papillose processes, of a triangular form. Behind the upper lip there are eight similar papillose processes, four on each side. There are two small, slender, conical, sharp-pointed and slightly recurved teeth, which project downwards from the intermaxillary bone, to which they are attached by ligaments. These teeth, in their paucity, relative size, and mode of fixation to the maxillæ, resemble those of the *Chimæra* and some of the extinct cartilaginous fishes, as *Cochliodus* and *Ceradodus;* but they are unlike these in their microscopic structure, and differ from any known dental apparatus in the class of fishes, in the modifications of the working surface which at once adapt them for piercing, cutting, and crushing. The strength of the jaws, and

the size of the muscles which work them, are proportionate to the size and formidable character of the maxillary dental plates. There are no lingual, palatine, pterygoid, vomerine, or pharyngeal teeth."

The skeleton of this curious fish is partly cartilaginous and partly bony, and the osseous portions are of a green colour, as in the Common Gar-Fish (*Belone vulgaris*). [BELONE.]

In reviewing the principal characters of the skeleton of the Lepidosiren, "we obtain," says Professor Owen, "good evidence of its ichthyic nature. If indeed the species had been known only by its skeleton, no one could have hesitated in referring it to the class of Fishes; but in that class it would have offered a most singular and interesting combination of the cartilaginous and osseous types.

"The central elements of the vertebral column, the basis of the skeleton, exhibit a persistence of its primitive embryonic condition, such as has hitherto been witnessed only in the sturgeon and cyclostomatous fishes; but the superior arches and spinous appendages, instead of retaining the cartilaginous state, are converted into the tough elastic fibrous texture characteristic of the skeleton of fishes. The cranium in like manner presents an extremely novel combination of the cartilaginous and bony states, both as regards its partial ossification and the condition of the ossified parts.

"It is only in the higher cartilaginous fishes, for example, that the maxillary, palatine, and pterygoid bones are blended together to form the simple superior dentigerous arch, or upper jaw. The composition of the lower jaw corresponds with that which characterises most of the osseous fishes, and is more simple than in the *Amphibia*. The confluence of the cranial vertebræ reminds one of the condition of the skull in the siren; but no vestige of a preopercular bone is present in any of the Perennibranchiates. The sphenoideum basilare, as it exists in the sturgeon, is here seen in its fully ossified state. As the basis of the vertebral column presents a condition analogous to that which characterises the early embryonic periods of the higher *Vertebrata*, so also the extremities retain their simple structure as when they first bud forth, and are devoid of any trace of digital divisions: still the march of development has begun, and we perceive by the numerous joints of the cartilaginous ray that its direction is towards the ichthyic modification of the great vertebral plan."

This animal is regarded by some naturalists as one of the *Amphibia*. In many points of its structure it certainly does approach that group of animals, especially in the condition of its air-bladder or lungs and its branchiæ; but as regards the former, we find considerable advances are made towards the reptilian structure by some other fishes; and it may be remarked that the present animal still differs widely from the *Amphibia* in possessing distinct large scales. There is another character which it appears is of the highest importance in determining the class to which the Lepidosiren belongs, namely, the structure of the nostrils. "In the organ of smell," says Professor Owen, "we have at last a character which is absolute in reference to the distinction of fishes from reptiles. In every fish it is a short sac communicating only with the external surface; in every reptile it is a canal with both an external and an internal opening. According to this test, the Lepidosiren is a fish; by its nose it is known not to be a reptile. In other words, it may be said that the Lepidosiren is proved to be a fish, not by its gills, not by its air-bladders, not by its spiral intestine, not by its unossified skeleton, not by its generative apparatus, nor its extremities, nor its skin, nor its eyes, nor its ears—but simply by its nose; so that at the close of our analysis we arrive at this very unexpected result, that a reptile is not characterised by its lungs nor a fish by its gills, but that the only unexceptionable distinction is afforded by the organ of smell."

In conclusion, the author states—"From every group of fishes however the Lepidosiren is sufficiently distinct to form a type, not merely of a genus, but of a family; and in the natural system it forms a link connecting the higher Cartilaginous Fishes with the Sauroid genera *Polypterus* and *Lepidosteus;* and at the same time makes the nearest approach in the class of Fishes to the Perennibranchiate Reptiles."

The South American Lepidosiren (*Lepidosiren paradoxa*) greatly resembles the species above described, but differs somewhat in its proportions. The whole length of *L. paradoxa* includes eleven lengths of the head, measured from the end of the mouth to the gill-openings; in the *L. annectens* the total length of the animal includes little more than six lengths of the head. This species is therefore distinguished from the *L. paradoxa* by the shorter relative length of the trunk as compared with the head.

PROTOROSAU'RUS, Meyer's name for the Fossil Monitor of Thuringia.

PROTOZOA, a term applied by Oken to the lowest forms of animal life. *Protophyta* has been applied to the same forms of vegetable life. As employed at the present day, it embraces the group of *Infusoria* termed by Ehrenberg *Polygastrica* [INFUSORIA], the *Rhizopoda* of Dujardin embracing the *Foraminifera* [FORAMINIFERA] and the Sponges. [SPONGIADÆ.] The *Acrita* of M'Leay, and the *Ooxoa* of Caius, correspond to this section of the animal kingdom.

PROX. [CERVIDÆ.]

PRUNELLA, a genus of Plants belonging to the natural order *Labiatæ*. It has two inferior stamens; the filaments bifid, one branch barren; the anthers all 2-celled; the corolla ringent, the upper lip concave, entire; the calyx ultimately closed and compressed, the upper lip flat, truncate, 3-toothed, the lower lip bifid.

P. vulgaris, Self-Heal, is a native of Europe and Asia; very plentiful in America and Australia, and also in England. The leaves are stalked, ovate or oblong, toothed or deeply pinnatifid; the upper lip of the calyx with short truncate mucronate teeth; the lower lip with ovate-lanceolate mucronate teeth, the two longest stamens with a straight spinous root at their apex. The flowers are purple, white, or nearly red. In the British specimens the leaves are nearly entire. This plant is considered astringent, and was formerly used in fluxes and gargarisms for apthæ and inflammation of the fauces. Its repute is now merely in name.

P. grandiflora has petiolate ovate leaves, quite entire or toothed, the lateral teeth of the upper lip of the corolla lanceolate; the corollas large, more than twice as long as the calyx. It is native throughout Europe in woods and shady places. The flowers are of a purple or violet colour, seldom white.

(Babington, *Manual of British Botany.*)

PRUNUS, a genus of Arborescent Rosaceous Plants, belongs to the Amygdaleous division of the order, and comprehends several of our domestic fruits. The Cherry, Bird-Cherry, Plum, Damson, Sloe, Bullace, and Apricot, are all comprehended in the genus as limited by Linnæus; but in the opinion of some modern botanists, the true Plums require to be separated from the others, and should exclusively constitute the genus *Prunus*, while the others are to be considered as belonging to two other genera, represented by the Cherry and the Apricot. In this view of the subject, each genus is characterised thus:—

Armeniaca, the Apricot.—Drupe woolly outside. Stone blunt at one end, sharp-pointed at the other, with a furrow passing all round it, and an even surface. Young leaves rolled up.

Cerasus, the Cherry.—Drupe smooth, without bloom. Stones roundish, smooth. Young leaves folded flat.

Prunus, the Plum.—Drupe smooth, covered with bloom. Stone sharp-pointed at each end, furrowed all round, and smooth on the surface. Young leaves rolled up.

Of the Plum genus, thus restricted, there is in common use the Garden Plum (*P. domestica*), with all its numerous varieties, the Bullace (*P. insititia*), and the Sloe (*P. spinosa*). These plants are distinguished specifically by botanists, but apparently without reason. It is the opinion of the best experimental physiologists, that the Sloe of our hedges was the origin of the others; and certainly there is not more difference between a Sloe and a Greengage than there is between a German Quetsche and an English White Magnum-Bonum. Several other species belong to the genus, but they are of no moment, with the exception of a plant called *Prunus Coccomilia*, which inhabits the mountains of Calabria, and has a great reputation in Italy on account of the tonic qualities of its bark.

PSALI'ODUS, a genus of Fossil Fishes. [FISH.]

PSALURUS. [GOAT-SUCKERS.]

PSAMMA, a genus of Grasses belonging to the tribe *Arundineæ*. It is known by its flower being enveloped in long silky hairs, the lower glume shorter than the upper, and its panicle being spike-like.

P. arenaria, Sea-Reed, Marram, is the only British species. It is found on sandy sea-shores, where its roots assist in binding the shifting sands.

PSAMMO'COLA, M. De Blainville's name for a genus of Conchifers (*Psammobia* and *Psammotæa*, Lam.) belonging to Lamarck's family *Nymphacea*.

PSAMMO'DROMUS, a genus of Saurian Reptiles.

PSAMMODUS, a genus of Fossil Fishes. (Agassiz.) [FISH.]

PSAMMOSAURUS. [MONITORIDÆ.]

PSARIS. [MUSCICAPIDÆ.]

PSE'LAPHUS (Herbst), a genus of Coleopterous Insects, but now regarded as a family, to which the name *Pselaphidæ* is applied. The *Pselaphi* are very minute insects, and most remarkable in their structure. By some entomologists they are arranged with the *Brachelytra*, owing to their having the wing-cases short and truncated; and by others they are placed in the section *Trimera*, their tarsi having but three joints: in the classification of Latreille they constitute the last family of Coleopterous Insects, being placed at the end of the *Trimera*.

Scarcely any of the known *Pselaphi* exceed one-twelfth of an inch in length, and the greater portion of them are under that size: they prey upon other insects still smaller than themselves, and are found under stones, and amongst herbage, especially in damp situations. Some species are found under the bark of trees, and in putrid wood, and the species of one of the genera are found in ants' nests (the genus *Claviger*). They are often collected during the winter months by shaking the moss from the roots of trees, or from old walls, over a piece of white paper or cloth. They are probably found in all parts of the world. The principal characters of the group are as follows:—

Head moderately large, exserted, and most commonly of a triangular form, being broad at the base and attenuated in front; the eyes moderately prominent, sometimes wanting; palpi usually large and generally 4-jointed; antennæ usually 11-jointed, sometimes with 6 joints, and in one genus apparently having but one large joint, generally equal to about half the length of the insect, and increasing

in thickness from the base to the apex. Thorax usually not much broader than the head, sometimes nearly cylindrical, but most commonly dilated in the middle; elytra broad, much shorter than the abdomen, and truncated behind, destitute of striæ, if we except one on each elytron near the suture, and an abbreviated stria at the base about mid-way between the suture and the outer margin—these are almost constant. Abdomen broad, obtusely terminated, and without appendages as observed in the *Brachelytra*; usually four or five joints are visible beyond the elytra. Legs rather long; tibiæ curved; tarsi 3-jointed, the basal joint small, and the terminal joint furnished either with one or two simple claws.

The *Pselaphidæ* are composed of the following 13 genera, which may be most briefly characterised by throwing them into a tabular form, as in M. Aubé's Monograph, published in Guerin's 'Magasin de Zoologie' for the year 1834.

Section 1. Antennæ two-jointed.

Division 1. Tarsi with two claws.

1. *A.* with the claws unequal.—*Metopias.*

1. *B.* with the claws equal.—*Tyrus, Chennium, Ctenistes.*

Division 2. Tarsi with a single claw.

Pselaphus; Bryaxis; Tychus; Bythinus; Trimium; Batrisus; Euplectus.

Section 2. Antennæ six-jointed.

Claviger.

Section 3. Antennæ with but one large and elongated joint.

Articerus.

Examples of most of these genera are found in this country. Of the genus *Metopias* only one species is known; it inhabits Guyana. The genus *Tyrus* is found in Sweden and Germany, and perhaps in England. Of the genus *Chennium* but one species is known: it is found in the south of France. The curious genus *Claviger* has been discovered in England by Mr. Westwood: it is found in the nest of a species of ant (*Formica flava*). On the Continent it has been long known.

Owing to their remarkable appearance, and the curious forms displayed by the various species, the *Pselaphidæ* have been more carefully studied perhaps than any other group of minute insects, and have given rise to several monographs—see the 'Monographia Pselaphidorum et Seydmænidarum Britanniæ,' by H. Denny, Norwich, 1825, 1 vol. 8vo.; 'Monographia Pselaphorum,' H. F. L. Reichenbach, Lipsiæ, 1816, 1 vol. 8vo. P. W. J. Müller has published a monograph on the *Pselaphi* in the third volume of the 'Magazin der Entomologie, von E. F. Germar.' M. C. Aubé has likewise published an excellent monograph on the same group, which has been quoted in the former part of this article.

PSEUDOBDELLA. [Annelida.]

PSEUDOCA'RCINUS, M. Milne-Edwards's name for a genus of *Crustacea.*

The general form is that of many *Xanthi.* [Xanthus.] The carapace is slightly convex, and a little embossed near the front, which is nearly horizontal; latero-anterior borders moderately curved, and armed with more or less projecting teeth; posterior portion of the carapace nearly of the same extent as the anterior, with its lateral borders straight, and directed very obliquely backwards. The basilary joint of the external antennæ is very small, the second hardly reaches the front, and the third, which is lodged in the orbital gap, does not fill it, so that the antennary fosset is not completely separated from the orbit; the terminal stem of these appendages, instead of being very short, is more than twice as long as its peduncle. The species are found in the Indian and Southern Oceans.

PSEUDOCORYSTES, M. Milne-Edwards's name for a genus of Brachyurous Crustaceans belonging to his tribe of Corystians, and bearing much analogy to *Corystes* [Corystes], and especially to *Nautilocorystes.*

General form approximating to *Corystes*, but the feet natatory, as in *Nautilocorystes:* jaw-feet differing from those of both.

PSEUDOGRAPSUS. [Grapsidæ.]

PSEUDOLI'VA, a genus of *Gasteropoda.*

PSEUDOPODIA. [Infusoria Foraminifera. *See* Supplement.]

PSEUDORHOMBILA. [Gonoplacidæ.]

PSEUDOZOA'RIA, a term proposed by De Blainville to include plants, many of which have been ranked with the *Polypiaria.* It is subdivided into two classes: *Calciphyta*, which are principally composed of the genus *Corallina*, Linn.; and *Nematophyta* (also called *Nematozoaria*), which include *Conferva, Oscillatoria, Byssus*, &c. [Algæ; Corallinaceæ.]

PSI'DIUM (from ψίδιον, the Greek name for a pomegranate), a genus of Plants belonging to the natural order *Myrtaceæ.* The tube of the calyx is ellipsoid or obovate, usually contracted at the apex; the limb ovate, undivided, but afterwards from 1- to 5-cleft. There are five petals and numerous free stamens inserted in a broad circle, almost through the whole undivided part of the limb; the style is filiform, the stigma capitate; the ovules are numerous, horizontal, and fixed to the margin of the placenta; the berry is many-seeded, corticate by the tube of the calyx, and crowned by its lobes. The seeds imbedded in the pulp in the mature fruit with a bony testa. The species are trees or shrubs, natives of America within the tropics. The fruit is edible, and is known by the name of Guava. It has a fragrant but peculiar odour and very sapid taste, and is eaten both raw and when made into jelly.

P. pomiferum, Apple-Bearing or Common Red Guava, has tetragonal branches, oval or oblong lanceolate leaves, pubescent beneath, from 3 to 8 peduncles, or many-flowered. The fruit is globose, yellow, and somewhat astringent, with an agreeable odour; the root and young leaves are astringent; and are esteemed strengthening to the stomach. It is a native of the West Indies, Mexico, and South America.

P. montanum has tetragonal branches, oval-oblong leaves, acuminated and quite glabrous; the peduncles many-flowered, and the fruit roundish. It is a native of Jamaica on the mountains. The fruit is small, acid, and smells strongly like bitter almonds, hence it is called *Almandron.* The wood is very hard and of a fine colour and grain. It works well, takes a fine polish, and is much esteemed for ornamental purposes.

PSILOCARYA. [*See* Supplement.]

PSILOMELANE. [Manganese.]

PSILOPOGON. [Picidæ.]

PSILOSO'MATA, M. De Blainville's name for his third family of his order *Aporobranchiata*, and placed by him at the end of that order and immediately before the order *Polybranchiata*, which contains the genus *Cavolina.* [Polybranchiata.]

The only genus of *Psilosomata* recorded by M. De Blainville is *Phyllirhöe.*

Body free, naked, very much compressed, or much higher than it is thick, terminated behind by a sort of vertical fin; cephalo-thorax small, and provided with a pair of natatory appendages, which are triangular, compressed, and simulate a kind of long tentacles or branchiæ; mouth subterminal, of a horse-shoe shape, with a short retractile proboscis; anus on the right side of the body; orifice of the organs of generation unique, on the same side, and more anterior than the anus. Organs of respiration (?).

Ex. *Phyllirhöe Bucephalum.*

This species was discovered in the Mediterranean Sea by Péron and Lesueur.

PSITHYRUS, Saint Fargeau, a genus of Hymenopterous Insects belonging to the section *Anthophila* (Latreille) and family *Apidæ.* The insects of this genus so closely resemble the Humble-Bees (*Bombus*), that till recently they were by all authors confounded with them. The *Psithyri* however differ widely from the Humble-Bees, inasmuch as they make no nests of their own, neither do they collect food for their young, but, like the Cuckoo among birds, they deposit their eggs in the nests of others, and leave their young to be hatched and reared by them. It is the nests of the Humble-Bees that they select for this purpose. Mr. Newman considered these facts relating to their economy so important, that he established an order among Hymenopterous Insects, to which he gave the name *Apathites* (from α, without, and πάθος, affection), for the reception of the present insects, which, according to him, constitute the genus *Apathus*, and some other genera of bees. The characters of the order *Apathites*, given by the author, are as follows:—Larva hatched from an egg, deposited by its parent in the nest of other *Apidæ* at the time when their own eggs are laid; when it hatches, being stronger and larger than the rightful possessor of the cell, it consumes the food provided for its companion, and starves it to death; and in those instances in which fresh supplies of food are daily provided, it continues to receive and appropriate them as its own. Pupa changes in the same situation, in a silken cocoon, spun by the larva. Imago has no apparatus either on the body or legs for collecting honey; in other respects it resembles in structure each of the other orders of *Apidæ.* It enters their nest with perfect familiarity, and seems to be quite unsuspected of intrusion. It collects no pollen or honey, never builds a nest of any kind, nor takes any care of its young, but spends its time among flowers, or hovering about sand-banks in which other bees have fixed their habitations. The genera included in this order are—*Apathus* (or *Psithyrus*), *Cœlioxys, Melecta, Stelis* (?), *Epeolus, Nomada*, and *Hylæus* (?). ('Entomological Magazine,' vol. ii. p. 404.) The order *Apathites* however is very objectionable in many points of view; it is founded upon the habits of the species, whilst in fact the habits of the individuals composing the very genera placed by the author in his order are in many cases but partially known: the order moreover comprises genera agreeing in no positive points of structure.

The species of the genus *Psithyrus* may be distinguished from those of *Bombus* by the structure of their hinder legs. In *Bombus* the hinder tibia is compressed, smooth, and somewhat concave on the outer side, and is furnished on its edges with a fringe of stiff curved hairs, which serve to retain on the outer side of the shank the pollen collected by the insect to feed its young. The *Psithyri* have the tibia narrower and covered throughout with hair. They have no basket for the purpose of carrying pollen.

Four or five species of *Psithyrus* are found in England, and these are well described by Kirby in his 'Monographia Apum Angliæ.' They are arranged by that author in his genus *Apis*, section **, c. 2, which section also includes the true *Bombi.*

Psithyrus rupestris very closely resembles the Red-Tailed Humble-

Bee (*Bombus lapidarius*), but may be distinguished by the dark (almost black) colour of its wings. The *Apis Albinella* of Kirby is no doubt the male of this species.

P. campestris is black, has a yellow band on the fore part of the thorax, yellow hair on the scutellum, and a patch of yellow on either side of the abdomen at the apex. *Apis Rossiellus* of Kirby is no doubt the male of this species.

P. Barbastellus is black, has the fore and hinder portion, the thorax, and the base of the abdomen yellow; the apex of the abdomen is white.

Apis subterraneus and *A. vestalis* of Kirby's monograph also belong to this group.

PSITTA'CIDÆ, an extensive and highly-interesting family of Birds, including those commonly called Parrots. They are remarkable for their beautiful colours, their powerful bill, their fleshy tongue, and their power of imitating the human voice. The articulation of some of the species is so perfect, that when the bird is unseen it is difficult to suppose that the words pronounced do not proceed from the mouth of man.

That several of these birds were known to the ancients, both Greek and Roman, we have abundant evidence. Not to weary the reader with quotations, we shall here only refer to Ctesias ('Indic.,' 3; Phot. 'Bibl.,' lxxii.); to Aristotle ('Hist. Anim.,' viii. xii.), where he notices the Ψίτταξη as the Indian Bird, and refers to its powers of mimicry; to Arrian, who speaks of the Ψίτταξος, and its imitation of the human voice ('Hist. Ind.,' c. xv.); to Plutarch, who alludes to the same quality in his treatise, 'De Solertia Animalium' (vol. x., p. 51, ed. Reiske; vol. iv., p. 972, Lut. Paris, 1724); to Ovid ('Amor.,' ii. 6); Persius, in the prologue to his 'Satires' (line 8); and Martial's delicate flattery (xiv. ep. 73)—

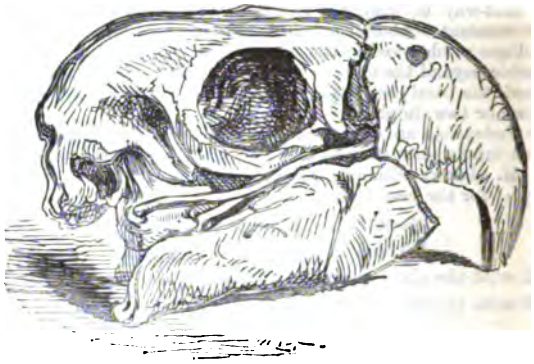
> "Psittacus, à vobis aliorum nomina discam;
> Hoc didici per me dicere, Cæsar ave."

These, with the exception of the passage in Ctesias, and many more examples, will be found in the learned treatise by Mr. Vigors, 'On a group of Psittacidæ known to the Ancients' ('Zool. Journ.,' vol. ii.), where he reminds us that the ancient writers are unanimous in informing us that the Parrots known to their times came exclusively from India. "We are informed by Ælian," continues Mr. Vigors, "that they were the favourite inmates of the palaces of the princes; and were looked up to as objects of sacred reverence by the religious feelings of the people. From thence they were introduced into Europe at the time of the Macedonian conquest; and the specific name of *Alexandri*, applied by modern science to the type of the group, in honour of the first European discoverer of it, serves to perpetuate the name of a warrior who is said to have valued the conquests that extended the boundaries of his empire chiefly as they served to extend the boundaries of science. It was not until the times of Nero that the Parrots of Africa became known to the Romans. (Pliny, 'Hist. Nat.,' vi. 29.) Some of these birds were among the discoveries made in the course of an expedition sent out by that prince. They came apparently from the neighbourhood of the Red Sea; and it is probable that, as that country became more known, numbers of the same race were imported from it into Rome, and formed the chief part of those victims of the Parrot tribes which in after-times are said to have supplied the inordinate luxury and wantonness of Heliogobalus. The Indian group, thus familiar to the ancients, may be identified with those beautiful birds, equally the favourites of our modern times, which are brought to us from the same country, and which are distinguished by the rose-coloured collar round their neck, the brilliant emerald of their body, and the deep ruby of their bill. Pliny ('Hist. Nat.,' x. 42) points out distinctly the former character. Solinus, in general the servile copier of Pliny, confirms this description, though with a slight variation as to colour. ('Polyhist.,' c. 23.) Apuleius again alludes to the same characters, but more immediately and forcibly distinguishes the varying tints of the collar round the neck. ('Florid.,' lib. ii.) Oppian gives the bird an epithet (Ποεσίχροον ὄρνιν, 'Grass-coloured bird,' 'De Venat.,' vii. 488); while Ovid, in like manner, particularises both the emerald plumage and the deep red bill. ('Amor.,' ii. vi.) To this group Mr. Vigors has assigned the name of *Palæornis*.

The upper mandible, which is immoveable in mammals, has more or less motion in birds. [BIRDS.] Some birds indeed, for instance the capercailzie and rhinoceros birds, are not gifted with this motion; but mobility of the upper mandible is the rule in this class, and the want of it the exception. In the *Psittacidæ* this power is highly developed; for the upper mandible is not connected into one piece with the skull, by yielding and elastic bony plates, as is the case with birds in general, but constitutes a particular bone, distinct from the rest of the cranium, and articulated to it.

The advantages derived to the animal from this conformation are obvious to any one who watches a parrot taking its food or using the bill as a third extremity to assist it in climbing about its cage. In most birds there is a progressive increase in the number of the phalanges of the toes: thus the great toe has two, the next three, the middle toe four, and the outer toe five. The parrots possess a peculiar cross-bone belonging to the great toe. In common with the pigeon and some other birds, they are destitute of a gall-bladder. Their intestines are very long, and are without cæca. The soft thick tongue

so characteristic of this tribe must be a highly sensitive organ of taste. It is covered with papillæ, and moistened with a salivary secretion, so that they are able to taste and select different articles of food. In some of the forms, the *Trichoglossi* for instance, which feed on the nectar of flowers, the brush-like tongue is fringed with tubular pro-



Skull of Maccaw.

cesses, in conformity with the suctorial mode of feeding adopted by these birds. One of them kept by Mr. Caley, on seeing the coloured drawing of a plant, made an attempt to suck the flowers, and evinced the same disposition towards a piece of printed cotton furniture. The accurate observer last mentioned supplied the *Psittacus pusillus*, Lath., a species of the same genus, with honey and moistened sugar, which it sucked with ease and apparent pleasure by means of its brush-like tongue. The tongue is short, thick, and fleshy, as in most of the parrot tribe; but it is further distinguished by terminating in a number of very delicate and close-set filaments, which can be protruded and expanded like a brush. The plumage of this extensive family is of the most rich and varied description, embracing almost every colour and gradation of tint. The Zoological Society of London possesses one of the finest living collections of these splendid birds in the world. The quantity of mealy dust discharged from the skin by the cockatoos, and other species of parrots, particularly at pairing time, is remarkable; though the separation of this peculiar matter from the skin is not confined to this family, but is effected in many birds of different orders, eagles and herons for instance. The characters of the powerful bill, and the grasping scansorial foot, which last is so constructed as also to convey the food to the mouth, will be seen below.

Head of Maccaw.

Foot of Maccaw.

This large, hard, and solid bill, rounded throughout, and surrounded at its base with a membrane wherein the nostrils are pierced, together with the thick fleshy and rounded tongue, gives the *Psittacidæ*, as Cuvier observes, the greatest facility in imitating the human voice, a facility to which their complicated lower larynx, with its three peculiar muscles on each side, contributes. Their strong mandibles, formed for shelling and cracking the hardest fruits, are worked by more numerous muscles than those of other birds.

The Parrot tribe are found in great numbers in warm climates, and principally in the torrid zone. They are however abundant in the southern hemisphere, and occur even in high latitudes, whilst in the north they do not appear to be represented beyond the tropics by any species, except perhaps in India by *Palæornis*. Parrots occur in the southern extremity of America, throughout Australia, in Van Diemen's Land, New Zealand, and even in Macquarrie Island, in 52° S. lat. They are monogamous, and make their nests in the holes of trees, which they climb with their feet and bill. The shortness of their wings not permitting them to pass wide seas, the old and new continents, and even some of the large islands, have their particular species. Their food consists of fruits of almost every kind, and their natural voice is loud, harsh, and grating almost beyond endurance.

Brisson places the Parrots in his thirteenth order of birds, consisting of those with two anterior and two posterior toes. This order he divides into four sections: the first, with a straight bill, includes the Wryneck, Woodpecker, and Jacamar as generic forms; the second, with the bill rather curved, the Barbets and Cuckoos; the third, with the bill short and hooked, the Trogons, Crotophaga, and the Parrots; and the fourth, with the bill long, and of the size of the head, the Toucans.

Linnæus placed the genus *Psittacus* at the head of his order *Picæ*, with the following definition:—Bill hooked; upper mandible moveable, furnished with a cere. Nostrils situated in the base of the bill. Tongue fleshy, obtuse, entire. Feet scansorial.

He divided the genus, which is preceded by *Lanius* (the Shrikes), and immediately followed by *Ramphastos* (the Toucans), into the following sections:—

* Macrouri cauda cuneiformi.

This division contained the Maccaws.

** Macrouri minores.

This division contained *Psittacus Alexandri* and the Parrakeets generally; but both in this and the former division we find Parrots that can hardly be called 'long-tailed.' Thus in the first division we have *Psittacus nobilis* with the synonyms of 'Psittacus viridis alarum costa superne rubente of Aldrovandi (vol. i., t. 669), Sloane, Jam., 2, p. 297,' '*Psittacus Amazonicus*, Briss., and *P. mediæ magnitudinis*, Will., t. 16:' whilst in the second we find the *P. agilis*, *P. minor viridis* of Edwards.

*** Brachyuri cauda æquali.

This contained the Cockatoos, Lories, and true Parrots.

Cuvier places the *Psittacidæ* between the Toucans and the Touracos; they consist of the *Aras* (*Ara*, Kuhl); *Perruches* (*Conurus*, Kuhl), divided by Le Valliant into *Perruches-Aras*, which have naked cheeks (*Psittacus Guyanensis*, &c.); Perruches à Queue en Flèche (*Palæornis*); and Perruches à Queue Élargie vers le Bout (*Platycercus*); Cockatoos (*Plyctolophus*); True Parrots; Lories; Short-Tailed Parrots (*Psittacula*, Kuhl); and Parroquets à Trompe, Le Vaill. (*Microglossus*, Vieill.), of which last Cuvier thinks that the Perruches Ingambes (*Pezoporus*, Ill.) may be made a sub-genus.

Mr. Swainson is of opinion that the Parrots constitute the subtypical division of the *Scansores* wherein the powers of climbing are less developed. "If," says Mr. Swainson, "any group in nature be isolated, it is this. Possessing in themselves the strongest characteristics, there is no bird yet discovered which presents any point of connection to them: approximations indeed are certainly made towards them by the tooth-billed Barbuts (Barbets, *Pogonias*); but there is still a gap, which no genus yet discovered is calculated to fill up. On considering the relative difference between the Barbuts and the Parrots, we should say, theoretically, that of all the five groups among the latter, one only remains to give the typical structure." As the Parrots appear to Mr. Swainson to form a group precisely equivalent to the true Woodpeckers, he arranges them under five genera: the Maccaws, the Parrots, the Cockatoos, the Lories, and the Ground Lories (*Platycercus*, Vig.). In the synopsis at the end of the work ('Classification of Birds') we find the following arrangement:—

Psittacidæ.

Bill very short: the upper mandible greatly curved over the lower, which is considerably shorter.

Sub-Family *Macrocercinæ*. Maccaws.

Upper mandible greatly hooked; lower mandible much higher than broad. Tail very long, cuneated.

Genera: *Macrocercus*, Vieill.; *Conurus*, Kuhl; *Leptorhynchus*, Sw.; *Palæornis*, Vig.

Sub-Family *Psittacinæ*. Parrots.

Upper mandible very distinctly toothed; lower mandible longer than it is high. Tail short, even, or rounded.

Genera: *Erythrostomus*, Sw.; *Chrysotis*, Sw. (Amazonian Parrots); *Psittacus* (Parrot of the Old World—most typical of this sub-family); *Agapornis*, Selby; *Poicephalus*, Sw.

Sub-Family *Plyctolophinæ*. Cockatoos.

Head large, ornamented with a folding or procumbent crest. Bill short, very broad; the culmen remarkably curved. Tail rounded, lengthened, broad; the feathers not narrowed.

Genera: *Plyctolophus*, Vieill. (subtypical); *Licmetis*, Wagl.; *Microglossus*, Geoff.; *Centrourus*, Sw.

Sub-Family *Lorianæ*. Lories.

Bill but slightly curved; the margin of the upper mandible sinuated; the notch obsolete; lower mandible slender, conic, much longer than high; the gonys (typically) straight.

Genera: *Brotogeris*, Vig.; *Psittaculus*, Kuhl; *Trichoglossus*, Vig.; *Lorius*, Brisson; *Pyrrhodes*, Sw.

Sub-Family *Platycercinæ*. Loriets.

Tail long, very broad, considerably cuneated. Bill strong, thick, toothed: the culmen very convex. Under mandible deep, but very short: the gonys curved. Feet and toes slender. Tarsus longer than the hallux.

Genera: *Vigorsia*, Sw.; *Platycercus*, Horsf. and Vig.; *Nanodes*, Horsf. and Vig.; *Leptolophus*, Sw.; *Pezoporus*, Ill. (Swainson.)

The family is placed by Mr. Swainson between the *Rhamphastidæ* and the *Picidæ*.

Mr. G. R. Gray ('List of the Genera of Birds') also arranges the *Psittacidæ* between the *Ramphastidæ* and the *Picidæ*.

We proceed to lay before the reader some of the forms here mentioned.

Macrocercus.—The Maccaws are all natives of America, and principally of its southern portion. The Carolina Arara (*Psittacus Carolinensis*, Linn.) has been recorded as occurring in the United States as high as 42° N. lat., though, according to Audubon, few are now to be found higher than Cincinnati; but the true Maccaws are natives of much warmer latitudes. Though the tongue is thick, fleshy, and soft, their powers of imitation fall far short of those of the true Parrots and Parrakeets, and the harsh tones with which, after much teaching, they not very perfectly articulate a few words, contrast strongly with the assumed musical voice and ready docility of the latter. They are however capable of great attachment when domesticated. Their natural notes are screams of the most discordant and piercing kind. The hollows of trees are the places selected for their nests, and the number of eggs laid amounts to two, which are said to undergo the incubation of the male as well as the female.

Blue and Yellow Maccaw (*Macrocercus Ararauna*).

The Great Green Maccaw (*Psittacus militaris*, Auct.), inhabiting the warmer districts of the chain of the Andes, where it is found as high as about 3000 feet, in Mexico and Peru; the Hyacinthine Maccaw (*Macrocercus Hyacinthinus*); the Red and Blue Maccaw (*M. Aracanga*); and the Blue and Yellow Maccaw (*M. Ararauna*), are known to most admirers of this gay race; though the Hyacinthine Maccaw is rarely seen alive in this country, and is not common even in museums.

The genus *Macrocercus* has the following characters:—Size large. Orbits and sometimes the face destitute of feathers. Nostrils concealed. Notch in the upper mandible obsolete; the under remarkably short, but very deep. (Sw.)

M. Ararauna has the bill black, largely and strongly developed. The upper mandible, which not unfrequently measures from the forehead to the tip 3¼ inches, is much deflected: the under mandible is short, deep, and very stout. Cheeks white, naked, with three fine narrow lines of black plumelets under the eyes, the irides of which are yellowish. Beneath the under mandible a broad black band extending upwards to the ears behind a great part of the white naked patch. Plumage rich blue above, blending into green on the forehead, crown, some of the smaller wing-coverts, and rump. Greater quills and tail nearly violet. Wings and tail, beneath, yellow. The rest of the under parts rich saffron. Legs and feet blackish-gray. Total length about 39 inches, of which the tail measures some 24 inches.

It is a native of tropical America, the Brazils, banks of the Marañon, or Amazon River, Guyana, Surinam, &c.

Though generally living in pairs, the Blue and Yellow Maccaws sometimes assemble in large flocks, their favourite haunts being swampy woods where a species of palm on whose fruit they principally feed is abundant. They fly well and often very high, showing a great command of wing, especially before they alight on the top of the lofty trees which they select for their resting-place. The two eggs, which are laid in the hollows of decayed trees, as well as the young, are said to receive the parental care of the male as well as of the female, which have two broods a year generally.

Psittacara. — Between the Maccaws and Parrakeets (*Palæornis*) comes the genus *Psittacara* (Vig.). "These birds," says Mr. Vigors, "although their cheeks are covered with feathers, and they are thus brought within the circle of the Parrakeets, have yet the bill of the Maccaws; and by a greater or less nakedness of the orbits round the eyes they still further assert their affinity to them. From their osculant situation between the two groups, thus strikingly apparent, the species that exhibit these characters have received the familiar name of Parrakeet-Maccaws in our language, and of Perruche-Aras among the French ornithologists. Like the true Maccaws, they are exclusively natives of the New World." ('Zool. Journ., vol. ii.) Mr. Vigors adds in a note, that a species nearly allied to both these groups had then lately been brought to this country.

It has the following characters:—Head feathered, space round the eye naked. Bill thick, rather short; upper mandible compressed at the apex, the lower mandible very short inclining inwards, deeply emarginate. Wings moderate; first and fourth quills equal, third rather longer, second longest; internal web of the first slightly notched near the middle, external webs of the second to the fifth inclusive gradually broader in the middle. Feet rather strong, tarsi short. (Vigors.)

Psittacara leptorhyncha.

P. leptorhyncha. Green; space round the eye white; interocular band and frontal fillet red; tail cinnamon red.

The sub-family *Palæornina*, as it appears in Mr. Vigors and Dr. Horsfield's 'Description of the Australian Birds in the Collection of the Linnæan Society' ('Linn. Trans.,' vol. xv.), consists of the genera *Nanodes*, *Platycercus*, *Pezoporus*, *Palæornis*, and *Trichoglossus*.

Palæornis.—The Parrakeets forming this group belong to continental India and some of the neighbouring islands in the Indian Ocean and Africa, with the exception of *Palæornis Barrabandi* (*Polytelis* of Wagler), which is a native of Australia. India and its islands must however be considered as the principal locality of the species, which, according to Wagler's monograph, amounts to eleven, including *Palæornis inornatus*, which he adds to the group with doubt.

These Ring Parrakeets, as they are generally termed, are justly held in high estimation for the symmetry of their form, the grace and elegance of their movements, the beauty of their colours, their great docility and powers of imitation, and their fond attachment to those with whom they are domesticated and who treat them with kindness. They were not less prized, as we have seen, by the ancients; and it becomes a not uninteresting inquiry to endeavour to ascertain what were the species known to them. Some suppose that *Palæornis Alexandri* was the only one: but though that species may have been and was probably the first introduced into Europe, we think that it will appear that those who confine the Parrakeets known to the ancients to that bird have taken too narrow a view of the subject.

Ring Parrakeet (*Palæornis Alexandri*).

This genus has the following characters:—Bill rather thick; the upper mandible dilated, the culmen round, the lower mandible broad, short, and emarginate. Wings moderate; three last quills (extimis) nearly equal, longest; external webs of the second, third, and fourth gradually broader in the middle. Tail graduated; the two middle very slender feathers much exceeding the rest in length. Feet with short and weak tarsi; the claws moderate, rather slender, and falcate. Body slender and neat. (Vig.)

Mr. Vigors divides the genus into the following sections:—

* Lower mandible short.

P. Alexandri, P. torquatus, P. flavitorquis, P. bitorquatus, P. xanthosomus, P. Malaccensis, P. erythrocephalus, P. Bengalensis, P. Pondicerianus, P. Barrabandi.

** Lower mandible elongated.

P. Papuensis.

Platycercus (Loriets).—Bill rather short, the uppper mandible rounded and dilated, the lower one short, deeply emarginate, with the apex squared. Wings rounded; the first quill shorter than the second and equal to the fifth; second and third longest; the external webs of all except the first abruptly notched towards the middle. Tail broad, depressed, rather rounded or sub-graduated; the tail-feathers rounded at the apex. Feet with elevated tarsi; the toes slender and elongated, and the claws long and but little falcated.

P. scapulatus, Tabuan Parrot, or King's Parrot.

Male.—Green; the head, neck, and body beneath scarlet; nuchal lunula and rump lazuline; longitudinal scapular line pale-green cerulean; tail-feathers black, with brilliant green reflections.

Female.—Head and neck green.

It is a native of Australia.

Tabuan Parrot (*Platycercus scapulatus*).

Mr. Caley seldom noticed a full-coloured specimen, that is, red. He states that, when the Indian corn is ripe, they may be seen in large flocks on the farms, clinging on the stalks and occasioning much mischief to the corn. He apprehends that the greater part of these flocks are young birds, as it is rare to see a bright-red one among them. The natives told him that this species breeds chiefly in a white gum-tree (a species of *Eucalyptus*), making its nest of a little grass, and lining it with feathers. It has, he adds, as many as twelve young ones, and the eggs are of a dirty-white with black specks; the nest is found by its enlarging the hole at which it creeps in; this process gives the surrounding part a reddish appearance, which forming a contrast with the whiteness of the other parts, renders it conspicuous.

Nymphicus.—Bill distinctly toothed; culmen slightly carinated; nostrils thick, tumid, naked; head crested. Wings very long; outer web of the quills not sinuated. Tail very broad, cuneated; the two middle tail-feathers conspicuously longest and pointed. (Sw.)

N. Novæ Hollandiæ. Male.—Forehead, crest, and cheeks lemon-yellow; ear-coverts rich reddish-orange; back of the neck, two centre tail-feathers, and the external margins of the primaries brownish-gray; back, shoulders, and all the under surface and outer tail-feathers grayish chocolate-brown, the shoulders and flanks being the darkest; a white mark extends from the shoulders lengthwise down the centre of the wing; bill and bare space round the eye brownish-gray; feet blackish-brown.

The Female differs from the male in the colour of the face and crest being of a dull olive-yellow, the latter becoming still darker at its extremity; the throat grayish-brown and the back lighter than in the male; the lower part of the abdomen, upper tail-coverts, and tail-feathers, yellow, except the four middle ones, which are gray; the whole transversely and irregularly barred with lines of brown. Total length 12 inches.

Mr. Gould, whose accurate description we have given from his grand work on the 'Birds of Australia,' states that this species has many of the actions of the *Platycerci*, being extremely active, and running round its cage with surprising agility, in which particular it is only equalled by the most terrestrial members of the family. To give some idea of the immense flocks of this beautiful bird, which inhabit the interior of Australia, the same author informs us that his brother-in-law, Stephen Coxen, Esq., procured more than 200 examples during a single excursion into the interior.

Nymphicus Novæ Hollandiæ.

Euphemia, Wagl. (*Nanodes*, Vig.).—Bill short; the culmen rounded, higher than it is long, being very like that of *Macrocercus*, the lower mandible very short, inclining inwards, and emarginate. Wings moderate, sub-acuminate; first and second quills, which are nearly equal, longest; the external webs of the second and third slightly emarginate towards the apex. Feet moderate; tarsi and toes rather slender. Tail gradually cuneated; tail-feathers slender towards the apex. (Vigors.)

E. undulata. Male.—Crown of the head and throat pale yellow, the latter ornamented on each side with several rich blue spots, a row of which, but of a darker tint, crosses the throat in the form of a crescent; sides and back of the head, back of the neck, upper part of the back, scapulars, and wing-coverts olive-brown, each feather having a crescent-shaped mark of black near its extremity, and margined with yellow; primaries green on their outer edges, the tip and internal

Euphemia undulata.

web brown; secondaries crossed by a broad band of yellow, which is continued, but much narrower, across some of the primaries; breast, all the under surface, lower part of the back, and the tail-coverts, fine pale green; two centre tail-feathers deep blue at the base, passing into deep green at the tip; the remainder of the tail-feathers bright yellow, tipped with dark green; bill horn-colour at the base, passing into pale yellow at the tip; feet flesh-colour.

The Female differs in being less brilliant in all her markings, and in having the blue spots on the throat less defined and irregular in form. Total length 7½ inches. (Gould, 'Birds of Australia.')

It is found in the interior of New South Wales.

Captain Sturt discovered this species in great abundance in the interior of New South Wales. He informed Mr. Gould that on the extensive plains bordering the Morumbidgee he met with it in immense flocks, feeding upon the seeds and berries of the low stunted bushes called scrubs. Mr. Gould also received several from Mr. Coxen, which the latter had procured to the north of Hunter's River. Mr. Gould adds that they are quick and active, and run on the ground with great facility, much after the manner of the true *Platycerci*, or Ground Parrakeets, to which he is of opinion they are closely allied.

Trichoglossus (Lorikeets).—Bill somewhat elongated, rather compressed; lower mandible nearly straight, the margin entire, longer than it is high; tongue furnished below with many marginal bristles at the apex. Wings moderate; first quill longest, second and third a little shorter; webs entire. Feet rather short; tarsi somewhat covered with the femoral feathers; acrotarsi a little feathered below the knee; toes rather strong, depressed; claws strong, falcate. Tail graduated; the tail-feathers rather narrower at the apex. (Vigors.)

It is a native of Australia.

The natural and acquired habits of the species of this genus require some notice. Mr. Caley informs us that the Blue-Mountain Parrot, War'rin of the natives (*T. hæmatodus*), is remarkable for its docility

Blue-Mountain Parrot (*Trichoglossus hæmatodus*).

and attachment to some people, whilst it is a perfect scold to others who may have teased or offended it. "Flocks of these birds," says this accurate observer, "may be seen in the *Eucalypti* trees when in flower, in different parts of the country, but in the greatest number near their breeding-places. It does not eat any kind of grain, even when in a domesticated state. It is much subject to fits, which generally prove fatal; and it is rare to find an individual kept alive above a couple of years. One that I kept, on being shown a figure of a coloured plant, used to put its tongue to the flowers, as if with the intent of sucking them; and I have seen it make the same attempt with a piece of cotton furniture. The flesh of this bird is very good eating." Again, speaking of the Crimson-Fronted Parrakeet, Coolich of the natives (*T. concinnus*), Mr. Caley states that it may be observed in large flocks sucking the *Eucalypti* flowers. He adds that, like the Blue-Mountain Parrot, it is subject to fits, which generally prove fatal, that it is seldom kept alive, and that its breath, or some part about its head, emits a very sweet odour. The natives told him that this species breeds in the hollow boughs of trees, scraping out the decayed mould, and making its nest of it. The eggs, he informs us, are green,

without spots, and the number of young two. Of the Small Parrakeet, Jerryang of the natives (*T. pusillus*), he observes that this, like the Coolich, is seen in very large flocks in the *Eucalypti* trees when in blossom. "The natives," says he, "now and then bring in the young ones, but they seldom live long. I had three young ones for some time, which used to huddle together, and give out a very pleasing note. They all died, strongly convulsed, and nearly at the same time; the limbs were as stiff the moment life was extinct as if the body had become cold. The natives tell me that it builds in the hollow limbs of trees, making no other nest than of the decayed wood. It has four young ones. The eggs are white, and without spot."

Mr. Caley also learned from the natives that the nest of this species, of the Ground Parrot (*Nymphicus pulchellus*), of the Dulang (*Platycercus Pennantii*), and of the Coolich (*T. concinnus*), smell very strong and offensive of dung.

T. hæmatodus, Vig. (*T. Swainsonii*, Jardine and Selby). Green; head, middle of the body, and bands on the sides, azure-blue; throat, breast, and flanks, orange-crimson. (Sw.)

Lorius.—The true Lories are remarkable for the elongated and weak form of the bill, and also for a formation of the tongue, similar to that in *Trichoglossus*. [See, col. 476.] They are inhabitants of the islands of the east, and are considered by Mr. Vigors to be the aberrant group of the family. Their colours are of the most rich and mellow description, and the birds are highly prized, not only for their beautiful plumage, but for their lively, active, and affectionate disposition, and their great docility in the articulation of words and even sentences. The genus has the following characters:—Bill elongated, weak. Wings pointed, two first quills longest. Tail moderate, rounded or graduated; the feathers broad, and hardly narrow at their tips.

L. Domicella. Rich scarlet; upon the upper part of the breast a yellow collar; crown of the head blackish-purple in front, passing into violet-purple behind; upper surface of the wings green, violet-blue at the bend and margins, as are the under wing-coverts; thighs externally azure, greenish at the base; bill orange-yellow. Length between 11 and 12 inches.

It is a native of the Moluccas and other Eastern islands.

Lorius Domicella.

The *Plyctolophinæ*, or Cockatoos, are natives of Australia and the Indian Islands, inhabiting the woods, and feeding upon seeds and soft and stony fruits, which last their powerful bill enables them to break with ease. Like others of their congeners, they make their nests in decayed trees, and are easily tamed when taken at an early age. They become familiar and even attached, but their imitative powers seldom go beyond a very few words, added to their own cry of 'Cockatoo.'

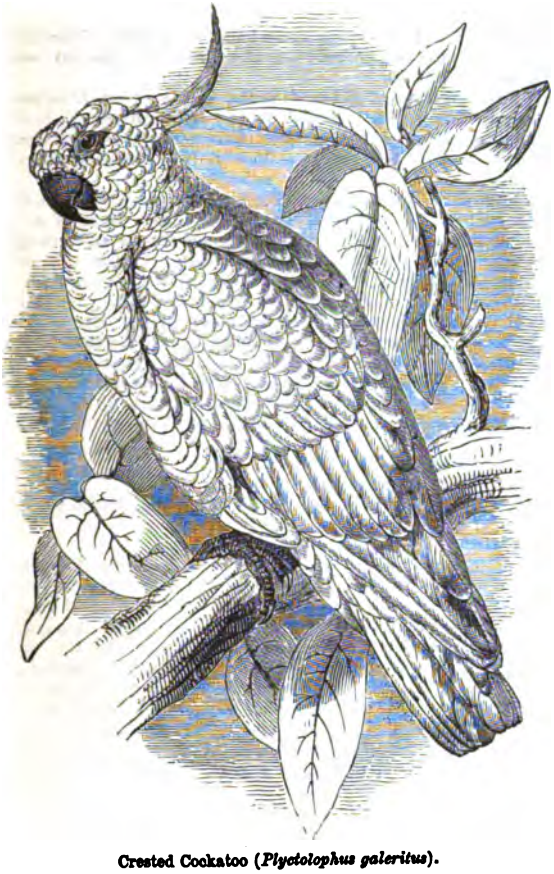
Plyctolophus, (True Cockatoos).—Bill strong, short, very broad; culmen much curved; head with a folding crest; base of the under mandible frequently concealed by feathers. Wings long; secondaries, tertiaries, and the tail-feathers sometimes mucronate.

P. galeritus, Crested Cockatoo (White). White; crest, and internal webs of the lateral tail-feathers, yellow; under wing-coverts sulphureous.

It is found in Australia.

Mr. Caley's notes contain the following observations on the Crested Cockatoo:—"This bird is called by the natives Car'away, and also Curriang. I have met with it in large flocks at the conflux of the Grose and Hawkesbury rivers, below Mulgo'ey on the former river,

and in the long meadow near the Nepean River. They are shy, and not easily approached. The flesh of the young ones is accounted good eating. I have heard from the natives that it makes its nest in the rotten limbs of trees, of nothing more than the vegetable mould formed by the decayed parts of the bough; that it has no more than two young ones at a time, and that the eggs are white without spots. The natives first find where the nests are by the bird making 'Co'tora'



Crested Cockatoo (*Plyctolophus galeritus*).

in an adjoining tree, which lies in conspicuous heaps on the ground. Co'tora is the bark stripped off the smaller branches, and cut into small pieces. When the young are nearly fledged, the old bird cuts a quantity of small branches from the adjoining trees, but never from that in which the nest is situated. They are sometimes found to enter the hollow limb as far as two yards. The nests are generally formed in a Black-Butted Gum-Tree; and also in Coroy'bo, Cajim'bbora, and Yarrowar'ry tree (species of *Eucalyptus*). Their breeding-places appear to be local."

Mr. Vigors divides the genus into the following sections:—

* Cristâ plicatili, acuminata, antrorsum tortâ.

Of this division he gives *Plyctolophus galeritus* above described as the example.

** Cristâ rotundatâ, retrorsum incumbente.

Of this section he gives *Plyctolophus Eos*, *Psittacus Eos* (Kuhl), the Rosalbin Cockatoo, as the example.

P. Leadbeateri, Vig., *Cacatua Leadbeateri*, Wagl., the Tricolour-Crested Cockatoo, also a native of Australia, is the most splendid species yet discovered. Nothing appears to be known of its habits.

In the same family of *Plyctolophinæ* Mr. Vigors places his genus *Calyptorhynchus*, the chief difference between which and *Plyctolophus* consists in the greater elevation and comparative shortness of the bill.

C. funereus, the Funereal Cockatoo. Mr. Caley says, "Its native name is Wy'la, so called from the similitude of that word to the sound which it makes. I have never seen them together in any numbers, not more perhaps than half-a-dozen at a time; but I have met with them in many different places. Sometimes they come within half a mile of the centre of Paramatta, where I have shot them in the trees. The natives told me it made its nest in Yar'ro-Trees (a species of *Eucalyptus*), using only the vegetable mould. It makes no Co'tora, but cuts off the small branches of apple-trees (a species of *Angophora*). It has two young ones."

Psittacus (True Parrots).—Mr. Vigors is of opinion that the group of the *Psittacidæ*, to which the name of *Psittacus* should be applied, may perhaps be considered to be that which comprises the *P. Amazonicus* of Brisson and some allied species. That at least, he observes, is the group best known under the old scientific term, and at the same time under the familiar names of Parrot in our language, and Perroquet in the French, which correspond with it.

These True Parrots are for the most part inhabitants of Tropical America, and their prevailing colour is green. The ash-coloured or Gray Parrot, *Psittacus erythacus*, Linn., is a native of Africa. This group excels all others in docility and power of imitation.

Mr. Swainson divides the True Parrots into two genera, namely:—

1. *Chrysotis* (Amazonian Parrots), which he thus characterises:—Face plumed. Wings rather short; the first and second quills graduated, and shorter than the third and fourth, which are the longest; all these have the inner web sinuated in the middle; tertials very long. Tail short, longer than the wings, broad, with the tips rounded.

The species of these Green Parrots are numerous. Among them the Festive Parrot (*P. festivus* of authors) and the Amazon's Parrot (*P. Amazonicus* of authors) are perhaps the best known; the latter particularly, which is often brought to Europe on account of its superior mimic propensities. The former, which exceeds the Amazon's Parrot in size, inhabits Guyana and the Brazils, the banks of the Marañon, or river Amazon, particularly, living in the forests upon seeds and kernels of fruits. It articulates, with great clearness and precision, words, and even sentences. The smaller Amazon's Parrot is common in Guyana and Brazil, and more especially near the banks of the river from which it takes its name. Fruits form its food, particularly those of the Rhizophora Mangle, or Mangrove-Tree, and in its decayed trunks the bird deposits its eggs. It is considered very destructive to orange plantations. In captivity it may be taught to repeat many words and short sentences, which it learns with great facility.

Sloane, in his account of the Common Parrot of Jamaica, says that it is less than those of the mainland, and has a reddish-coloured neck, being everywhere else of a green colour; that it has a short broad tail; speaks very articulately; and that it is eaten baked in pies, tasting like pigeons.

2. *Psittacus*.—Wings lengthened, nearly as long as the tail. Face naked. Tail even; the feathers rounded. It inhabits the Old World.

P. erythacus, the Common Gray Parrot, is generally considered to be superior to all others in docility and mimicry: its imitation of the human voice, when well taught, is complete, and its articulation most clear. Very high prices have been given for clever and well-taught birds. The parrot for which the Roman cardinal gave a hundred gold pieces had, it is said, learned to repeat with clearness, and without hesitation, the whole of the Apostles' Creed, a wonderful instance of memory and imitation. This species is very long-lived. Le Vaillant mentions one that he saw which had been domesticated 93 years: it was indeed then in a state of decrepitude, and both sight and memory were gone.

Wagler's genera, *Electus*, *Pionus*, and *Psittacodis*, vary in some points from *Psittacus*; the former, *Electus grandis* (Moluccas and New Guinea), approaches the Lories.

The Australian genus *Nestor*, of the same author, is pointed out as forming a connecting link between the Parrots and the Cockatoos, and is thus characterised:—Bill elongated; upper mandible compressed, hooked; the tomia sinuated, but not distinctly toothed; the tip projecting, with its under surface sulcated and deeply excavated for the reception of the tip of the under mandible; under mandible narrow, compressed, slightly convex, or forming, when closed, an obtuse angle with the upper; wings rather long, ample; tail of moderate length, and even at the end; tips of the shafts bare, and slightly projecting beyond the feathered parts.

N. productus, Long-Billed Parrot (Gould). General colour of the upper surface brown; beak elongated; head and back of the neck tinged with gray; the feathers of these parts, as well as of the back, margined with a deeper tint; rump, belly, and under tail-coverts, deep red; cheeks, throat, and chest, yellow, the former tinged with red; shoulders, on their inner surface, yellow, tinged with rufous-olive; tail-feathers banded at the base with orange-yellow and brown, the inner webs of the quill-feathers at the base and beneath with dusky-red and brown; bill brown; feet blackish-brown. Total length 15 inches. (Gould, 'Birds of Australia.')

This species inhabits Norfolk Island and the most eastern portions of New South Wales.

"Like all the other members of this extensive family," says Mr. Gould, "it bears captivity remarkably well, readily becoming cheerful and contented; at least such is the case with an individual in the possession of Sir J. P. Millbank, Bart.; and, as might have been reasonably expected, the variation in the form of the mandibles, which renders these birds so conspicuous, is accompanied by a marked difference in the nature of their food, the powerful bills of the other members of the family enabling them to feed upon hard seeds and stony fruits, while, from the elongated form of this organ in the present birds, this power is denied to them, and we find that they give a decided preference to the leaves of succulent plants and the softer kinds of fruit. Sir J. P. Millbank informed me that the bird in his possession evinced a strong partiality to the leaves of the common lettuce and other soft vegetables, and that it was also very fond of the juice of fruits, of cream, and butter. Its voice was hoarse and

inharmonious, frequently resembling the barking of a dog; and in Yates's 'New Zealand' we are informed that the *Nestor hypopolius*, known there by the name of Kaka, is 'capable of learning to imitate the human voice to a remarkable degree. . . The cry of this bird, when ranging at large in the woods, is harsh and disagreeable in the extreme.' Although I cannot assert it for a certainty, I have every reason to believe that both these birds frequently descend to the ground and grub up with their lengthened bills the bulbous and other roots which form a portion of their food, particularly as I have found earth still adhering to the mandibles of the specimens I have examined; besides which, I have been informed by Captain Sturt that a parrot inhabiting Australia, having a similar bill, but belonging to another group, is frequently in the habit of so doing."

Long-Billed Parrot (*Nestor productus*).

The genera *Psittacula* and *Agapornis* appear to be the most diminutive of this extensive and interesting tribe. The latter, a ready example of which occurs in the Love-Birds, so extensively petted, and remarkable for their sexual attachment, was separated from *Psittacula* by Sir W. Jardine and Mr. Selby.

The following cut will give some idea of the form of *Psittacula* (*Poicephalus* of Swainson).

Love Bird (*Psittacula Taranta*).

The student should carefully consult the monograph of Kuhl, and that of Wagler; and of illustrated works should direct his attention more particularly to Le Vaillant's 'Perroquets,' with figures after the celebrated Barraband; Lear's 'Parrots;' Swainson's 'Zoological Illustrations,' 1st and 2nd series; and Selby's 'Parrots,' containing many beautful figures after Lear, though on a small scale, and forming the 6th volume of the 'Ornithology' of the 'Naturalists' Library.'

Those who keep birds belonging to this group would do well to study their natural habits, if they wish to keep them in health. Some, as we have seen, live upon the nectar of flowers, others on soft fruits, and others again on hard fruits, for breaking which they are gifted with a powerful vice of a bill. We have known a case where the upper mandible of the bill of a parrot of this last description, which had been kept upon soft food, grew to such a length as to begin to penetrate its throat. To such a moderate proportion of hard food, such as almonds, and even harder food, should be presented. Some of the tribe have bred in captivity; and there is little doubt that if pairs were kept in good roomy cages, with a part of them so fitted up as to remind them of their favourite hollow trees, and furnished with dry rotten wood or vegetable earth, the instances would be comparatively frequent.

PSITTIROSTRA, M. Temminck's name for a genus of Granivorous Birds, which he places between the Crossbills (*Loxia*) and the Bullfinches (*Pyrrhula*).

PSOLIDÆ, a tribe of *Echinodermata*, in the order *Holothuriadæ*. The only British genus, included by the late Professor E. Forbes in this tribe, is *Psolus*, which is thus characterised:—Body irregular, ascidiform; suckers in five rows, three only of which are developed and placed on a soft foot or disc; tentacula ten.

P. phantapus (*Holothuria phantapus*, Linnæus), the Snail Sea-Cucumber, is an inhabitant of the British Seas. It is of a brown colour, has the head reddish-white with orange spots and orange tentacula, the body covered with pectinated scales, or rugæ. It adheres to substances with great firmness by means of its ventral disc. "So powerfully does it adhere," says Professor E. Forbes, "that I have known the head of the animal carried away by the dredge when it brought up entire every other fixed animal which it came in contact with." It is found in European seas, and the genus ranges to the Indian seas. Professor Forbes says, "The *Psolus ternaria* of Jäger and Lesson, should form the type of another genus, distinguished by its twenty tentacula. The genus *Cuvieria* of Peron should be united with *Psolus*."

(Forbes, *History of British Star-Fishes.*)

PSOLINUS. [PENTACTÆ.]

PSOPHIA, a genus of Birds. The *P. crepitans*, is called the Agami. [AGAMI.]

PSOPHOCARPUS. [DOLICHOS.]

PSORA'LEA (so called from the Greek ψωραλέος, 'warted,' on account of most of the species being covered with little tubercles), a genus of Papilionaceous Plants belonging to the natural family of *Leguminosæ*, characterised by the tube of the permanent calyx being sprinkled with callous points. Sepals 5, united to the middle; stamens 10, usually diadelphous. Legume indehiscent, 1-seeded, sometimes ending in a beak. Leaves of various forms. Flowers blue, white, or purple. The species, about 60 in number, and natives of different parts of the world, are either herbaceous plants or low shrubs, some of them ornamental, and all of them easy of culture. They may be propagated either by cuttings or seeds, which they produce abundantly.

P. esculenta, the Bread-Root of North America, is cultivated along the banks of the Missouri and in other parts of that country. The roots, which abound in farinaceous matter, are, like the tubers of the potato, employed as food, especially during the winter months. In this climate it will grow in the open air, but requires the protection of a frame to produce abundant crops of roots. *P. corylifolia* is diffused over every part of India, especially in the vicinity of villages, during the rainy and cold seasons. It is employed as a stomachic and deobstruent. Other species are also used medicinally. *P. glandulosa* is called in Chili, Coulen, Culen, or Cullen. Some of the native tribes make a very intoxicating kind of beer from a variety called Yellow Cullen.

PSYCHOMYIA. [NEUROPTERA.]

PSYCHO'TRIA, a genus of Plants belonging to the natural order *Cinchonaceæ*. It is characterised by having a calyx 5-parted, somewhat entire; corolla regular, funnel-shaped, 5 (rarely 4) cleft; stamens 5, rarely 4, exserted or included within the throat of the corolla. Stigma bifid. Berry drupaceous, crowned with the limb of the calyx, usually marked with 10 ribs, and containing two nuts. Nuts ribbed; single seeded. Trees or shrubs; rarely herbaceous plants. Some of the species are ornamental in foliage, and one, *P. parasitica*, as its name indicates, is found growing on trees in the West India Islands.

Several of the species are supposed to possess considerable medicinal properties. *P. emetica* is a small under-shrub, a native of New Granada on the banks of the Magdalena, and probably of other parts of South America; the *Cephælis emetica* of some other authors. The stem is erect, simple, hairy, and tomentose; leaves oblong-acuminate, narrow at the base, membranous, ciliate, rather hairy on the under surface; stipules very short, ovate-acuminate; peduncles few-flowered, axillary, sub-racemose. This species has long been celebrated as yielding the black or Peruvian or striated ipecacuanha, which, analysed by Pelletier gave of emetine 6, fatty matter 2, and of starch and ligneous matter (the latter bearing but a small proportion) 92. *P. herbacea* is an Indian species used for the same purposes. The roots of *P. sulphurea* and of *P tinctoria* are employed in dyeing.

PSYLLA (Geoffroy), a genus of Insects belonging to the family *Aphidæ*, which, according to Latreille, forms the second family of the Homopterous *Hemiptera*.

The *Psyllæ* are minute insects, allied to those commonly called Plant-Lice, and live upon trees and plants, from which they derive

their nutriment by suction, and in so doing they often produce excrescences somewhat resembling gall-nuts, particularly on their leaves and buds. They have two joints to the tarsi; the antennæ are composed of ten or eleven joints, the last of which have two bristles; both sexes have wings, and they possess the faculty of leaping. Their larvæ usually have a very flat body, broad head, and the abdomen rounded behind; the legs are terminated by a little membranous vesicle accompanied beneath with two hooks. Four wide and flat pieces, which are the sheaths of the wings, distinguish the pupa state; several of the species in this stage, as well as in the larva state, are covered with a white substance resembling cotton. The species are very numerous, and are often named after the plants which they infest. Mr. Stephens records 26 species as natives of this country.

PSYLLASTOMATINA. [CHEIROPTERA.]

PSY'LLIUM, a name of a Plant which occurs in Dioscorides, &c., supposed to be so named from Psyllus (Ψύλλος).

PSY'THIRUS. [PSITHYRUS.]

PTA'RMICA, a genus of Plants belonging to the natural order *Asteraceæ*. It has a campanulate involucre with the scales brown and scarious at the edge. The receptacle is flat or scarcely convex, broad, and paleaceous. The ligulæ from 5 to 20, flat, expanded, much longer than the involucre. The achænia are bald, obcompressed, the outer often somewhat winged at the edge.

P. vulgaris has a widely creeping root, very difficult to extirpate when the soil is moist. Upright stems about two feet high, angular, smooth, hollow, leafy, with small axillary rudiments of branches corymbose at the top. The leaves are sessile, linear, or slightly lanceolate acute, very minutely serrated with bristly teeth; smooth on both sides, and of a dark green. The flowers are milk-white, larger than most others of the same genus. The whole plant is pungent, and provokes a flow of saliva. Its dried leaves produce sneezing, but this is thought to be owing to their little sharp marginal teeth: the root is aromatic. The heads of *P. nana*, *P. atrata*, and *P. moschata* are used in the Swiss Alps as a substitute for tea. *P. moschata* is the basis of the aromatic liqueur called Esprit d'Iva.

(Lindley, *Vegetable Kingdom*; Lindley, *Flora Medica*.)

PTARMIGAN. [TETRAONIDÆ.]

PTERACLIS. [CORYPHÆNA.]

PTERI'CHTHYS, a singular genus of Fossil Ganoid Fishes, from the Old Red-Sandstone of Scotland and Orkney. (Agassiz.) [FISH.]

PTERI'NEA, a fossil genus of *Conchifera*, allied to *Avicula*, and hitherto confined to the Palæozoic, and chiefly found in the Devonian Strata. (Goldfuss.)

PTERIS (from πτέρον, a wing), a genus of Plants belonging to the natural order *Filices*. The thecæ arise from the points of veins placed on a nerve-like receptacle running along the edge of the leaf, forming an uninterrupted marginal sorus; the involucres are continuous with the edge of the leaf, scarious, and opening inwards.

P. aquilina, Common Fern, Bracken, or Brakes, is the most abundant of our British species. It has a long tapering rhizoma, creeping, externally black. The leaves are erect, from one to six feet high, repeatedly compound with horizontally spreading divisions, whose ribs are smooth; the primary leaves are nearly opposite, the lower ones more alternate, pinnatifid segments oblong, obtuse. They are all of a light bright green colour, slightly brown at the edge, which is revolute and crisped, or wavy, sheltering the dense linear masses of tawny thecæ. The main stalks are angular and sharp-edged, wounding the hands severely if plucked incautiously. When cut across, the rhizoma has a branched appearance resembling a spread eagle, whence the Latin name. There is scarcely any wood, heath, or forest in the United Kingdom where this plant does not make its appearance. It is said to be indicative of poor soil, but it is more probable that its absence from cultivated ground is to be attributed to the effects of the hoe and the plough, rather than to the quality of the soil. The geographical range of this species is very extensive; it is included in every European list, and is found also in Asia and Africa. It is used in many parts of England and Scotland for manure, and in the Western Isles the poor people gain considerable profit by collecting the leaves, and selling the ashes to soap and glass makers, on account of the large quantities of alkali contained in them. As a litter for horses, brakes or fern is in great request in Wales, Scotland, and Ireland, and when chopped up with hay they are sometimes fed upon it. In Inverness-shire the poorer classes thatch the tops of their houses with the leaves, and they form a very durable covering. Pigs are fed upon the roots boiled down into a mucilaginous mass. This species is the *Filix fœmina* of our older authors. It is likewise the Θηλυπτέρις of Theophrastus, 'Hist. Pl.' 9. 18, and of Dioscorides, 4. 184. The ancients are said to have used both the rhizomas and fronds of this fern in decoctions and diet-drinks, in chronic disorders of all kinds arising from obstruction of the viscera and spleen. Some modern authors give it a high character for the same purposes, but it is now seldom used by medical practitioners. In Haller's time its reputation was very extensive as a destroyer of worms, and a bed of the green fronds was esteemed a sovereign remedy for rickets in children. The rhizoma is so astringent that in some places it is used for tanning and dressing red and chamois leather. It has been employed as a substitute for hops, and in the Canaries a miserable sort of bread is made by grinding the root with barley.

(Newman, *British Ferns*; Babington, *Manual of British Botany*; Lindley, *Flora Medica*.)

PTEROCARPUS (from πτέρον, a wing, and κάρπος, a fruit, in reference to the pods being girded with a broad wing), a genus of Plants belonging to the natural order *Leguminosæ*. It has a 5-cleft calyx, a corolla with 5 petals, disposed into a papilionaceous form; 10 monadelphous or diadelphous stamens, an irregular indehiscent legume, somewhat orbicular, surrounded by a wing, woody, and often rugose, in the middle 1-3-celled. The leaves are unequally pinnated. The racemes axillary, or forming terminal panicles. The species are unarmed trees or shrubs.

P. Draco, Dragon's-Blood Pterocarpus, is a tree nearly 30 feet high, with alternate shining leaflets, about 5 on each side, and an odd one, rather obtuse, entire, veined, smooth, pale green below; the legumes nearly smooth. The wood of this tree is white and heavy, the bark thick and of a rusty gray colour. When first cut it presents no marks of redness, but in a little time red drops of juice begin to collect and exude from the wood. If left in the sun for about ten minutes they become hard and clear, and are collected under the name of *Sanguis Draconis*, or Dragon's-Blood. This resin formerly constituted an extensive article of commerce from Carthagena, but from its diminished consumption its collection has ceased, and all the dragon's-blood obtained now in the market is the produce of *Calamus Draco*.

P. Marsupium is a tree with a very high trunk, scarcely ever found straight. The bark has a brown outer coat which is thin and spongy, and falls off in flakes, disclosing the inner bark, which is fibrous, red, and astringent. The branches are numerous, horizontal, and spreading. The leaves sub-bifarious, alternate, pinnate, with an odd one, 8 or 9 inches long. The panicles are terminal and very large, ramifications bifarious. The flowers are very numerous, white, and with a small spot of yellow in the centre. The bracts small, caducous, solitary below each division and sub-division of the panicle. The seed is solitary and kidney-shaped. This tree is thought by Roxburgh to be the one yielding Gum Kino, a well known astringent,—the juice hardening into a dark red and very brittle gum-resin, which, on being powdered, changes to a light brown, not unlike Peruvian bark. Its taste is strong, but simply astringent. The real kino-tree however appears to be the next species.

P. dalbergioides is a native of the Andaman Islands, where it grows to an immense size, and forms a valuable timber-tree, of which the wood is known as Andaman red wood, from its resemblance to mahogany; but it is redder, heavier, and coarser grained, though that of the root is finer than that of the stem. It was introduced by Col. Kyd into the Calcutta botanic garden in 1794, whence it has been spread into the country.

P. erinaceus is a tree 40 or 50 feet in height. It has unequally pinnate leaves, smooth above, downy beneath; from 11 to 15 leaflets, alternate, distant, on short stalks, ovate, oblong, obtuse, or emarginate, wiry at the edge; lanceolate stipules, solitary or clustered racemes, downy from the old wood below, the young branches much shorter than the leaves. The flowers are yellow, the legumes stipulate, compressed, membranous, velvety, serrated, and undulated, prickly on the centre. When the branches are wounded, a clear bright gum exudes from them, which is the gum kino of commerce, and is mentioned as such by Mr. Mungo Park. It is a very powerful remedy in obstinate chronic diarrhœas and dysenteries, and in all diseases arising from laxity of tissue. Externally it is applied as a styptic to check hæmorrhages from wounds and ulcers, and to diminish discharges.

P. santalinus is a lofty tree having alternate stalked ternate leaves, petiolate alternate leaflets, smooth above, hoary beneath. The racemes are axillary, simple, or branched, and erect. The legume roundish, stalked, falcate upwards, compressed, smooth, keeled on the lower edge, the keel being membranous and undulated. From this tree is obtained the Red Sandal-Wood, a timber chiefly used by dyers and colour manufacturers of the present day, but which is also used to colour several officinal preparations, such as compound tincture of lavender. Its colouring matter forms beautiful coloured precipitates with many metallic solutions.

P. flavus is the Yellow Sandal-Tree, and is used for dyeing yellow. Its bark is very bitter.

(Lindley, *Flora Medica*; Burnett, *Outlines of Botany*.)

PTERO'CERAS. [STROMBIDÆ.]

PTE'ROCLES. [TETRAONIDÆ.]

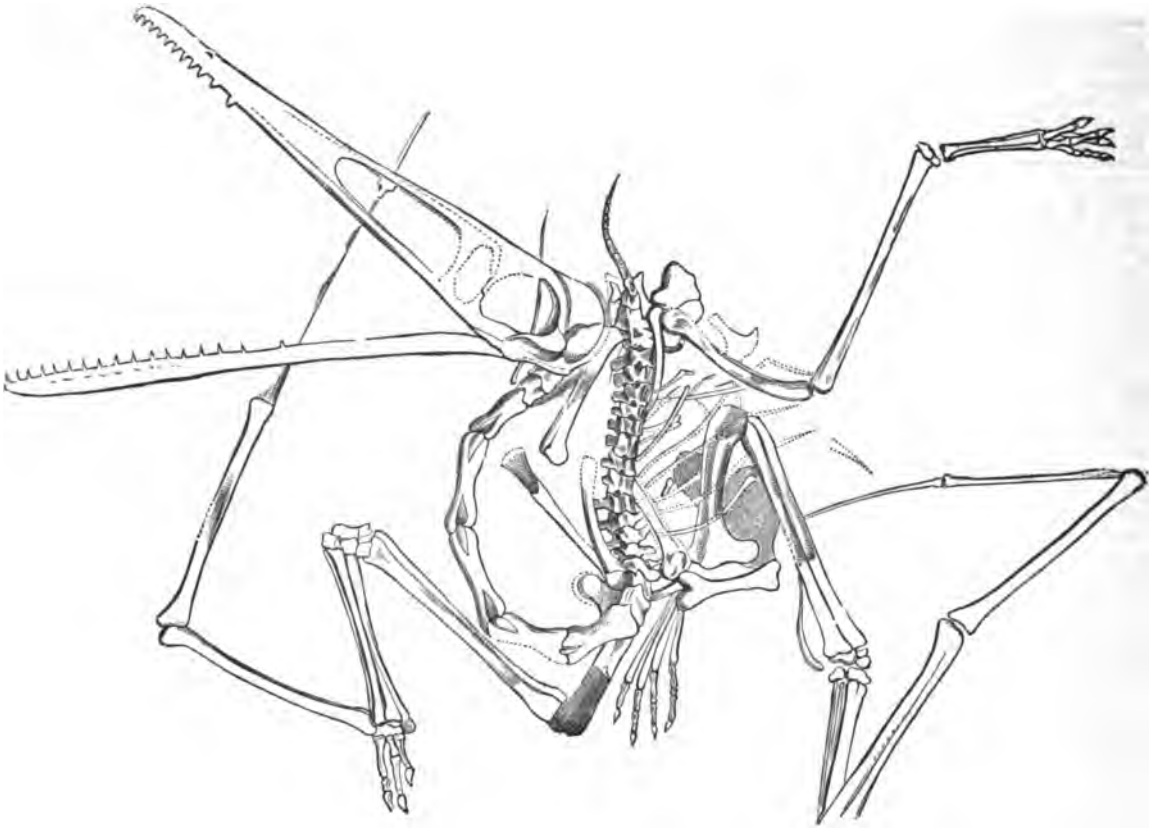
PTEROCYANEA. [DUCKS.]

PTERODACTYLE (*Pterodactylus* of Cuvier; *Ornithocephalus* of Sömmering), a genus of fossil Saurians, whose type is entirely extinct. To Collini, the director of the elector-palatine at Mannheim, we are indebted for the first introduction of this Heteroclite. He described the skeleton of the long-billed species from a specimen, found at Aichstädt near Solenhofen, in that museum, and figured it in the 'Memoirs of the Palatine Academy' (Part. Phys., v. 58, et seq.).

Collini had well made out the head, the neck, the retrograde direction of the trunk, the small tail, the left leg, and the two arms; but beyond this he seems to have been at a loss. He came to the conclusion that the animal was neither a bird nor a bat; inquired whether it might not be some amphibian; and finished by expressing his opinion that the type must be sought among the marine *Vertebrata*.

Blumenbach took a widely different view of the subject, and referred this extraordinary form to the Palmipede or Web-Footed Birds.

Professor Hermann of Strasburg, who drew upon his imagination for a restoration of the animal, and clothed it in a hairy skin, considered it to be a Mammal, and assigned to it a situation between the mammiferous class and birds, still more intermediate than that occupied by the bats.



Pterodactylus longirostris.

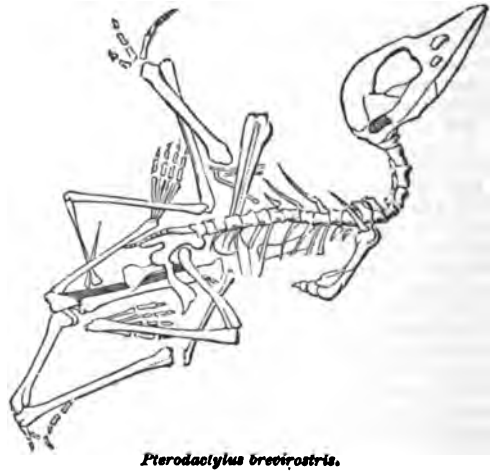
Sömmering also arranged the form among the mammals, in the neighbourhood of the bats, not without an elaborate detail of the reasons which had conducted him to that conclusion.

It was reserved for the penetrating eye and acute but patient investigation of Cuvier effectually to destroy these theories, supported though they were by weighty authorities: the satisfactory reasoning by which he disposes of them one after the other, and proves conclusively from the organisation of the animal that it was a Saurian (in which opinion he was supported by Oken), will be found at large in the fifth volume of the last edition of his 'Ossemens Fossiles.' Our limits will not permit us to detail the links of the harmonious chain of his proofs; and we must here content ourselves with observing that the form of the os quadratum appears to have been the principal key by which the great French naturalist solved this intricate zoological puzzle, and detected its Saurian character. "Behold," says he, after having built, as it were, the animal before our eyes, "an animal which, in its osteology, from its teeth to the end of its claws, offers all the characters of the Saurians; nor can we doubt that those characters existed in its integuments and soft parts—in its scales, its circulation, its generative organs. But it was at the same time an animal provided with the means of flight—which, when stationary, could not have made much use of its anterior extremities, even if it did not keep them always folded as birds keep their wings, which nevertheless might use its small anterior fingers to suspend itself from the branches of trees, but when at rest must have been ordinarily on its hind feet, like the birds again; and, also like them, must have carried its neck suberect and curved backwards, so that its enormous head should not interrupt its equilibrium."

Well may Cuvier remark, that of all the beings whose ancient existence is revealed to us in his great work above alluded to, these Pterodactyles are the most extraordinary; and that if we could see them alive, they would be the most at variance with living forms. Their flight was not performed by means of ribs as in the dragons [Draconina]; nor by means of a wing without distinct fingers, like that of a bird; nor by a wing leaving the thumb alone at liberty, as in the bats; but by a wing sustained principally on one very elongated finger, whilst the rest preserved their ordinary brevity and their claws. At the same time these flying reptiles—a denomination almost contradictory—have a long neck, the bill of a bird, everything in short that could conduce to give them a strange aspect. ('Oss. Foss.')

About 20 species of the genus *Pterodactylus* have been described. The following are some of those best known:—

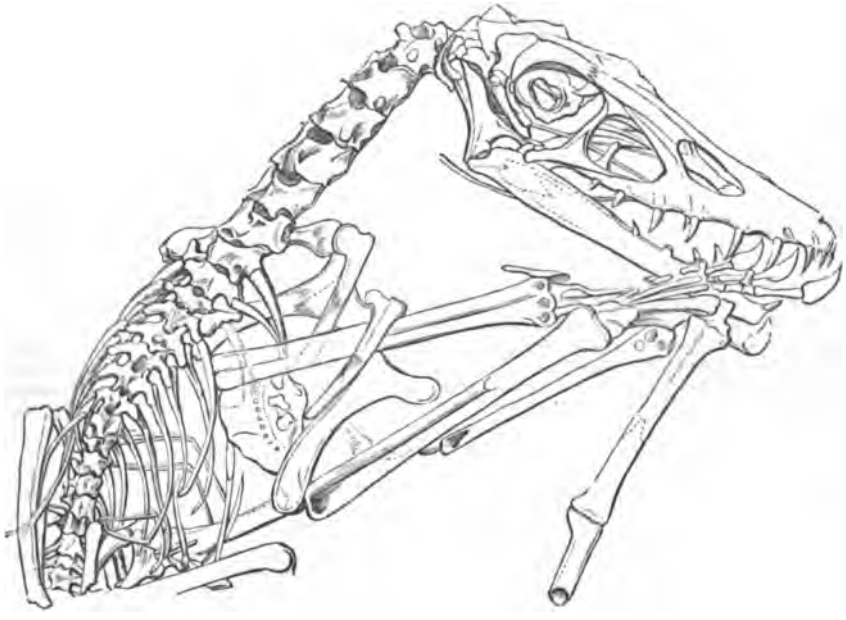
1. *P. longirostris*, Cuv. (*Ornithocephalus longirostris*, Sömm.; *P. crocodilocephaloides*, Ritgen). About the size of a woodcock. It is found in Solenhofen.
2. *P. brevirostris*, Cuv. (*O. brevirostris*, Sömm.; *P. nettecephaloides* Ritgen). Found in Solenhofen.



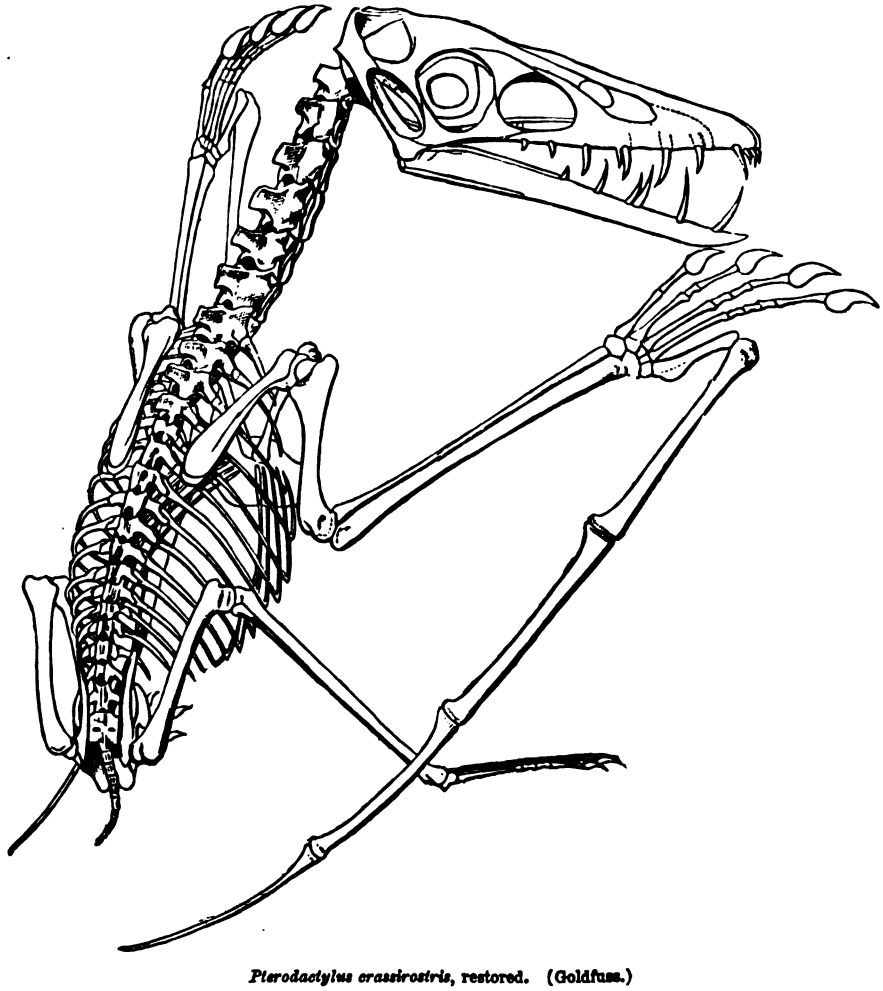
Pterodactylus brevirostris.

3. *P. crassirostris*, Goldf. Found in Solenhofen.
4. *P. medius*, Münster. Solenhofen.
5. *P. Münsteri*, Goldf. Solenhofen.
6. *P. macronyx*, Buckland (*O. Banthensis*, Theodori). Size about that of a raven; wings, when expanded, about four feet from tip to tip. Found at Lyme Regis (Buckland); Banz, Germany (H. Von Meyer).
7. *P. grandis*, Cuv. (*O. giganteus*, Sömm.). About four times as large as *P. longirostris*. Found at Solenhofen (?).
8. *P. Bucklandii*, Goldf. Stonesfield.

Dr. Buckland remarks that in *P. macronyx* (Lias at Lyme Regis) there is an unusual provision for giving support and movement to a large head at the extremity of a long neck, by the occurrence of bony tendons running parallel to the cervical vertebræ, like the tendons that pass along the back of the Pigmy Musk (*Moschus pygmæus*), and of many birds. This provision, he observes, does not occur in any modern Lizards, whose necks are short, and require no such aid to support the head. In the compensation which these tendons afforded for the weakness arising from the elongation of the neck, Dr. Buckland sees an example of the same mechanism in an extinct order of the most ancient reptiles, which is still applied to strengthen other parts of the vertebral column in a few existing species of *Mammalia* and birds.



Pterodactylus crassirostris. (Goldfuss.)



Pterodactylus crassirostris, restored. (Goldfuss.)

The same author points out that the three first fingers of the Pterodactyle agree in structure with those of the fore foot of living Lizards; but as the hand of the fossil reptile was to be converted into an organ of flight, the joints of the fourth or fifth finger were lengthened to become expansors of a membranous wing. Thus, in *P. longirostris*, he observes, the fourth finger is stated by Cuvier to have four elongated joints, and the fifth or ungueal joint to be omitted, as its presence is unneccessary. In the *P. crassirostris*, according to Goldfuss, this claw is present upon the fourth finger, which thus has five bones, and the fifth finger is elongated to carry the wing. Throughout all these arrangements in the fore foot the normal numbers of the type of Lizards are maintained. "If," continues Dr. Buckland, "as appears from the specimen engraved by Goldfuss of *P. crassirostris*, the fifth finger was elongated to expand the wing, we should infer, from the normal number of joints in the fifth finger of Lizards being only three, that this wing-finger had but three joints. In the fossil itself the two first joints only are preserved, so that his conjectural addition of a fourth joint to the fifth finger in the restored figure, seems inconsistent with the analogies that pervade the structure of this and of every other species of Pterodactyle, as described by Cuvier. According to Goldfuss, this species had one more toe than Cuvier assigns to the other species; in this respect it is so far from violating the analogies we are considering, that it adds another approximation to the character of the living Lizards." After referring to the difference manifested in *P. crassirostris* from the other Pterodactyles, in having the fifth instead of the fourth finger elongated, as above noticed, for the purpose of expanding the wing, Dr. Buckland states that it is however probable that the fifth toe had only three joints, for the same reasons that are assigned respecting the number of joints in the fifth finger; and he observes that in *P. longirostris*, Cuvier considers the small bone in the foot to be a rudimentary form of a fifth toe.

The Pterodactyles have been found in the lithographic limestone of the Jura formation at Aichstädt and Solenhofen, which abounds with remains of Fish, and of Brachyurous and Macrurous Crustaceans, and where *Xiphosuri* (*Limulus*) not unfrequently occur. The fish examined by Cuvier belonged, partially at least, to marine genera. He distinguished, for example, a well-characterised species of anchovy, probably *Clupea sprattiformis* (Blainv.). *Libellulæ* and other insects have also been found in this Solenhofen slate. The other localities are Lyme Regis (Lias), Bantz, and Stonesfield (Oolite).

Cuvier, speaking of the Solenhofen district, observes that there is no doubt that at the time of the deposit of the lithographic slate, there lived in that canton crocodiles, *Limuli*, and other beings whose geographical distribution is now confined to the torrid zone, together with these flying Saurians, which flitted about by means of the membrane sustained by a single finger, suspended themselves and perhaps crept by the aid of the other three fingers, stood upon their hind legs only, and had their enormous gape armed with small pointed teeth, fit only for seizing insects and small animals.

Dr. Buckland thinks it probable that the Pterodactyle had the power of swimming so common in reptiles, and now possessed by the Vampire Bat of the island of Bouin. ('Bridgewater Treatise.') "Thus," says the Professor, "like Milton's fiend, all qualified for all services and all elements, the creature was a fit companion for the kindred reptiles that swarmed in the seas or crawled on the shores of a turbulent planet:—

> "'The Fiend
> O'er bog, or steep, through strait, rough, dense, or rare,
> With head, hands, wings, or feet, pursues his way,
> And swims, or sinks, or wades, or creeps, or flies.'

With flocks of such-like creatures flying in the air, and shoals of no less monstrous *Ichthyosauri* and *Plesiosauri* swarming in the ocean, and gigantic crocodiles and tortoises crawling on the shores of the primeval lakes and rivers—air, sea, and land, must have been strangely tenanted in these early periods of our infant world." ('Geol. Trans.,' new series, iii., part 1.)

In the 'Bridgewater Treatise,' we find the size and form of the foot, and also of the leg and thigh, adduced as showing that the Pterodactyles had the power of standing firmly on the ground, where, with their wings folded, they possibly moved after the manner of birds; and an opinion that they could also perch on trees, and climb on rocks and cliffs, with their hind and fore feet conjointly, like bats and lizards.

Cuvier, as we have seen, conjectured that the food of these flying Saurians consisted of insects and other small animals, and he thought that, from the magnitude of their eyes, they may have been also noctivagous. Dr. Buckland refers to the presence of large fossil *Libellulæ*, or Dragon-Flies, together with many other insects, in the same quarries with the Solenhofen Pterodactyles, and to the occurrence of the wings of Coleopterous Insects, mingled with the bones of those Saurians in the oolitic slate at Stonesfield, as proof that large insects existed at the same time with them, and that they may have contributed to their supply of food. He adds however that the head and teeth of two species of Pterodactyle are so much greater and stronger than is necessary for the capture of insects, that the larger species of them may possibly have fed on fishes, darting upon the latter from the air, after the manner of Sea-Swallows, or Terns, and Solan Geese. The enormous size and strength of *P. crassirostris*, he observes, would not only have enabled it to catch fish, but also to kill and devour the few small Marsupial *Mammalia* which then existed upon the land.

A new species has lately been discovered by Mr. Bowerbank in the Kentish Chalk, which seems to have been more colossal than any hitherto described. Some portions of the upper maxilla prove the total length of the head to have been upwards of 16 inches; and the bones of the upper extremity indicate a width of from 16 to 18 feet from the extreme point of one wing to the other.

PTERODONTA, a genus of gasteropodous mollusca.

PTEROGLOSSUS. [RAMPHASTIDÆ.]

PTEROLO'BIUM, a small genus of Plants belonging to the natural order *Leguminosæ*, so named from its pod ending in a membranous wing. The genus was first mentioned by Mr. Brown, in the appendix to Salt's 'Travels in Abyssinia,' and from a species, *P. Kantuffa*, which is also named by Bruce, and described by him as being ordered to be cut away from the roads when the king was going to travel. The genus is found in India as well as in Africa, and even the *Kantuffa* occurs there, as it is the *Cæsalpinia lacerans* of Roxburgh, but referred to *Mimosa* by De Candolle, and called *M. Kantuffa*; having been ascertained to be identical with the Indian plant, and belonging to this genus, it has been called *P. lacerans*. The genus contains only a few species of trees and climbing shrubs covered with strong sharp hooked prickles.

PTE'ROMYS. [SCIURIDÆ.]

PTEROPHY'LLUM, a genus of Fossil Cycadeous Plants from the Oolite of Yorkshire and beds of the same age in Scania. (Brongniart.)

PTEROPLEURA. [GECKOTIDÆ.]

PTEROPODA, a class of *Mollusca* placed between the *Gasteropoda* and *Brachiopoda* by some writers, and by others next the *Cephalopoda*. The number of species is not large. They pass their entire life in the open sea away from shelter, except that which is afforded by the gulf-weed. In appearance and habits they resemble the fry of the other forms of *Mollusca*. They are supplied with a pair of flippers or wings (hence their name), by means of which they pass rapidly through the water. They swarm in tropical and arctic seas, and are sometimes so numerous as to colour the ocean for leagues. They are the principal food in high latitudes of the species of whale and of sea-birds. They are rarely found on the sea-shore, and only one or two species have been accidentally taken in the British seas.

"In structure, the *Pteropoda* are most nearly related to the marine univalves, but much inferior to them. Their nervous ganglia are concentrated into a mass below the œsophagus; they have auditory vesicles, containing otolites; and are sensible of light and heat and probably of odours, although at most they possess very imperfect eyes and tentacles. The true foot is small or obsolete; in *Cleodora* it is combined with the fins, but in *Clio* it is sufficiently distinct, and consists of two elements; in *Spiralis* the posterior portion of the foot supports an operculum. The fins are developed from the sides of the mouth or neck, and are the equivalents of the side-lappets (*Epipodia*) of the sea-snails. The mouth of *Pneumodermon* is furnished with two tentacles supporting miniature suckers; these organs have been compared with the dorsal arms of the cuttle-fishes, but it is doubtful whether their nature is the same. A more certain point of resemblance is the ventral flexure of the alimentary canal, which terminates on the under surface, near the right side of the neck. The pteropods have a muscular gizzard, armed with gastric teeth; a liver, a pyloric cœcum, and a contractile renal organ opening into the cavity of the mantle. The heart consists of an auricle and a ventricle, and is essentially opistho-branchiate, although sometimes affected by the general flexure of the body. The venous system is extremely incomplete. The respiratory organ, which is little more than a ciliated surface, is either situated at the extremity of the body and unprotected by a mantle, or included in a branchial chamber with an opening in front. The shell, when present, is symmetrical, glassy, and translucent, consisting of a dorsal and a ventral plate united, with an anterior opening for the head, lateral slits for long filiform processes of the mantle, and terminated behind in one or three points; in other cases it is conical, or spirally coiled and closed by a spiral operculum. The sexes are united, and the orifices situated on the right side of the neck. According to Vogt, the embryo Pteropod has deciduous vela, like the sea-snails, before the proper locomotive organs are developed. (Huxley.)

"From this it would appear that while the *Pteropoda* present some analogical resemblances to the *Cephalopoda*, and permanently represent the larval stage of the sea-snails, they are developed on a type sufficiently peculiar to entitle them to rank as a distinct group; not indeed of equal value with the *Gasteropoda*, but with one of its orders.

"This group, the lowest of the univalve or encephalous orders, makes no approach towards the bivalves or acephala." (Woodward, 'Treatise on Shells.')

De Blainville divides this group into two sections, *Thecosomata* and *Gymnosomata*:—

A. Thecosomata.—Animal furnished with an external shell; head indistinct; foot and tentacles rudimentary, combined with the fins; mouth situated in a cavity formed by the union of the

locomotive organs; respiratory organ contained within a mantle cavity.

This section embraces two families, *Hyalæidæ* and *Limacinidæ*.

B. Gymnosomata.—Animal naked, without mantle or shell; head distinct; fins attached to the sides of the neck; gills indistinct.

It contains but one family, the *Cliidæ*. [CLIONIDÆ.]

PTERO'PTOCHUS. [MERULIDÆ.]

PTE'ROPUS. [CHEIROPTERA.]

PTEROSPERMUM (from the Greek word πτερόν, signifying a wing, and σπέρμα, a seed), a small genus of Plants belonging to the natural order *Byttneriaceæ*, which is found in the Indian Isles and the southern parts of India. The flowers being large and the foliage showy, have induced the cultivation of the species as ornamental trees all over India. The calyx is leathery, 5-partite, tomentose outside, hairy within; petals 5, shorter than the calyx; stamens 20 (5 sterile), united at the base into a column with the stalk of the ovary: style slender, club-shaped; seeds winged. The genus is small, but all the species form handsome trees, and, like most of the plants of the nearly allied order of *Malvaceæ*, abound in mucilage.

PTEROTRA'CHEA. [GASTEROPODA.]

PTERU'THIUS. [LEIOTRICHANÆ.]

PTI'LINOPUS. [COLUMBIDÆ.]

PTILIUM. [*See* SUPPLEMENT.]

PTILOCERCUS. [*See* SUPPLEMENT.]

PTILO'GONYS. [LANIADÆ.]

PTILOLEPTUS. [CUCULIDÆ.]

PTILONORHY'NCHUS. [STURNIDÆ; CORVIDÆ.]

PTILOPACHUS. [TETRAONIDÆ; PERDICIDÆ.]

PTI'LORIS, Mr. Swainson's name for a genus of Birds which he arranges under the *Paradisiadæ*, or Birds of Paradise.

PTILO'STOMUS, Mr. Swainson's name for a genus of Birds which he places under the sub-family *Glaucopinæ* (Wattle-Crows) of the family *Corvidæ*. *P. Senegalensis* (Sw.), the Senegal Piapec, is a native of Africa.

PTILO'TIS. [MELIPHAGIDÆ.]

PTILOTU'RUS. [MELIPHAGIDÆ.]

PTINUS. [SERRICORNES.]

PTYCHACA'NTHUS, a genus of Fossil Fishes. [FISH.]

PTYCHO'CERAS. [CEPHALOPODA.]

PTY'CHODUS, a genus of Fossil Fishes. [FISH.]

PTY'CHOGENS are Endogenous Plants whose leaves are occupied by veins running side by side from the base to the apex, without irregular division, as in grasses, lilies, &c. The name has been given in contradistinction to Dictyogens, which are those Endogens that, like *Smilax*, have the reticulated veins of Exogens. [SMILACEÆ.]

PTYCHO'LEPIS, a genus of Fossil Fishes. [FISH.]

PTYCHOPLEURES, the name used by Messrs. Duméril and Bibron to designate a sub-family of the Chalcidians or Cyclosaurs, the seventh family of Saurians according to their arrangement.

PTYCHO'TIS, a small genus of Umbelliferous Plants, of which the seeds of some of the species have formed articles of condiment and of medicine from very early times. The genus extends from the south of Europe, through the Oriental region, to all parts of India. The calyx is 5-toothed; petals obovate, bifid, or emarginate, with a long inflexed point. Fruit compressed laterally, ovate or oblong. Seed roundish, or flat before and convex posteriorly. The species are annual or biennial plants. Stem-leaves usually cut into numerous capillary segments. Flowers white, disposed in compound umbels, of which the involucels are many-leaved, and the involucre either wanting or few-leaved.

The European species are not remarkable for any useful properties, but *P. coptica* and *P. Ajowan* probably yielded the seeds which formed the 'Ammi' of the ancients. Botanists and inquirers into the plants, condiments, and medicines of the ancients, have usually sought too exclusively in Europe for what was frequently derived from the East. Dioscorides states that the Æthiopic Ammi is called Cumin by some, and that it is thought to be distinct from the royal kind. The seeds of one kind were sent by Forskäl to Linnæus, who named the plant *Ammi copticum*. This has now been removed to the present genus *Ptychotis*. Arabian authors give Nankhwah as the synonym of Ammi, and Persian authors consider Ajwain to be a synonym of the former. It is remarkable, according to Dr. Royle, that there is also an Indian plant which is everywhere called Ajwain, and celebrated for its aromatic smell, pungent taste, and for its employment both by natives and Europeans for culinary and medicinal purposes; so much so, that Dr. Roxburgh could not conceive that "this famous Indian plant should be unknown to European botanists." Dr. Royle says, "in Persian works in use in India the Arabic Nankhwah is given as a synonym of the Indian Ajwain, as it is also of the Greek Ammi."

The Indian species has been referred by De Candolle to the genus *Ptychotis*, and called by him *P. Ajowan*, stating that it was very closely allied to *P. coptica*, which we have seen was considered to be one kind of Ammi—the two kinds described by Dioscorides being *Cuminum Æthiopicum* and *C. regium*. The latter name is translated by the Persians 'Kamoon Mullooke,' or Royal Cumin, and given as a synonym of the Nankhwah. The Indian and Egyptian kinds of *Ptychotis*, as ascertained by modern botanists, are therefore most probably the two kinds of Ammi of Dioscorides. These afford interesting instances of the results to be obtained by closely examining the products of nature possessed of any remarkable properties, in the countries where they are produced, and continue to be used, and whence they were probably first obtained by the ancients.

PTYCHOZO'ON. [GECKOTIDÆ.]

PTYODA'CTYLUS. [GECKOTIDÆ.]

PUCCI'NIA, a genus of *Fungi*, well known to farmers under the name of Mildew. It is distinguished from other parasitical genera by its spore-cases being elevated upon long slender stalks and divided internally by one or two horizontal partitions into two or three separate cavities; the spore-cases arise from a spawn or matrix which is dispersed among the living tissue of the plant on which they grow. A considerable number of species have been distinguished by writers on *Fungi*, and 38 are enumerated as inhabitants of this country. They all grow upon the living leaves or stems of plants, and are generated in their interior, bursting through the epidermis when ready to scatter their seeds or spores. By what means the latter are introduced into the tissue has never been satisfactorily explained. Some writers imagine the seeds to be introduced through the stomates from the atmosphere where they float; but it seems more probable that they are absorbed by the young roots, and carried upwards in the current of vegetation, a mode of introduction which their extremely small size renders quite possible. The mildew of corn is the *P. graminis*, which makes its appearance on the straw and leaves in the form of dark gray or black lines and patches, broken in outline in consequence of their running irregularly together. Each line consists of numerous minute spore-cases, which are individually black when quite ripe. The plant appears in all corn-fields in all seasons, but its injurious effects are only observed in wet seasons, or in places where, from whatever cause, the straw becomes very rank; in the latter instance, the spore-cases, from their great abundance, attract from the straw the fluid food which was intended for the support of the grain, intercepting it in its passage upwards, and thus cause the ruin of the crop. In a disease of this kind there seems no hope of discovering a remedy, for the earth is undoubtedly well stored with the spores of *Puccinia* in all places and in all seasons. [FUNGI; ENTOPHYTA.]

PUCCOON. This name is given in the United States of America to a red vegetable pigment employed by the Indians, and hence has been transferred to the plant that produces it. By some it has been ascribed to *Sanguisorba Canadensis;* but Pursh asserts that it is obtained from the root of *Batschia canescens*, a Boraginaceous plant, while the American writers with one accord apply the name to *Sanguinaria Canadensis*, a Papaveraceous plant, whose roots yield, when wounded, a deep orange-red fluid.

PUCHURY. [NECTANDRA.]

PUDDING-STONE. [CONGLOMERATE.]

PUFF-BALL. [LYCOPERDON.]

PUFF-BIRDS. [BARBETS.]

PUFFIN. [AUK; PROCELLARIDÆ.]

PUFFINUS, a genus of Birds belonging to the family *Laridæ*. [LARIDÆ.] It has the following generic characters:—Bill as long or longer than the head, slender; upper mandible compressed, and curved towards the point; under mandible also slender, and curved at the point; nostrils tubular, opening by two separate orifices. Legs of moderate length, tarsi compressed laterally; toes three in front, rather long, webbed throughout; hind toe rudimentary. Wings long and pointed, the first quill-feather the longest.

P. major, the Greater Shearwater. It is the *P. cinereus* of Selby; *Procellaria Puffinus* of Jenyns; Puffin Majeur of the French; and Cinereous and Dusky Shearwater of English writers. This bird has only been rarely shot in the British Islands. There are specimens in the British Museum from the coasts of South Africa. M. Temminck says it breeds by thousands on the banks of Newfoundland. Mr. Yarrell says it is probably the Wandering Shearwater of Messrs. Audubon and Nuttall.

P. Anglorum, the Manx Shearwater; *Procellaria Puffinus* of Pennant; the Manx Puffin, Shearwater Petrel, and the Shearwater of English writers. This bird is smaller than the last, its whole length is only 14 inches. The bill is blackish-brown, the iris is hazel, the head, back of the neck, back, wings, and tail uniform brownish-black; chin and neck in front white; breast, belly, and under tail-coverts white; behind the thighs a patch of brownish-black.

This little bird is an inhabitant of the ocean only, seeking the shore for the purposes of incubation. They lay but one egg, and this of dazzling whiteness. They are not so numerous now as formerly on the Calf of Man. They are still found in considerable numbers on the coasts of South Wales. [PROCELLARIDÆ.]

(Yarrell, *British Birds.*)

PUG, a dwarf variety of the Dog, somewhat resembling a mastiff or bulldog in miniature. The Dutch Pugs have more the aspect of the large varieties last named than the French Pugs, some of which latter are very small. Both are snappish and noisy, but capable of strong attachment to their masters or mistresses. The French Pugs are docile and may be easily taught many amusing tricks.

PULEX, the name given by Linnæus to a group of Insects, of

which the Common Flea may be regarded as the type. The fleas are considered by Latreille, Kirby, and many other entomologists, as constituting an order of insects. They form the group *Suctoria* of De Geer; the order *Siphonaptera* of Latreille, and *Aphaniptera* of Kirby and Spence, by whom they are placed between the orders *Diptera* and *Aptera*. In the 'Règne Animal' they are arranged between the orders *Parasita*, or *Anoplura*, of Leach, and the *Coleoptera*. It is highly probable however that when this group is better known—when the numerous insects allied to the fleas are more common in our cabinets—it will be found that they do not constitute an order by themselves, but are aberrant forms of the other well-established orders; in these there is a certain degree of uniformity, as regards numbers, variety of habits, &c., which can but lead us to doubt the validity of the so-called orders containing only one or two genera, and but few species, such as the present order, and the orders *Aptera*, *Homaloptera*, and *Strepsiptera*. It is moreover worthy of observation that each of these so-called orders is composed of parasitic insects, which necessarily involves a structure very unlike the more typical species of the groups to which we may suppose they belong.

The *Suctoria* have the mouth composed of three pieces, inclosed by two articulated laminæ, which, when united, form a cylindrical or conical proboscis, the base of which is protected by two scales. They undergo a complete metamorphosis: the larva is of an elongated cylindrical form, and when about to change into the pupa state, incloses itself in a silken cocoon, and at the end of a few days assumes the imago or perfect state.

In the genus *Pulex* the body is compressed, of an oval form, and protected by a tough coriaceous covering. The head is small and much compressed, and furnished on each side with a small round eye; behind this is a concavity in which the antennæ (which are three-pointed) are situated.

On the anterior part of the head are two four-jointed organs, supposed by Latreille to be the antennæ, but which must be palpi, the organs situated behind the eyes being now supposed to be the antennæ. The legs are large and strong, particularly the hinder pair, by which the insect jumps, and covered with spines; the tarsi are 5-jointed, and the terminal joint is furnished with two elongated claws; the anterior pair of legs are inserted almost under the head, and the rostrum lies between them.

The female flea is said to lay about a dozen eggs, which are of a whitish colour and somewhat viscid: the larvæ are long and slender, and have no legs; the head is scaly and has no eyes, but is furnished with two very small antennæ: each of the segments of the body is provided with little tufts of hair, and the terminal segment has moreover two hooked appendages at its apex.

The Common Flea (*Pulex irritans*) is but too well known. It is said to attack dogs, cats, and other animals, as well as man; but there are other species which appear to be peculiar to certain birds and quadrupeds, and these have received in most cases the names of the species they attack, such as the Dog-Flea (*Pulex Canis*), the Mole-Flea (*P. Talpæ*), that of the Martins (*P. Hirundinis*), and of the Mouse (*P. Musculi*), &c.

The Chigoe of the West Indies and South America also belongs to this group, being the *Pulex penetrans* of authors. "It is described," says Messrs. Kirby and Spence (vol. i. p. 102), "as generally attacking the feet and legs, getting, without being felt, between the skin and the flesh, usually under the nails of the toes, where it nidificates and lays its eggs; and if timely attention be not paid to it, which, as it occasions no other uneasiness than itching (the sensation at first, I am assured, is rather pleasing than otherwise), is sometimes neglected, it multiplies to such a degree as to be attended by the most fatal consequences, often rendering amputation necessary, and sometimes causing death. The female slaves in the West Indies are frequently employed to extract these pests, which they do with uncommon dexterity." Besides the name Chigoe, they are sometimes called Jiggers, Nigua, Tungua, Pique, &c.

(Duges, *Recherches sur les Charactères Zoologiques du genre Pulex*, in *Annales des Sciences Naturelles*, October, 1832; Westwood, *On the Structure of the Antennæ of the order Aphaniptera*, in *Entomological Magazine*, vol. i.)

PULICA'RIA, a genus of Plants belonging to the natural order *Asteraceæ*. It has an involucre laxly imbricated in few rows. The pappus in two rows, the outer one short, cup-like, membranous, and toothed, the inner one pilose.

P. vulgaris, Flea-Bane, has lanceolate wavy leaves, narrow at the base, and somewhat clasping; the stem much branched and downy; the heads lateral and terminal, hemispherical, with very short rays. It is the *Inula* of Linnæus. The heads are small, the florets yellow. It is found on moist sandy heaths in Great Britain. It has obtained its English name from being used to drive away fleas.

P. dysenterica has a creeping root, and is a herb more or less woolly or cottony, glutinous, and with a peculiar and aromatic smell. The stem rises 12 or 15 inches high: it is round, leafy, cottony, corymbose at the summit, with many bright yellow flower-heads, whose disc is of a darker hue than their numerous spreading rays. The leaves are acute, veiny, and wrinkled, or slightly toothed or serrated, from 1 to 2 inches long, sessile, clasping the stem, the under side cottony. The fruit is bristly and obovate, the pappus rough, the receptacle slightly cellular, unequally toothed or scaly. Linnæus states, on the authority of General Keith, that this plant cured the Russian army of the dysentery. But Haller speaks contemptuously of the medical virtues of this plant, because he says it abounds in earthy matter. It is found in damp places in Great Britain.

(Lindley, *Flora Medica; Vegetable Kingdom.*)

PULMOBRANCHIA'TA (De Blainville), an order of Gasteropodous *Mollusca*. [MALACOLOGY.]

PULMOGRADA. [ACALEPHÆ.]

PULMONA'RIA (so named from its being supposed efficacious in disorders of the lungs, or from the spots on the leaves resembling those on some diseased lungs), a genus of Plants belonging to the natural order *Boraginaceæ*. It has a tubular 5-cleft calyx, a funnel-shaped corolla with a naked throat. The stamens included in the tube filaments very short. The style is simple, the nuts smooth, attached by their truncate base with a central tubercle. The species are herbaceous plants with spotted leaves and terminal corymbose racemes of flowers.

P. officinalis, Lungwort, has ovate leaves, roundish or cordate, the upper leaves oblong. The root is thick and black. The corollas are red before expansion and then purple. The whole plant is more or less hispid. It is found in the woods and thickets of England, and is native of Europe and the Caucasus. The leaves, which are the parts of the plant recommended in medicine, have no peculiar smell, but in their recent state manifest a slightly astringent and mucilaginous taste—hence they are supposed to be demulcent and pectoral, and have been prescribed in consumption. All these plants contain nitre in considerable quantities, and when burnt this species yields one-seventh of its weight in ashes. In the north of Europe it is eaten as a pot-herb, and according to Ray in his time it was brought to table in Scotland.

P. angustifolia has all lanceolate leaves. It is difficult to distinguish from the former species, but is more pubescent, and has narrower spotless leaves. The corolla is purple, and there is a variety with white flowers. It is a native of Europe.

PULMONELLA. [SYNOICUM.]

PULP, a name given in Vegetable Physiology and Botany to such parts of plants as are semifluid. [FRUIT.]

PULSE. [HEART.]

PULVINITES. [MALLEACEA.]

PUMA. [FELIDÆ.]

PUMICE, a vesicular variety of Obsidian.

PUMPKIN is the vulgar name of the fruit of the *Cucurbita maxima* and *C. Pepo*. [CUCURBITA.]

PU'NICA, a genus of Plants belonging to the natural order *Myrtaceæ*, sometimes distinguished, in consequence of its having two verticels of capsules developed instead of one, from *Myrtaceæ* under the name of *Granateæ*. The genus consists of only a single species, the celebrated Pomegranate, with a dwarf variety, which is sometimes considered a distinct species. The pomegranate has from the earliest periods formed an object of attraction in the countries from Syria to the north of India, where it grows in perfection, as well as in the north of Africa; and this, as well from its shining dark-green foliage, as from its conspicuous flowers, of which the flower-cup and petals are both of a crimson colour, while its large red-coloured fruit, filled with juicy pleasant-flavoured pulp, which covers its numerous seeds, makes it an object of desire in hot countries. Thus we find it mentioned in the Bible under the name Rimmon (Numbers, ch. xiii.), and we hence learn that it was cultivated in Egypt and also in Palestine; by the Arab authors it is called Rooman, and by the Persians Anar, and it is probably indigenous all along the mountains from the Caucasus to the Himalayas, where it is described by Dr. Royle as being found in a wild state. Forster describes the Pomegranate as being delicious in most parts of Persia; and Burnes states that the famous Pomegranates without seeds are grown in gardens under the snowy hills near the Caubul River.

The Pomegranate was well known to the Greeks, being the 'Ροὰ of Theophrastus and the 'Ροιὰ of Dioscorides. Hippocrates mentions it by what is supposed to be its Phœnician name, Side. By the Romans it was called *Punica*, and *Punicum Malum*, from having been introduced from Carthage. Besides the fruit, the parts employed by the ancients were the double flowers, which were called balaustion; the pericarp, from its leathery consistence, called malicorium, was used for its astringent properties; while the bark of the root was considered an efficient anthelmintic. In the East, where so much has remained stationary, the different parts continue to be employed for the same purposes; and Dr. Royle mentions that in India bulooston is given as the Greek name of the double flower. The rind of the wild fruit is much preferred for astringent purposes, and forms in the present day an article of commerce from the Himalayas to the plains of India. The bark of the root, being also still employed in India for the expulsion of intestinal worms, was made known as a recent discovery in India, in consequence of a Mohammedan practitioner having cured a European gentleman there of tape-worm with great ease. He had no doubt learned this property of the bark of the pomegranate from the translations of Dioscorides, which are incorporated in most of the Mohammedan works on Materia Medica, affording a striking instance of facts once well known being forgotten until they are

rediscovered. It is remarkable that the African slaves in the West Indies are also acquainted with this property of the root of the pomegranate, which they must have learned in their own country, probably from the prevalence there of Mohammedan works on medicine, or of the practice which is inculcated in them. [POMEGRANATE, in ARTS AND SC. DIV.]

PUPA. In Entomology this term is applied to the third stage of existence of an insect, the egg being the first stage, and the larva or caterpillar, the second. [INSECTA.]

PUPA. (Conchology.) [HELIX.]

PUPIL. [EYE.]

PUPI'VORA. In Entomology this term is applied by Latreille to his second great section of hymenopterous Insects—a section the species of which are distinguished by their having the abdomen attached to the thorax, in most cases, by a slender stalk, and not, as in the first section (*Securifera*), forming as it were a continuation of the thorax. The females are furnished with a slender bristle-like ovipositor, and in this respect they also differ from the greater portion of the *Securifera*.

The larvæ of the *Pupivora* have no feet, and most of them are parasitical. Latreille divides this section into two groups, the *Evaniales* and the *Ichneumonides*, distinguished chiefly by the insertion of the stalk or basal portion of the abdomen. In the *Evaniales* the stalk is attached to the thorax, and in most cases immediately under the scutellum; they have distinct nervures to the wings, and those of the upper pair form cellules; the antennæ are filiform, or setaceous, and composed either of thirteen or fourteen joints; the mandibles are toothed on the inner side; the maxillary palpi have six joints, and the labial four; the ovipositor is generally exserted, and composed of three slender pieces.

Dr. Leach regarded the present group as constituting a family, and applied to it the name *Evanidæ*; compared with the next section of the *Pupivora*, the present one is very limited in species. Mr. Stephens, in his 'Systematic Catalogue of British Insects,' only enumerates five species, and these constitute three genera, *Evania*, *Brachygaster*, and *Fœnus*.

In the *Ichneumonides* the abdomen has its origin between the two posterior legs; the nervures of the upper wings form cellules; the antennæ are generally filiform or setaceous, and composed of many joints (sixteen at least); the mandibles are in most cases destitute of denticulations on the inner side, and are bifid at the apex; the maxillary palpi are always distinct, and seldom have more than six joints. Of this group the species are exceedingly numerous. Mr. Stephens states that he possesses 800 British species of this family. The *Pupivora* appear to be destined to prevent other tribes of insects (particularly the *Lepidoptera*) from becoming numerous.

The *Ichneumonidæ* may be seen during the summer months in great numbers flying from plant to plant in search of the caterpillars which are suited to furnish the proper food and to rear their larvæ, each caterpillar apparently having its own peculiar parasite, or parasites, for sometimes several species of Ichneumon attack the same larvæ. The female Ichneumon, by means of her long bristle-like ovipositor, inserts her eggs in the body of the caterpillar in such a manner, and in such parts, that it does not destroy the life of the victim. In most cases these eggs are not hatched until the caterpillar has changed into a chrysalis; they then hatch, and the Ichneumon larvæ feed upon the contents of the pupa case, inclose themselves in silken cocoons, and undergo their final transformations, to come forth in proper season, eating their way through the chrysalis case. Instances are not uncommon in which the eggs of the Ichneumon hatch in the body of the living caterpillar, and, what is most remarkable, they do not destroy its life. It is not until the larvæ have quitted their abode in the caterpillar that it dies, having the cocoons of the Ichneumon larvæ attached to its skin. The caterpillar so abundant on cabbages, and which is that of the common white butterfly, affords a familiar example of this nature. At certain times of the year numbers of those caterpillars may be seen on walls adjoining gardens: on these they usually attach themselves (in some sheltered situation) to undergo the transformation into the pupa state. One of these caterpillars will appear healthy, select a convenient situation, attach itself (as usual before the change into the pupa state) by means of a silken thread around its body, but instead of undergoing the transformation, we shall find it after a short time covered with an immense number of small yellowish silken cocoons spun by the larvæ of the Ichneumons as they crawl from its body. These cocoons, which are about one-eighth of an inch in length, are attached to each other, and to the skin of the caterpillar, which then dies. The larvæ of some of the *Ichneumonidæ* themselves are infected with parasites.

(Gravenhorst, *Conspectus Generum et Familiarum Ichneumonum.*)

PU'RPURA. [ENTOMOSTOMATA.]

PURPURI'FERA, a family of *Mollusca*.

PURSLANE. [PORTULACEÆ.]

PUSTULI'PORA. [MILLEPORIDÆ.]

PUTCHUK is the name by which a fragrant root is designated in the price-currents of Calcutta and Bombay, whence it is exported to Canton, being highly esteemed by the Chinese as an incense. From the places of export this would appear to be a product of India, but neither the plant which yields it nor the place where it grows has been discovered until very recently. The discovery is interesting, as the Putchuk is a substance which was known to the ancients. Dr. Royle, while in the north-western provinces of India, obtained a root which formed a considerable article of commerce, and which was said to be brought from still farther north, that is, from Lahore. It was warm and aromatic in taste, fragrant in odour, and frequently called Orris-Root (Iris-Root) by Europeans in India, though by the natives in Northern India it is called Kooth. On comparing specimens of Kooth which he obtained in Northern India with what was called Putchuk in Calcutta, he found that they were identical, and he was subsequently informed by Mr. Beckett, who was long settled as a merchant in Northern India, that what the latter purchased from Umritseer under the name of Kooth he sold in Calcutta by that of Putchuk, so that there can be no doubt of the identity of the two substances; but all that had been ascertained with respect to the place where it was produced was, that it seemed to be to the north of the Sutlej.

Kooth, being used in India as a medicine, as well as exported to China, is described in the Persian works on Materia Medica in use in that country, and has assigned to it Kust as the Arabic, Kooshta as the Syriac, and Koostus as the Greek name. Three kinds are described. Dr. Royle states that he was only able to meet with two kinds in India, one called Koost-Hindee, and the other Koost-Arabee. These evidently refer to two of the three kinds of Costus described by Dioscorides as the Arabian, Indian, and Syriac. ('Illust. Himal. Bot.,' p. 360.) There can be little doubt therefore that the Kooth or Putchuk is one of the kinds of Costus of the ancients, which was highly esteemed by them, and formed an ingredient in their most famous compound alexipharmic confections, such as the Theriaca and the Mithridatium. It was also highly esteemed by them as an incense, as, in the line of Propertius—"Ure puer costum Assyrium redolentibus aris"; and is mentioned by Horace as 'Achæmenium costum.' ('Od.,' iii. 1.)

The identity of Kooth and Costus was however long ago ascertained, though not generally known, as is evident in the following passage from Garcias ab Horto, in Clusius ('Exot.,' lib. x.) "Est ergo Costus dictus Arabibus Cost aut Cast; in Malacca, ubi ejus plurimus est usus, Pucho, et inde vehitur in Sinarum regionem." In MacCulloch's 'Commercial Dictionary,' Putchook is described as "the root of a plant growing in Sinde. When burned it yields a fine smell. The Chinese beat it into a fine powder, which they burn as incense in the temples of their gods." Of the Putchuk, 6697¾ bazar maunds, of the value of 99,903 rupees, were exported from Calcutta in the year 1837-38.

On Dr. Falconer's proceeding on his journey to Cashmere, Dr. Royle requested him to make inquiries respecting this substance, and he discovered that it was exported from the valley in large quantities to the Punjab, whence it finds its way to Bombay and Calcutta; and that it is sold in China at an advance of about 3000 per cent. on the price at which it is gathered in Cashmere. Dr. Falconer subsequently found it growing in great abundance all round the elevated summits of Cashmere. From the plants with which it is associated, and the circumstances under which the Koot grows, being one of the *Compositæ*, or Thistle tribe, with feathered seed, of which when once established the dissemination becomes easy, Dr. Falconer has no hesitation in thinking that it could be produced to an unlimited extent, of the best quality, in the Himalayas at elevations of from 7500 to 9000 feet above the sea, and that the Choor Mountain alone might be brought in a few years to produce thousands of maunds of it. Preparatory to diffusing the Koot, or Costus, he has introduced it into the Himalayan nursery attached to the Saharumpore Botanic Garden.

Finding that it belongs to a new genus, he has named it *Aucklandia*, in honour of George, earl Auckland, governor-general of India, "as a distinction well merited by his lordship's services in the cause of Indian Botany."

(Royle, *On the Productive Resources of India.*)

PUTORIUS. [MUSTELIDÆ.]

PUTRANJI'VA, an Indian genus of Plants, referred by Dr. Roxburgh to *Nageia*, but which has been separated by Dr. Wallich under the above name, which is a Sanscrit compound, consisting of the words, 'pootra,' a son, and 'jeeva,' life, in consequence of the seeds being strung by parents round the necks of children, under the supposition that they will preserve them in health. They are sold in bazaars throughout India for this purpose. *P. Roxburghii*, the only species known, forms a large timber-tree, with an erect straight trunk, and a white close-grained very hard wood. The head is large and shady, composed of numerous spreading branches, with shining dark green leaves arranged on two sides of the branchlets. The flowers are dicecious, the male ones crowded together; the perianth small, calyx-like, 4-5-leaved; corolla none; stamens three; filaments thread-like, all or only two united together, and the third free. The female flowers solitary in the axils of the leaves, with long foot-stalks; perianth 5-leaved; ovary ovate, oblong, 3-celled; cells 2-seeded; styles three, filiform; stigmas crescent-shaped and toothed; drupe 1-seeded. Young plants of this tree have been cultivated in moist stoves in this country. The genus has been referred to the natural family of

Myricaceæ, but is considered by Endlicher as more nearly allied to the *Antidesmeæ*.

PY'CNODUS, a genus of Fossil Fishes. [FISH.]

PYCNOPHYCUS. [FUCACEÆ.]

PY'GATHRIX, M. Geoffroy's name for the Douc, or Cochin-China Monkey (*Lasyopyga*, Illiger). It has the following characters:—Head rounded; muzzle moderately prolonged; tail long; cheek pouches; hands longer than the fore arms and the legs; anterior thumbs very short and slender; no callosities; buttocks fringed with long hairs.

Dental Formula:—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 32$.

P. Nemæus, Geoff. (*Lasiopyga Nemæus*, Ill.; *Simia Nemæus*, Linn., 'Mant.').

This very rare monkey is perhaps the most remarkable of the whole tribe for the variety and liveliness of the colours with which it is marked, and which are the more striking from being distributed in large masses.

The upper part of the head is brown with a dark-reddish chestnut frontal band. The cheeks are clothed with very long and whitish or yellowish-white hairs. The back, the belly, the arms, and the sides are gray with a somewhat greenish cast; the tail is whitish, and so are the rump and the fore arms; the anterior fingers are blackish; the hips and thighs are blackish, and the legs of a brightish-red chestnut; the more exposed parts of the face are of a reddish tint. Length rather more than 2 feet when erect; length of tail about 1 foot 7 inches.

It is a native of Cochin China.

Cochin-China Monkey (*Pygathrix Nemæus*).

PYGAULUS, a genus of Echinoderms.

PY'GOPODES, Illiger's name for those Natatorial Birds whose wings are well-developed, and whose feet are placed very far back so as to facilitate their diving, as *Colymbus*, *Uria*, *Alca*, &c.

PY'GORHYNCHUS, a genus of Echinoderms.

PYLORI'DIA, *Pyloridea*, M. De Blainville's name for his ninth family of *Lamellibranchiata*, which he thus characterises:—Body compressed, more and more cylindrical, the mantle more and more closed and prolonged backwards by two long tubes which are ordinarily distinct, with an anterior and inferior aperture for the passage of a very small and ordinarily conical foot; branchiæ narrow, free, and prolonged in the tube. Shell regular, rarely irregular, nearly always equivalve, gaping at the two extremities; hinge incomplete, the teeth gradually vanishing ('s'effaçant peu en peu'); ligament internal or external; two distinct muscular impressions, united by a pallial impression which is very flexuous backwards.

M. De Blainville remarks that all the animals of this family live inclosed in the mud, the sand, or calcareous stone, almost without ever changing their place, always in a vertical position, the mouth below and the anus above. All their shells, he observes (ordinarily white, and covered with an epidermis), hardly ever exhibit any stria from the umbo to the base, but only lines of growth (stries d'accroissement).

Section 1. (Ligament internal.)

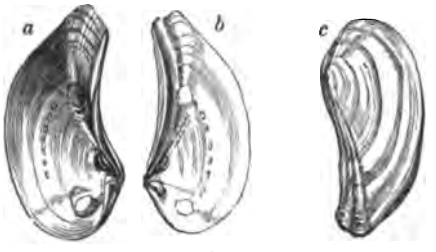
Pandora.—Animal oval, compressed, rather elongated, with the mantle in form of a case, terminating backwards by two tubes united at their base only, and rather short, opening anteriorly for the passage of the foot, which is large, triangular, thick, and swollen at its extremity; branchiæ large, free backwards, where the two pairs are united and terminate in a point in the siphon; labial appendages rather large, triangular, and not striated. Shell delicate, regular, elongated, compressed, inequivalve, inequilateral, having the right valve flattened and the left more or less convex; umbones but little distinct; hinge composed of a cardinal tooth in the right valve, corresponding with a cavity in the left; ligament internal, oblique, triangular, inserted in a little pit with rather projecting edges; muscular impressions rounded, that of the mantle but little apparent and forming a small excavation. (Rang.)

The *Pandoræ* live sunk in the sand so deep that it requires some difficulty to get them out. They have been found at depths varying from the surface to 10 fathoms.

Species are recorded from Norway, the European seas, including the Mediterranean, the Pacific, the coasts of Georgia and Florida in North America, and New Zealand. Woodward enumerates 13 recent and 6 fossil species.

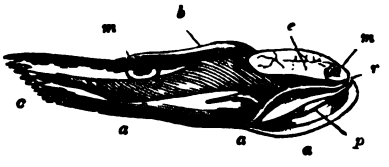
P. rostrata has the shell with the anterior side produced, attenuated, rostrated, and angulated in each valve. Dr. Carpenter says of its microscopic structure that the outer layer of regular, vertical, and prismatic cells are 250 times smaller than those of *Pinna*.

It is found on the coasts of England and France, and the Mediterranean.



Shell of *Pandora rostrata*.

a, Interior of deep valve; *b*, interior of flat valve; *c*, valves closed.



Soft parts of *Pandora rostrata*.

a, *a*, *a*, *r*, Mantle, opened anteriorly to show the issue of the foot; *p*, foot; *b*, rectum; *o*, liver covered by the ovary; *m*, adductor muscles; *c*, *c*, tubes.

P. obtusa is a more abundant British species.

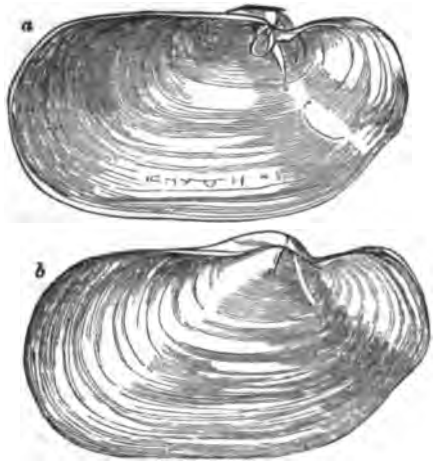
Anatina.—Animal oblong, rather thick, having the mantle closed by a rather large membranous lamina with a small rounded aperture at the antero-inferior part for the passage of a linguiform foot; two elongated tubes separated deeply at their extremity, the lower being rather greater than the upper; branchiæ narrow, free, and pointed backwards. Shell delicate, sometimes translucent, oval, elongated or oblong, gaping at one or both extremities, equivalve; very inequilateral; umbones placed backwards, the upper anterior border being longer than the posterior; hinge without teeth, but having in their place a horizontal excavated apophysis or spoon-shaped process, receiving the internal ligament, and sustained by a lamina which is oblique and decurrent into the interior of the shell; muscular impressions distant, oval, united by a pallial impression which is but little marked, but having a deep and rounded excavation backwards. (Rang.)

There are 20 living species known. They inhabit India, the Philippines, New Zealand, and Western America. There are 50 fossil from the Devonian and Oolitic Rocks. *Periploma*, *Cochlodesma*, and *Cercomya* are sub-genera.

A. subrostrata has the shell ovate, membranaceous, anterior side attenuated and subrostrated.

It is a native of the seas of Australia. Lamarck adds, the Indian Ocean.

The *Anatinæ* have hitherto been found for the most part in sands and shallow water.



Anatina subrostrata.

a, Inside view of valve, showing the hinge, &c.; *b*, external view; valves closed.

Mya.—Animal oblong, a little compressed, enveloped in a rather delicate mantle adhering by its borders, closed by a membranous lamina, and forming backwards round the tubes a loose envelope in which they are withdrawn; tubes united, of moderate length, a little separated at their summit and radiated at their orifices; foot very small, conical, coming out of the mantle by a small slit situated at its antero-inferior border, in the median line; branchiæ moderate, not much elongated, unequal on the same side; mouth small, having triangular appendages striated like the branchiæ. Shell enveloped with an epidermis prolonged upon the tubes and mantle of the animal, rather solid, gaping at both extremities, equivalve; umbones projecting but little; hinge composed of one or two oblique folds, diverging backwards from a horizontal, compressed, spoon-shaped process, belonging to the left valve and corresponding to an equally horizontal fosset in the right valve; ligament internal, inserting itself between the fosset and the spoon-shaped process; muscular impressions distant, the anterior elongated, the posterior rounded; pallial impression narrow and deeply excavated. (Rang.)

There are ten species. They are found in the northern seas, west Africa, the Philippines, Australia, and California.

The *Myæ* live buried in sandy beaches, wherein they often lie with the tube just projecting: they are also found in the silt of estuaries.

M. arenaria has the shell ovate, rounded anteriorly. The subjoined cut shows the hinge, muscular impressions, markings, and general form of the shell.

Mya arenaria.

It is found in the British Channel and European seas. It burrows a foot deep. It is eaten in Zetland and America, and is regarded as excellent food.

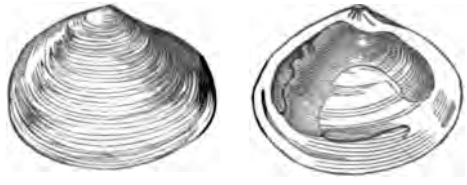
Lutricola.—Body oval, very much compressed or subcylindrical, the mantle only closed in the half of its lower border; foot small, projecting but little beyond the abdominal mass; tubes long, distinct or united. Shell oval or elongated, regular, equivalve, more or less inequilateral, sometimes scarcely gaping, the edges constantly simple and trenchant, the umbones but little marked; hinge subsimilar, formed of two very small diverging cardinal teeth, sometimes effaced before a large triangular fosset; ligament double, the external posterior rather small, the internal much thicker, and inserted in the fossets; two distinct muscular impressions united by a pallial impression, which is deeply sinuous backwards. (De Blainville.)

M. De Blainville divides the genus *Lutricola* into the two following sections:—

A. Oval or orbicular species nearly equilateral, very much compressed, gaping but little; hinge similar; internal ligament inserted in the fosset of a vertical spoonshaped process; two distinct tubes. Genus *Ligula*, Leach.

* Without longitudinal striæ.

L. compressa has the shell somewhat thin, compressed, rounded-trigonal, squalid, transversely striated, dirty gray, sometimes yellowish or reddish. It is found in the British Channel.



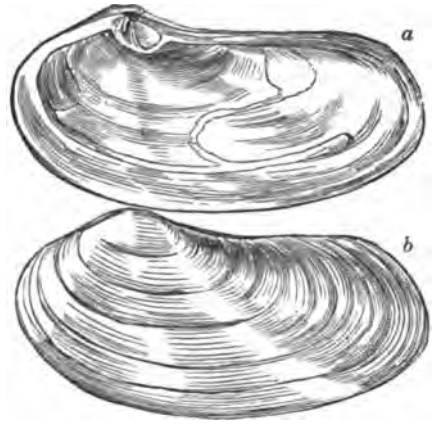
Lutricola compressa.

** Striæ from the umbo to the base.

L. rugosa (*Mactra rugosa*, Gm.). It is found in the European seas.

B. Oblong species, subcylindrical, gaping very much; two very strong hinge-teeth; spoon-shaped process of the ligament vertical. Genus *Lutraria*, Lam.

L. solenoides (*Mya oblonga*, Gm.; *Mactra hians*, Dilw.) has the shell oblong, with transverse rugiform striæ, anterior end very long, apex rounded, gaping much; dirty white or reddish. It is found in the European seas.



Lutraria solenoides.

a, Internal view of valve; *b*, external view.

The genera above collected under the name of *Lutricola* by M. De Blainville belong to the genus *Lutraria* of Lamarck. [Conchacea.]

There are 18 species of *Lutraria* found in the United States, Brazil, the Mediterranean, Senegal, Cape of Good Hope, India, New Zealand, Sitka, and the British Islands.

Section 2. (Ligament external and convex.)

Psammocola.—Of the genera, or rather sub-genera, enumerated by M. De Blainville, of this genus, M. Deshayes is of opinion that the genus *Psammobia* should be retained. It comes near to the *Tellinæ*, differing from them more in the shell, which has not the irregular posterior bend, than in the animal, if reference be made only to the figure of Poli. The species figured by Messrs. Quoy and Gaimard, in the 'Voyage of the Astrolabe,' presents particular characters, observes M. Deshayes, different from those which *Tellinæ* have hitherto shown. *Psammotæa*, he thinks, should not be continued as a genus. (Edit. Lam.)

The species are numerous. In his 'Tables,' M. Deshayes gives eighteen as the number of recent *Psammobiæ*, and notices four as fossil (tertiary). *Psammobia vespertina* and *P. muricata* he notes as

both living and fossil (tertiary). The number of species of *Psammotæa* recorded is eight recent and one fossil.

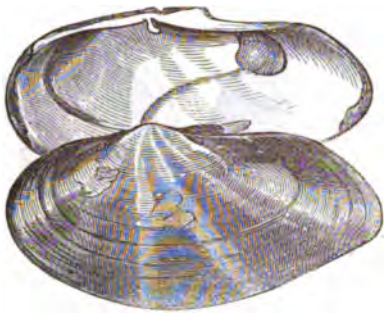
The species of *Psammobia* have been found in sands at depths varying from near the surface to thirteen fathoms.

There are 40 species of *Psammobia*. They are found in Norway, the British Islands, New Zealand, and the Pacific. *P. gari* is eaten in the Pacific.

Soletellina.—Shell oval oblong, compressed, with sharp edges, both curved; equivalve, subequilateral, much more wide and rounded at the cephalic extremity than at the other, which is more or less attenuated and sub-carinated; the umbones sub-median, not projecting much; hinge formed of one or two very small cardinal teeth; ligament thick, convex, and supported on very elevated nymphal callosities; two rounded, distant, muscular impressions; pallial impression very sinuous backwards. (Blainv.)

M. De Blainville observes that this genus, which he instituted for four or five species of Lamarck's Solens, differs very little from *Psammocola*.

S. radiata (*Solen rostratus*, Lam.). Shell transversely oblong, violaceous, with many obscure rays; anterior side attenuated and rostrated. It is found in Oriental seas.

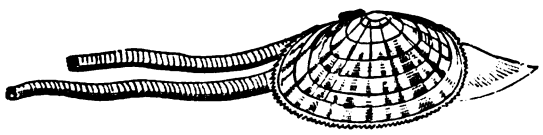


Soletellina radiata.

Sanguinolaria.—Animal very like that of *Psammobia florida*. (Garner, 'Zool. Trans.,' vol. ii., pl. 18, *figs.* 1, 2.) Shell oval, a little elongated, very much compressed, hardly gaping, equivalve, sub-equilateral, equally rounded at both extremities, without any posterior carination; umbones slightly indicated; hinge formed of one or two approximated cardinal teeth in each valve; ligament projecting, convex; two rounded muscular impressions, which are distant and united by a narrow pallial impression, which is very sinuous backwards. (Blainv.)

Both M. De Blainville and M. Rang state that the animal of *Sanguinolaria* is unknown.

S. occidens. Shell radiated and spotted with whitish and red. Found in the Mediterranean.



Animal of *Sanguinolaria occidens* in the shell. (Poli.)

S. rugosa.—Shell semiorbiculate, slightly convex, white, with rosy umbones; the striæ transverse and arcuate. It is found at Jamaica. (Lamarck.)

Shell of *Sanguinolaria rosea*. (*Psammobia rosea*, Desh.)

The *Sanguinolariæ* have been found in sands and sandy mud, at depths varying from five to thirteen fathoms.

There are 20 recent and 30 fossil species. The former are found in the West Indies, Red Sea, India, Madagascar, Japan, Australia, Tasmania, and Peru. The latter are found in the tertiary beds.

Solecurtus.—Animal much too large for the shell; lobes of the mantle thick forward, soldered together on their posterior moiety, and prolonged on this side into two great unequal siphons united near their summit; foot linguiform, large, very thick; labial palps very long and narrow; branchiæ narrow and very long, extending throughout the length of the branchial siphon. Shell oval-oblong, transverse, covered with undulating oblique and longitudinal striæ, gaping at both extremities. Hinge median, two cardinal teeth in one valve, one, rarely two, on the other, non-intrant; nymphæ callous, thick, supporting an external and convex ligament; pallial impression very deeply sinuous. (Desh.)

M. De Blainville separates his *Solecurtus* into the following sections:—

A. Flat delicate species with an interior bar running obliquely from the umbo to the abdominal edge.

Ex. *S. radiatus.*

B. More cylindrical species, without an internal bar

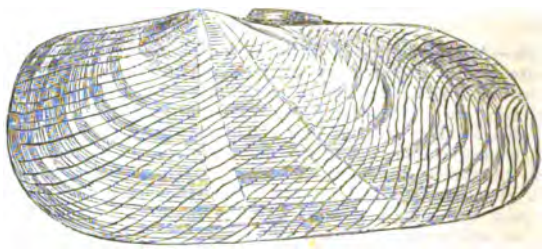
Ex. *S. strigilatus.*

C. Species still more elongated and sub-cylindrical.

Ex. *S. Legumen.*

M. Deshayes confines the genus to those species which have all the same character with *S. strigilatus*.

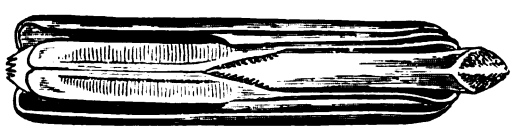
S. strigilatus. Shell oval oblong, very convex, rosy, with two white rays, sculptured with oblique striæ. It is a native of the Mediterranean and Atlantic ocean.



Solecurtus (*Solen*) *strigilatus.*

There are 25 recent and 30 fossil species. The former occur in the United States, the British Islands, the Mediterranean, West Africa, and Madeira.

Solen.—Animal very much elongated, more or less cylindrical or compressed; mantle closed throughout its length, adhering by its borders, and bound to the lower edge of the shell by a double membrane, which folds back upon itself to form the epidermis, presenting backwards a single tube, double in the interior, conical, annulated, susceptible of much elongation, with two simple orifices, that of the siphon being greater than that of the anus; open entirely in front for the passage of a stout foot, which is conical, convex in its middle, pointed at its extremity, and which terminates the body of the animal in a straight line; branchiæ long, narrow, pointed backwards, nearly of equal size, adhering to two lines forward, one on each side of the body, uniting at last at a certain distance backwards on a single line, and then free and floating up to the entry of the siphon; labial appendages not striated like the branchiæ, elongated, triangular, recurved, and directing their point backwards; mouth small, anus at the extremity of a very small tube floating in the cavity above the free part of the branchiæ. Shell rather delicate generally, translucid, equivalve, extremely inequilateral, elongated, gaping, truncated at both extremities, and with nearly parallel edges; umbones entirely anterior, hardly distinct; hinge composed of one or two teeth; ligament convex, slightly elongated; muscular impressions very distant, the anterior oblong, elongated, rather narrow, the posterior rather rounded; pallial impression straight, very long, terminated backwards by a short bifurcation. (Rang.)



Razor-Fish (*Solen vagina*). Shell and soft parts.

The species of *Solen*, which are popularly called Razor Fishes, live in sandy beaches, wherein they often lie buried in a vertical position 2 feet deep, though their ordinary habit is to go only so low in the sand or silt (for they are found also in æstuaries) as to leave the tube just projecting. They may be said to have regular burrows, which leave a mark in the sand like a key-hole. When the animal is undisturbed and the tide is in, it lies with the tubes at the entrance of its perpendicular hole; if it be disturbed, down it goes: in short its life is spent in descending to the depth of its burrow and ascending from

it again to the surface by means of the extension and contraction of its great muscular foot, which is situated at that part of the shell which is lowest. Although with difficulty obtained by digging, they are easily induced to come forth from their hiding places by putting a little salt over their holes. They may then be easily captured. Some of the species make an excellent soup.

They are found in the seas of the whole world. There are 25 recent species.

Solen Legumen. Shell and soft parts.

M. De Blainville thus divides the genus :—

A. Species somewhat curved longitudinally; umbo not terminal.
Ex. *Solen cultellus.*

B. Species straight, or hardly curved; umbo terminal.
Ex. *S. Vagina.*

The British species of *Solen* recorded by Messrs. Forbes and Hanley are *S. Ensis, S. marginatus, S. pellucidus,* and *S. siliqua.*

Shell of *Solen Ensis.*
a, External view of valves closed; *b*, internal view of valve.

Solemya.—Animal oval, transverse; lobes of the mantle united for their posterior half, terminated by two short and unequal siphons; foot proboscidiform, truncated anteriorly by a disc, or kind of sucker, the borders of which are fringed; a single branchia on each side in form of a plumule, the barbs of which are isolated up to the base; anus terminal, not floating. (Deshayes.) Shell very delicate, fragile, compressed, elongated, rounded at its extremities; the borders straight and parallel, gaping a little backwards, regular, equivalve, very inequilateral, covered with a shining epidermis, which invests it on all sides, except in front and behind; anterior side much longer than the posterior; umbones but little distinct; hinge composed of a cardinal, dilated, compressed tooth, which is very oblique, a little curved above, serving for the insertion of the ligament in each valve; ligament almost entirely posterior; muscular impressions small, rounded, distant; some traces of a pallial impression. (Rang.)

Sands are the localities in which the genus has been found.

Panopæa.—Shell thick, solid, convex, oblique, elongated, gaping at both extremities, equivalve, inequilateral, rather irregular; umbones well marked, contiguous, rather curved forward, and more approximated to the anterior than the posterior part; hinge presenting a conical tooth in each valve in front of a fosset, and of a thick callosity, not projecting outwards, and but little elongated, on which is inserted the external, posterior, and convex ligament; muscular impressions irregularly oval, the anterior the longest, both united by a pallial impression, which is wide, parallel to the border of the shell, and rather deeply excavated backwards. (Rang.)

P. Aldrovandi is noted as both living and fossil (tertiary). Six recent and 140 fossil species are the numbers stated by Woodward in his 'Treatise on Shells.'

The species of *Panopæa* have been found in sands and shallow water.

Glycimeris.—Animal elongated, thick, cylindraceous, having the lobes of the mantle very thick, open only at the anterior extremity for the passage of a small cylindrical foot, and terminated posteriorly by two siphons, united into a single cylindrical very fleshy mass, and never capable of entering the shell; mouth moderate, oval, accompanied on each side by two large equal triangular palps, joined by their base to the anterior adductor muscle. Branchiæ long and thick, two on each side nearly equal. (Deshayes, after Audouin.) Shell with a strong epidermis, elongated, rounded, gaping at both extremities, rather irregular, equivalve, very inequilateral; umbones projecting but little, skinned (écorchés); hinge toothless, presenting only a thick and but little elongated callosity; external ligament supported by nymphæ projecting outwards; muscular impressions distinct and very distant; pallial impression well marked, not excavated posteriorly; valves thickened by callosities in the interior. (Rang.)

There is but one species, which is found on sands at moderate depths.

Saxicava. [LITHOPHAGIDÆ.]

Byssomya. [BYSSOMYA.]

Rhomboides.—Animal. Body rhomboidal, elongated, rather compressed, with two distinct tubes backwards; a rather wide slit at the anterior and inferior part of the mantle for the exit of a small conical foot, with a byssus the filaments of which are enlarged at the extremity. Shell rhomboidal, rather irregular, striated longitudinally, very inequilateral; umbones very distinct and very antero-dorsal; hinge formed by two small cardinal teeth; ligament external, posterior, rather projecting; two rounded muscular impressions.

Ex. *Rhomboides rugosus.*

Hiatella.—Animal unknown. Shell delicate, elongated, sub-rhomboidal, equivalve, very inequilateral, gaping at its inferior border and posterior extremity; umbo very anterior and curved forwards; hinge dorsal, formed of a single tooth in one valve corresponding with a notch on the opposite valve, or of a small tooth with a cardinal fosset on each valve; ligament probably external and dorsal; muscular and pallial impressions unknown. (De Blainville.)

M. De Blainville divides the genus into the following sections :—

A. Species with a tooth in one valve only.
Ex. *Hiatella biaperta.*

B. Species with a small tooth on each valve. Genus *Biapholius,* Leach.
Ex. *Hiatella Arctica* (*Mya Arctica,* Oth.; Fabr.)

Gastrochæna. [GASTROCHÆNA.]

Clavagella. [CLAVAGELLA.]

Aspergillum. [ASPERGILLUM; TUBICOLIDÆ.]

PYLORUS. [DIGESTION; STOMACH.]

PYRALLOLITE, a Mineral occurring crystallised and massive. Primary form, according to Levy, an oblique-angled parallelopiped. Cleavage parallel to the two lateral faces of the primary form, and to one of the diagonal planes. Fracture earthy. Hardness, scratches carbonate of lime, and is scratched by felspar. Colour white and greenish; transparent on the edges; lustre resinous. Specific gravity 2·55 to 2·60.

Before the blow-pipe it becomes at first black, and afterwards white; swells and fuses on the edges into a glass, and with borax gives a transparent glass.

A massive variety, yellowish, in small laminar masses, with white carbonate of lime, red phosphate of lime, and green pyroxene. It occurs at Storgard, Pargas, Finland.

Its analysis by M. Nordenskiöld gives—

Silica	56·62
Magnesia	23·38
Alumina	5·38
Lime	5·58
Oxide of Iron	0.99
Oxide of Manganese	0·99
Water	3·58
	96·52

PYRAMIDELLIDÆ, a family of Gasteropodous *Mollusca.* The shell is spiral, turreted; the nucleus minute, sinistral; aperture small; columella sometimes with one or more prominent plaits. Operculum horny, imbricated, nucleus internal. The animal has broad ear-shaped tentacles, often connate; eyes behind their tentacles, at their bases; proboscis retractile; foot truncated in front; tongue unarmed. The species of this genus are all marine. Messrs. Forbes and Hanley speak of this family as presenting "subjects of much interest to the student of extinct *Mollusca,* numerous forms having all the aspect of being members of this family occurring among the fossils of even the oldest stratified rocks. Many of them are gigantic compared with existing species, and the group, as a whole, may be regarded rather as appertaining to past ages than to the present epoch."

The genera embraced in this order are—*Pyramidella, Odostomia, Aclis, Stylifer, Chemnitzia, Eulima, Eulimella, Stylina, Loxonema, Macrocheilus, Truncatella, Otina.*

Pyramidella has 11 recent and 12 fossil species. The recent species are found in the West Indies, Mauritius, and Australia. The fossil in the chalk.

Stylina has 6 recent species. They are found in the West Indies, the Philippines, and the Galapagos.

Loxonema is a fossil genus with 75 species. Principally from the Lower Silurian of North America and Europe.

Macrocheilus is fossil, and has 12 species. They are found in the Devonian and Carboniferous Rocks.

For the other genera see CHEMNITZIA, ODOSTOMIA, EULIMA.

PYRAMIS, a genus of Gasteropodous *Mollusca*; also of *Acalephæ*. [ACALEPHÆ.]

PYRARGILLITE, a Mineral occurring in four-sided prisms, with bevelled edges and massive; frequently traversed by chlorite. Colour black or blue; in the former case shining, in the latter dull. Emits an argillaceous odour when heated. It dissolves entirely in nitric acid. It is found in granite near Helsingfors in Finland.

Its analysis by Nordenskiöld gives—

Silica	43·93
Alumina	28·93
Oxide of Iron	5·30
Magnesia	2·90
Potash	1·05
Soda	1·83
Water	15·47
	——99·41

PYRENEITE. [GARNET.]

PYRENESTES. [FRINGILLIDÆ.]

PYRENOMYCETES. [FUNGI.]

PYRETHRUM (from πῦρ. fire, because of the hot taste of the root), a genus of Composite Plants belonging to the tribe *Asteraceæ*. It has a hemispherical involucre, the receptacle flat or convex. The fruit angular and not winged. The pappus an elevated membranous border.

P. Parthenium, Feverfew, has stalked pinnate leaves, with ovate or oblong segments, and pinnatifid; they are of a hoary green the leaflets incline to ovate decurrent and cut. The flower-heads are erect, about half an inch broad, with a convex yellow disc, and numerous short broad abrupt 2-ribbed white rays, often wanting, sometimes multiplied, and the disc being obliterated constituting a double flower. The whole plant is bitter and strong scented, reckoned tonic, stimulating, and anti-hysteric. It was once a popular remedy in ague. It is said that the odour is peculiarly disagreeable to bees, and that these insects may be easily kept at a distance by carrying a handful of the flower-heads. It is common in many parts of Europe and in England.

P. inodorum has sessile pinnatifid leaves, in numerous capillary-pointed segments. A branched stem, solitary heads, the involucral scales lanceolate obtuse; the fruit rugose with two round glandular dots on the external face just below the elevated entire border. It is found in fields and waste places in Great Britain.

P. maritimum has sessile doubly pinnate leaves, with fleshy segments, convex above, keeled beneath. The stem diffuse and branched, the heads solitary; the fruit rugose, and with two elongated glandular spots on the external face, just below the elevated lobed border. It is found on sea-shores in Great Britain.

P. officinale is the Pellitory of Spain, once much esteemed as a sialagogue, and resorted to for relief in toothache. Grew says that "when the root of Pyrethrum is chewed, it makes a sensible impression on the lips, which continues like the flame of a coal betwixt in and out for nine or ten minutes." When extracted, the acrid oil contained in the root is said to be serviceable in cases of palsy, and when cutaneous action is required, as a liniment. Ainslie says it is administered in typhus fever by the Indian practitioners.

(Lindley, *Flora Medica*; Babington, *Manual of British Botany*.)

PYRGITA. [PASSER.]

PYRGOM. [PYROXENE.]

PYRGOMA. [CIRRIPEDIA.]

PYRINA, a genus of Fossil *Echinodermata*.

PYRITES. [COPPER; IRON.]

PYROCHLORE, a Mineral which occurs in octahedral crystals. Primary form a cube. Cleavage parallel to the faces of a regular octahedron, but not easily to be obtained. Fracture conchoidal, with a lustre between vitreous and resinous. Hardness 5·0. Colour reddish brown or black. Streak pale. Translucent, opaque. Specific gravity 4·206 to 4·216. Infusible by the blow-pipe; becomes greenish-yellow by calcination. Found at Fredrichswärn in Norway, and in Siberia. The analysis by Wöhler gives—

Titanic Acid	62·75
Lime	12·85
Oxide of Cerium	6·80
Oxide of Uranium	6·18
Oxide of Manganese	2·75
Oxide of Iron	2·16
Oxide of Tin	0·61
Water	4·20
	——98·3

PYROLA, a genus of Plants, the type of the order *Pyrolaceæ*. It has the calyx 5-cleft, or 5-parted; 5 petals; 10 stamens, slightly adhering at the base; style exserted; stigma 5-lobed; capsule 5-celled, dehiscing near the base, and the margins of the valves connected by tomentum.

P. rotundifolia, Round-Leaved Winter-Green, has the stamens curved upwards; the style declinate, arcuate at the apex; the petals obovate; the segments of the calyx lanceolate-acute, recurved at the apex, half the length of the corolla, and with equal racemes. This plant is a native of Asia, Europe, and North America. It is found in Great Britain, in the North of England, and the Highlands of Scotland, but it is a rare plant. It has milk-white flowers and numerous leaves, and is the largest plant of the genus. There are four other species of *Pyrola* natives of Great Britain; one of these, *P. uniflora*, is only found in Scotland.

P. aphylla, Leafless Winter-Green, has no leaves, the scape is angular, and furnished with numerous scales at the base; the racemes are many-flowered; the petals are roundish, and the disc of the stigma is elongated. This plant is a native of Nootka Island, on the north-west coast of America, where it was collected by Mr. Menzies. It is remarkable as indicating the approach of the genus to the characters of *Monotropaceæ*. It has globose pendulous milk-white flowers, and the scales upon the scape are of a greenish colour.

Chimaphila corymbosa is the *Pyrola umbellata* of Linnæus. [CHIMAPHILA.]

PYROLACEÆ, *Winter-Greens*, a natural order of Exogenous Plants. It has the following characters:—Calyx 5-leaved, persistent, inferior. Corolla monopetalous hypogynous, regular, deciduous, 4- or 5-toothed, with an imbricated æstivation. Stamens hypogynous, twice as numerous as the divisions of the corolla; anthers 2-celled, opening by pores. Ovary superior, 4- or 5-celled, many-seeded, with a hypogynous disc; style 1, declinate; stigma slightly indusiate. Fruit capsular, 4- or 5-celled, dehiscent, with central placentæ. Seeds indefinite, minute, winged; embryo minute, at the base of a fleshy albumen. (Lindley.) The species are herbaceous plants, rarely under-shrubs. The stem is round, and in the frutescent species leafy. The leaves are simple, and are either entire or toothed. The flowers are either solitary or disposed in terminal racemes. Although often placed with *Ericaceæ*, the habit of these plants is very different from that order; they have also winged seeds, a minute embryo, and declinate styles, all marks of difference which have induced Dr. Lindley to place them in an order separate from *Ericaceæ*. *Monotropaceæ* are distinguished from this order by their leafless scaly stems and parasitical habit. The embryo also is at the apex of the albumen in *Monotropaceæ*, while it is at its base in *Pyrolaceæ*. *Pyrola aphylla* forms a passing link from *Pyrolaceæ* to *Monotropaceæ*; whilst *Tolmiea*, in the latter order, is a link in the other direction. There is an approach to an indusiate stigma in some of the species of *Pyrolaceæ*, which indicate an affinity with *Goodeniaceæ*.

The following genera belong to this order:—*Pyrola*, *Chimaphila*, *Moneses*, *Cladothamnus*, *Galax*.

The species of these genera are natives of Europe, North America, and the northern parts of Asia.

Moneses and *Cladothamnus* have each one species. *M. grandifolia* is a native of Europe, Asia, and North America, in alpine woods. *C. pyroliflorus* is a native of the north-west coast of America, and of the island of Sitcha.

Galax is a genus of doubtful position.

PYROLUSITE. [MANGANESE.]

PYROMORPHITE. [LEAD.]

PYROPE. [GARNET.]

PYROPHYLLITE (*Radiated Talc*), a Mineral which occurs in fibrous radiating masses and small prisms of indeterminate form. Hardness 1·5. Colour light green. Lustre pearly, transparent in thin laminæ. Specific gravity 2·8. Before the blow-pipe it exfoliates into white leaves, but does not fuse. With borax it gives a green glass, which becomes colourless when cold; with soda it gives a transparent yellow glass. It occurs near Beresof, in the Uralian Mountains, Siberia. Its analysis by Hermann gives—

Silica	59·79
Alumina	29·46
Magnesia	4·00
Oxide of Iron	1·80
Water	5·62
	——100·67

PYRORTHITE, a Mineral, which occurs imbedded in granite or quartz, in single or aggregated slender columnar masses. Fracture conchoidal, uneven, earthy. Hardness 2·5. Colour blackish-brown. Lustre resinous. Opaque. Specific gravity 2·19. When cautiously heated by the blow-pipe it takes fire and burns without either flame or smoke; it afterwards becomes white, and eventually fuses into a black enamel. With borax it gives a transparent glass. It dissolves in acids when heated, except a black powder. It is found near Fahlun, in Sweden. The analysis by Berzelius gives—

Silica	10·43
Oxide of Cerium	13·92
Oxide of Iron	6·08
Yttria	4·87
Alumina	3·59
Lime	1·81
Oxide of Manganese	1·39
Water	26·50
Carbon and Loss	31·41
	——100

PYROSIDERITE. [IRON.]

PYROSKLERITE, a Mineral. Its primary form is a rhombic prism, with one perfect cleavage, and another at right angles with this imperfect. Colour emerald-green and apple-green; streak white. Fracture uneven and splintery. Hardness 3·0. Lustre dull. Translucent. Specific gravity 2·74. It is found in the island of Elba, and at Aker in Südermanland. Its analysis by Von Kobell gives—

Silica	37·03
Alumina	13·50
Magnesia	31·62
Protoxide of Iron	3·52
Oxide of Chromium	1·43
Water	11·00
	——98·10

PYROSMALITE. [IRON.]

PYROXENE, a Mineral, which has received various names, probably because it has been found in different countries, and under slightly varying circumstances and properties. The different names by which it has been known are *Alalite, Augite, Baikalite, Coccolite, Diopside, Fassaite, Jeffersonite, Malacolite, Mussite, Pyrgom*, and *Sahlite*. [AUGITE.]

PYRRHITE, a Mineral, occurring crystallised in regular octahedrons. It has no cleavage observable. Colour deep orange-yellow. Hardness equal to that of Felspar. Lustre vitreous, brilliant. Transparent on the edges. It is found at Alabaschka, near Murainsk, and at the Azores.

PY'RRHOCORAX. [CORVIDÆ.]

PYRRHO'DES. [PSITTACIDÆ.]

PYRRHOTINE, or magnetic iron pyrites. [IRON.]

PY'RRHULA. [BULLFINCH.]

PYRRHULAUDA, a genus of Birds.

PY'RULA. [SIPHONOSTOMATA.]

PYRUS, the Latin word for Pear-Tree, is the name of a genus of Plants belonging to the natural order *Rosaceæ*. This genus is characterised by having a superior calyx with a 5-lobed limb; roundish petals; five styles; the fruit a closed 5-celled pome with a cartilaginous putamen called the core; two seeds in each cell; the testa cartilaginous. The species are trees or shrubs with simple or pinnate leaves, and the flowers placed on terminal many-flowered cymes. The species of this genus have obtained various names, as Apples and Pears, Crabs, Beam-Trees, and Mountain-Ashes.

P. communis, the Pear, has ovate serrated leaves, glabrous on both surfaces, with umbellate peduncles. It is a native of Europe in woods and hedges. In its wild state it is thorny, but always unarmed when cultivated. It is the Pear-Tree of our orchards. It is easily distinguished from the apple-tree by the shape of its fruit. [PEAR, in ARTS AND SC. DIV.]

P. Malus, the Apple, has acute serrate ovate-acute leaves; flowers in a sessile umbel; the fruit globose, and the styles combined below. This is the Crab-Tree of our hedges when wild, and the Apple-Tree of our orchards. [APPLE, in ARTS AND SC. DIV.]

Other species of *Pyrus* besides the above yield edible fruits.

On Mount Sinai grows a species called *P. Sinaica*, whose fruit is hard, gritty, and austere, and whose leaves are gray with down; in Germany a similar kind, the *P. nivalis*, is by no means uncommon, with a considerable resemblance to the last; Siberia and Persia produce another, called *P. salicifolia*, with very narrow hoary leaves; and in the former country are found the Siberian Crab, *P. prunifolia*, and the Berry-Fruited Crab, *P. baccata*, whose fruit is too small for ordinary consumption, but is often seen in the form of a sweetmeat.

Besides these, the Chinese Crab, *P. spectabilis*, and also *P. coronaria*, are cultivated for their flowers.

P. domestica, the Service-Tree, has serrated pinnated leaves, downy below; the flowers in panicles, and the fruit obovate. This tree, though not uncommon in Great Britain, is a doubtful native. Its wood is very compact, and is said to be the hardest and heaviest of any indigenous in Europe.

P. Aria, the White Beam-Tree, has the leaves oval or oblong, unequally and doubly serrate or slightly lobed towards the end, nearly entire below; flowers corymbose. It inhabits rocks in the West and North of England. Its scarlet fruit renders it very ornamental in the autumn.

P. aucuparia, the Rowan-Tree, or Roan-Tree, known also under the names of the Fowler's Service-Tree and Mountain-Ash. Its Latin name, *P. aucuparia*, and its various modern designations, have been given to it on account of the general use made of its fruit for the purpose of decoying birds into traps. It is much cultivated, both on account of its valuable wood and rapid growth. It is known from the other species of *Pyrus* by its slightly glabrous serrated leaflets and its globose fruit. It is found in most parts of Europe, in the north-west of Asia, in Nova Scotia, and other regions of the northern parts of North America, and in the island of Japan. It does not however attain equal magnitude in all climates. In its most northern localities and alpine situations it is a low shrubby bush; whilst in southern districts it forms a handsome tree, growing to the height of 20 or 30 feet. The finest trees in this island are found in the Western Highlands and on the west coast of Scotland. This tree has enjoyed from remote times a distinguished reputation. A belief in its power against witchcraft and evil spirits of all kinds seems to have been prevalent at a very early date; and, according to Lightfoot, in his 'Flora Scotica,' it was till a late period held in high reputation in Scotland as a charm against evil influence. It is through a hoop of this wood that sheep are made to pass night and morning as a preservative against evil spirits.

The Rowan-Tree is a graceful tree, with an erect stem and orbicular head. It grows very rapidly for the first three or four years of its existence, and on this account it is well adapted for planting with young oaks, which it protects till they grow above it, when it is destroyed by their shade. It also forms excellent coppice-wood, the shoots being adapted for poles and for making hoops. The bark is used by tanners. The leaves, when dried, have been sometimes used in the north of Europe as a substitute for wheat in times of scarcity. It is prized next to yew for making the bow. In Wales it is as religiously planted in churchyards as the yew is in England.

P. fennica is a species also called a Service-Tree, and found in the north of Europe and Scotland. It has scarlet fruit. The leaves are oblong, doubly serrate near the apex, pinnatifid below; the pinnæ lanceolate-oblong, serrated, the two lowermost distinct, under side white and downy. Flowers corymbose.

P. torminalis, the Wild Service-Tree, is a native of England. It has cordate or ovate-lobed glabrous leaves, the lobes triangular acute, serrated, the lower ones larger and spreading, the flowers corymbose. It has brown oval fruit.

P. scandica is another British species; at one time supposed to be a hybrid, but distinguished by the lobes of its leaves being triangular-oval, toothed, deepest towards the middle. Flowers corymbose.

These species are all natives of Great Britain. A number of others have been introduced into our shrubberies and parks. Of these a full account is given in Loudon's 'Arboretum et Fruticetum Britannicum.'

PYTHON. [BOA.]

PYXIS. [CHELONIA.]

Q

QUADRU'MANA, Cuvier's name for his second order of Mammiferous Animals, an order which must be always viewed by the zoologist with great interest, inasmuch as it contains those forms among which will be found the nearest approach—though the distance is still great—to Man. [CHIMPANZEE; ORANG-UTAN; APE; CHEIROPODA.]

The order *Primates* of Linnæus consisted of the genera *Homo, Simia, Lemur*, and *Vespertilio*. [PRIMATES.]

Cuvier placed *Homo* aloof in his order *Bimana*, of which it is the only genus. His order *Quadrumana* embraced the Singes (*Simia*, Linn., including the Orangs) and the Makis (*Lemur*, Linn.); between these two extremes came the *Ouistitis*, or *Arctopitheci*. [JACCHUS.]

Of his *Quadrumana*, Cuvier remarks that, independently of the anatomical details which distinguish them from man, they differ from him in the very striking character arising from their hind-feet having free thumbs, which are opposeable to the other fingers, whilst those fingers are long and flexible, like those of the hand. They therefore climb trees with facility; but they do not hold themselves or walk erect except with difficulty, their foot in such case not resting on the sole, but on its external edge, and their narrow pelvis not favouring equilibrium in that posture. Their intestines, he observes, are sufficiently similar to ours, their eyes are directed forward, they have mammæ on the breast, et penem pendentem. The cerebrum has three lobes on each side, the posterior of which covers the cerebellum, and the temporal fossa is separated from the orbit by a bony partition; but for the rest, they recede gradually from the form of man, assuming a more elongated muzzle, a tail, and a progression more and more exclusively quadruped. Nevertheless, adds Cuvier, the liberty of their fore arms and the complication of their hands permit among them all many actions and gestures similar to those of man.

Illiger's first order, *Erecta*, like Cuvier's *Bimana*, included man alone. His second order, *Pollicata*, consisted of the *Quadrumana*, the *Prosimii*, the *Macrotarsi*, the *Leptodactyla*, and the *Marsupialia*.

The *Quadrumana* embraced the Orangs and *Simiæ* generally, including *Hapale* (the *Jacchus*).

Dr. J. E. Gray divides the *Primates* into the Anthropomorphous and Quadrupedoid.

The first family of the first division, *Hominidæ*, is thus subdivided:—

† Tail none.

1. HOMININA, *Homo*. 2. SIMIINA, *Troglodytes*, Geoff.; *Simia*, Linn. *Hylobates*, Ill.

†† Tail long or short.

3. PRESBYTINA, *Presbytes*, Esch. 4. CERCOPITHECINA, *Lasiopyga*, Ill.; *Cercopithecus*, Linn.; *Cercocebus*, Geoff.; *Macacus*. 5. CYNOCEPHALINA, *Cynocephalus*, Briss.; *Papio*, Briss.

The second family, *Sariguidæ*, is thus subdivided :—

† Tail end naked.

1. MYCETINA, *Mycetes*, Ill. 2. ATELINA, *Ateles*, Geoff.; *Brachyteles*, Spix; *Gastromargus*, Spix; *Lagothrix*, Geoff.

†† Tail end hairy.

3. CALLITHRICINA, *Cebus*, Erxl. 4. SAGUININA, *Saguinus*, Lacép.; *Nyctipithecus*, Spix; *Pithecia*, Geoff.; *Brachypus*, Spix. 5. HARPALINA (Hapalina ?), *Jacchus*, Geoff.

Under the Quadrupedoid division, Dr. Gray arranges the *Lemuridæ*, the *Galeopithecidæ*, and the *Vespertilionidæ*.

Under the *Quadrumana*, or Tetracheirs (his second order), M. Lesson arranges the *Simiæ* and *Lemuridæ* generally, together with *Loris*, *Nycticebus*, *Galago*, *Tarsius*, *Cheiromys*, and *Cheiragaleus*.

His first order, *Bimana*, includes man only.

The *Quadrumana* form the first order of the system of Mr. Swainson, who excludes man from the zoological circle. His *Quadrumana* consist of the following families and genera :—

1. SIMIADÆ.—*Simia* (including *Troglodytes*, *Hylobates*, *Presbytes*, and *Pithecus*, as sub-genera).

Cercopithecus (including *Lasiopyga*, *Semnopithecus*, *Colobus*, *Cercopithecus*, *Cercocebus*, and *Nasalis*, as sub-genera).

Inuus.

Macacus.

Papio (including *Papio* and *Cynocephalus* (*Cynocephalus* ?) as sub-genera).

2. CEBIDÆ.—*Mycetes*, *Lagothrix*, *Ateles*, *Cebus*, *Callithrix*, *Hapales* (including *Midas* as a sub-genus), and *Pithecia*.

3. LEMURIDÆ; and 4. VESPERTILIONIDÆ. [SIMIADÆ; LEMURIDÆ; GALEOPITHECUS; CHEIROPTERA.]

QUAGGA. [EQUIDÆ.]

QUAIL. [PERDICIDÆ.]

QUAKING GRASS. [BRIZA.]

QUAMASH is the North American name of an eatable Bulb, found in the plains of the Missouri, and called *Camassia esculenta* by botanists. It is a plant of the Liliaceous order, and is nearly allied to the European Squill.

QUAMOCLIT, a genus of climbing Plants of the natural family of *Convolvulaceæ*, chiefly found in the hot parts of America, but species are indigenous both in India and China. The genus is characterised by having a 5-leaved calyx. Corolla somewhat salver-shaped, plicate, and 5-lobed. Stamens 5, inserted into the base of the corolla. Ovary 4-celled. Cells with single ovules. Style simple. Stigma capitate and bilobed. Capsule 4-celled, 4-valved. Seeds 4, erect. Climbing plants with the leaves alternate, cordate, entire, lobed, or pinnatifid; peduncles axillary; one or many flowers of a red colour. *Q. vulgaris* is common in every part of India, and, being a beautiful plant, has been cultivated in this country as a tender annual. The name of the genus has been taken from that of this species, which was *Ipomœa Quamoclit*, the latter name signifying Dwarf-Bean, because, though smaller, it resembles the kidney-bean in its habit.

QUARTZ, the Mineralogical name of numerous varieties of Rock Crystal, the Native Oxide of Silicon [SILICA], called also Siliceous or Flint Earth, and Silicic Acid. It is remarked by Mr. Brooke ('Mineralogy') that the "differences of structure, hardness, specific gravity, mixture with foreign matter, and other characters belonging to this species, are so numerous as to render any single description inapplicable to all its varieties." Some of the varieties of quartz have been already described; these we shall presently refer to.

Quartz occurs crystallised and massive, and in both states it is widely diffused throughout nature, and is especially one of the constituents of granitic and the older rocks. The primary form of the crystal is a rhomboid, but this is of rare occurrence; it is generally met with in hexagonal prisms terminated by hexagonal pyramids, and when the prism is entirely wanting and both pyramids are present the crystal is a dodecahedron with triangular planes. Cleavage parallel to the planes and pyramids of the ordinary crystal. Fracture conchoidal. Hardness 7·0. Scratches glass readily, and gives fire with steel. Becomes positively electrical by friction, and two pieces, when rubbed together, become luminous in the dark. Transparent; translucent; opaque. Lustre vitreous, resinous. Specific gravity 2·69 to 2·81. Colourless when pure, but exhibiting a vast variety of colours, of which those mentioned below are the more remarkable.

Quartz is infusible; insoluble in acids in general, but acted on by hydrofluoric acid. It combines, by fusion, with the alkalies, potash and soda; and thus with them acts the part of an acid, and also in many natural compounds. The acid is termed Silicic Acid, and its compounds Silicates.

The finest specimens of crystallised quartz occur in Dauphiné, Madagascar, &c.; they are found also in Cornwall and near Bristol of great brilliancy, and are known by the name of Cornish and Bristol diamonds. To enumerate the different places in which this substance occurs would be almost endless. Quartz is composed of one equivalent of silicon = 14, and one equivalent of oxygen = 8; its equivalent is therefore 22.

Hornstone and *Chert* are varieties of compact quartz. Cavernous quartz is termed Spongiform Quartz or Swimming Stone, and other scarlet varieties have also been described.

Quartz possessing different colours has received various names; some of these we shall briefly notice.

Brown or Smoky Quartz occurs in fine crystals near Cairngorm in Aberdeenshire. It is used for seals and ornaments when cut and polished. The nature of the colouring-matter is not known, but is probably carbonaceous matter.

Purple Quartz, or *Amethyst*, is found both crystallised and massive. It is of every shade of purplish-violet, and the colour in the perfect amethyst is pretty equal throughout the crystal or mass; frequently however the summits of the crystals only are coloured. It is used for ornaments. According to Rose, amethyst consists of—

Silica	97·50
Alumina	0·25
Oxide of Iron	0·75
	98·5

Amethysts of the finest quality are found in India, Ceylon, Persia, and Siberia. Amethystine Quartz of inferior quality is met with in most countries. In Cornwall it occurs in some tin-mines.

Blue Quartz (*Siderite*) occurs crystallised and massive. It is compact, of a grayish or greenish-blue colour. Lustre resinous, waxy. Translucent on the edges. It is found near Salzburg.

Green Quartz is found in Peru, in translucent hexagonal prisms. Opaque massive green quartz is called Prase; the colour appears to be owing to actinolite. It is found in Saxony. *Chrysoprase* is light green amorphous quartz; it is coloured by oxide of nickel. It is found in Silesia and North America.

Yellow Quartz is transparent; of various shades of colour. It is found in Cornwall, Scotland, Bohemia, &c. It is probably coloured by oxide of iron. It has been called Scottish and Bohemian Topaz.

Yellow Quartz is opaque. Ferruginous Quartz occurs of various shades of yellow and reddish-yellow. According to Bucholz, it contains 5 per cent of oxide of iron, to which its colour is owing. It is found near Bristol, in Scotland, &c.

Red Quartz (*Compostella*), Hyacinthine Quartz. Colour yellowish or reddish-brown. It is found in Spain and North America.

Amorphous Quartz. The following varieties of quartz will be found under their articles, AGATE, AVANTURINE, FLINT, FLINTY SLATE, OPAL, and BLOODSTONE.

In addition to these, which may be considered as among the purer varieties of quartz, it occurs mixed with variously-coloured clays and other extraneous matter, forming different kinds of Jasper.

Jasper occurs opaque, which constitutes one of the most prominent differences between it and agate. Its colours are green, yellow, and red, of various shades, rarely blue: these colours are occasionally mixed in spots and irregular veins. Jasper is massive, has often a resinous lustre, but is sometimes dull. It is found on many parts of the continent, in Cornwall, and in Scotland.

Striped or Riband Jasper presents green, yellow, and red colours of various shades, sometimes in spots; but the most beautiful variety is composed of equal and parallel stripes of these colours. It occurs in Siberia, the Harz, and Saxony.

Egyptian Jasper, or Egyptian Pebble, occurs in rough roundish masses, and is generally of a brown colour. Internally it is usually of a light colour. It is found on the surface to the eastward of Grand Cairo, and on the borders of the Red Sea.

It is well known that siliceous earth assumes other forms besides that of quartz and the varieties of it which have now been described; one of the most useful of these is Common Sand.

QUA'SSIA, a name formed in remembrance of a negro named Quassy, who first made known the medicinal virtues of one of the species, is a genus of Plants belonging to the natural order *Simarubaceæ*. It consists of trees inhabiting the tropical parts of South America, particularly Surinam and the adjoining countries. They have leaves pinnated like those of the common ash; flowers with a small 5-parted calyx, 5 petals, a definite number of hypogynous stamens, and a fruit consisting of 5 dry or fleshy drupes.

Q. amara, the true Quassia of modern botanists, is a small tree, with its leaflets in two pairs, with an odd one, and a winged jointed leafstalk. Its flowers are scarlet, large, like those of the Red American Horse-Chestnut, and arranged in narrow racemes. It inhabits the woods of Surinam, Demarara, and probably the greater part of Central America. The wood of the root of this plant was formerly in great repute as a stomachic and as a remedy for the malignant endemic fevers of Surinam. The flowers also were, and still are in that country, infused in wine or spirits, and form a bitter beverage; but the wood is out of use, in consequence partly of its being less easily procured than that of the next species, and partly from an opinion being entertained of some bad properties existing in connection with the intense bitter.

Q. excelsa (*Picræna excelsa*, Lindley) is a large tree inhabiting Jamaica. It has oblong acuminate obtuse leaflets, in from four to eight pairs, and panicled corymbose small pale yellowish-green flowers.

This tree yields the Quassia chips now so extensively employed in Europe as a bitter substance. The wood is imported from Jamaica in billets of various sizes, is white, scentless, but most intensely bitter. It is one of the ingredients employed by fraudulent brewers in adulterating beer.

Q. Simaruba (*Simaruba amara*, Aublet) is the plant which furnishes the bark called Simarouba, which comes from Jamaica in bales, and is used as a tonic, although it also appears to act as an emetic. It is a large tree, found in the West India Islands and on the mainland of America. Its leaflets are 2 to 9 on each side, oval, smooth, firm, and sharp-pointed. The flowers are very small, whitish, and arranged in branching scattered panicles.

The three genera, *Quassia*, *Picræna*, and *Simaruba*, may be distinguished thus:—

Quassia.—Petals forming a tube; stamens 10. Flowers hermaphrodite; ovaries 5.

Picræna.—Petals quite distinct; stamens 5. Flowers polygamous; ovaries 3.

Simaruba.—Petals quite distinct; stamens 10. Flowers unisexual; ovaries 5.

QUATA. [Ateles.]

QUEEN'S GILLIFLOWER. [Hesperis.]

QUERCUS, the Latin word for an oak-tree, which is of frequent occurrence in the Roman writers. It is now, as then, applied to the oak and all the other species associated with it by botanists in one common genus. *Quercus* differs essentially from *Castanea*, the Chestnut, in having short obtuse stigmata, and from both it and *Fagus*, the Beech, in the cells of its ovary containing two ovules instead of four. It is also distinguished by its acorn or nut being seated in a cup, and not in a close husk; but there are intermediate conditions of this part, technically called the cupule, which render it of less value as a mark of distinction than would at first sight appear. Many of the oaks of the hotter parts of Asia have the acorn completely inclosed within the cupule. Still however the prickly husk of the beech and the chestnut, splitting into valves, may in general be distinguished from the closed-up cup of the Indian oaks.

Oaks, like roses, are scarcely known in a wild state in the southern hemisphere. In the islands of the Indian Archipelago they reach their most southern limits, especially in Java; thence they pass upwards beyond the equinoctial line, and following the eastern parts of Asia, they spread to the westward along the Himalaya Mountains, and reaching Europe, are only arrested by the Atlantic Ocean. On the other hand they find their way to the eastward of their Asiatic origin, and overrun America from Canada and Oregon through California and Mexico, till their progress to the south is stopped by the Isthmus of Darien.

While however the genus is thus extensively distributed, the species are confined within comparatively narrow territorial limits. Many of the Javanese kinds appear to be peculiar to the Indian Archipelago, or only occur near the south-eastern angle of Asia. Those of the Himalayas are perfectly distinct from the oaks of the Trans-Himalayan regions, and have not even been found on the mountains of Persia. Several of the Oriental kinds are known nowhere else, and the American species are quite peculiar to that country.

The species are very numerous, and we propose to give some of the more remarkable according to their geographical distribution.

I. Oaks of Europe, Northern Asia, and Barbary.

Under this head we include all the more common species of the genus, the greater part of which exist in cultivation in this country. They may be divided into three groups: the Forest Oaks, or *Robora;* the European Oaks, or *Ilices;* and the Mossy-Cupped Oaks, or *Cerres*.

a. The Forest Oaks (*Robora*).

The species comprehended under this head have deciduous thin leaves, whose lobes are never lengthened into a bristle, and whose acorns are seated in shallow cups, the scales of which are so short and closely pressed to the sides as not to form visible extensions. The wild oaks of England may be taken as the representatives of the others, which differ from them chiefly in the quantity of down upon their leaves, the size of the acorns, and the quality of their timber.

Q. pedunculata, Common British Oak. Leaves sessile or nearly so, with numerous deep sinuosities and a thin texture, with but little polish on the upper side. Acorns arranged in long stalked spikes. This, which is our commonest oak in England at the present day, appears not to be confined to the colder parts of Europe, as has by some been supposed, for we have specimens before us both from Spain and Hungary, but it is certainly much more common in the north than in the south, where its place is usurped by the next species. It has the reputation of being the True British Oak, whose timber is alone suited for naval purposes on account of its durability and hardness; but this is a mere fable, the wood of the next species being as suitable in all respects under equal circumstances. But the timber of the oak, like all other wood, is materially affected by the nature of the soil in which it grows, and this has probably given rise to the often repeated assertion that Sussex oak, which chiefly consists of *Q. pedunculata*, is the best kind that can be employed in ship building. The species is readily known by its leaves having very short stalks, or none at all, while the acorns are placed on very long stalks. In consequence of the importance of distinguishing it from *Q. sessiliflora*, we have thought it desirable to introduce a wood-cut of the plant, common as it is.

1, Common British Oak (*Quercus pedunculata*); 2, Manna-Oak (*Q. mannifera*); 3, Sessile-Cupped Oak (*Q. sessiliflora*).

The *Q. fastigiata* of the gardens is a singular variety, with the branches rising close to the stem, like those of a Lombardy poplar.

Q. sessiliflora, Sessile-Cupped Oak. Leaves on long yellowish stalks, with numerous sinuosities, and a firm texture; much polished on the upper side. Acorns either altogether sessile or arranged in very short stalked spikes. We have already stated that the timber of this has been supposed, although erroneously, to be inferior to that of *Q. pedunculata*. Experiments as to strength and toughness have shown that there is no material difference between the two in those respects, and the durability of the wood of the Sessile-Cupped Oak is attested by the well-known fact, that the roof of Westminster Hall is constructed of it, and not of chestnut, as has been sometimes said. It has been found to be the timber of some of the most ancient of buildings in this country and elsewhere; an immense beam in an old Shropshire building, now called Stone House, was *Q. sessiliflora*, and the oak usually obtained from bogs, where it must have lain for centuries, has often proved to be the same.

The wood may be easily known by its medullary rays, or silver grain, being so far apart that it cannot be rent, and this gives it quite a peculiar aspect. *Q. sessiliflora* is found all over England now, but nowhere in much quantity. It however is more abundant in the west than elsewhere, and constitutes the greater part of the oak of North Wales. It is a much handsomer plant than the last, and grows considerably faster, and therefore is by far the most advantageous kind for the planter. Its comparative scarcity at the present day may perhaps have arisen from its having been felled in preference as long as any of it remained in the ancient forests, which its superiority in size to the other species would render probable, and not having been replaced, it would thus become gradually exterminated. It appears to be still common over all the south of Europe, where however it is not uncommonly mistaken for the last. The supposed species called *Q. apennina* and *Q. microcarpa* are probably varieties of it. What is called the Durmast Oak, which has been regarded as a species by some botanists under the name of *Q. atrovirens*, or *Q. intermedia*, seems to us a slight variety of *Q. sessiliflora*, with the leaves pubescent on the under side. It is here in all probability that the classical *Esculus* of Virgil belongs, for, according to Professor Tenore, a

oroad-leaved variety, which he calls *Q. robur Virgiliana*, answers in all respects to the language of the poet, and its acorns are sweet, and eaten like chestnuts at this day in Italy, where they are called Quercia Castagnara. ('Osserv. sull. Flor. Virgiliana,' p. 12.)

Q. pubescens, a native of the southern parts of Europe, has most of the characters of *Q. sessiflora*, but its leaves are smaller, often quite woolly on the under side, and the lobes are themselves much sinuated. It has been injudiciously confounded with that species, to which it is said to be in all respects inferior in the quality of its timber. It forms a majestic tree, with much the habit of *Q. Cerris*.

The *Q. Esculus* of Loudon is, no doubt, the same as the last; but what the plant was to which Linnæus applied the name, and which has been supposed by some to be the *Esculus* of Virgil, is altogether doubtful. Another oak related to the sessile-cupped is the *Q. pyrenaica*, or Tauzin, a small scrubby tree inhabiting poor sandy soil in the south of France, and throwing up an abundance of suckers. Its wood is of little value except for the staves of casks. This species is readily known by its gray leaves, the hair of which is remarkably coarse.

b. The Evergreen Oaks (*Ilices*).

All the European oaks with leaves truly evergreen belong to this section, which however in some respects approaches the Mossy-Cupped Oaks when the latter acquire a semi-European habit. In such cases they are known by the scales of their cups being very short, and the toothings of their leaves not bristle-pointed.

Q. rotundifolia, Round-Leaved Oak. Leaves nearly orbicular, with spinous teeth, a little heart-shaped at the base, smoothish above, downy beneath. Very little is known of this plant, except that it is allied to *Q. Ilex*. Smith and others say it is a Spanish plant, and if so, they probably meant *Ballota*; but we have before us a Turkish specimen, of which a cut is given, to which the name is very applicable, and which is quite different from that species.

1, *Quercus Brantii*; 2, Round-Leaved Oak (*Q. rotundifolia*).

Q. Ilex, Common Evergreen Oak, or Holm-Oak. Leaves ovate-oblong, acute, coriaceous, entire, or serrated, hoary beneath. Bark even. Acorns ovate, on short stalks. A most variable plant, common all over the south of Europe, where it may be found with leaves varying from being as prickly as a holly to being as even at the edge as an olive, and from the size of a sloe-leaf to that of a beech. It loves the neighbourhood of the sea, and in its wild state generally grows singly or in small clusters, not forming forests. Its wood is very hard and heavy, tough, and in all respects of excellent quality, where its weight is not against it. Its acorns are bitter, and unfit for food.

Q. Ballota, Sweet Acorn-Oak. Leaves elliptical, coriaceous, entire or serrated, very obtuse, white, and downy beneath. Bark even. Acorns cylindrical, elongated. "This evergreen oak," says Captain Cooke, "is one of the leading vegetable features of nearly all Spain. The native woods are formed of it in a great measure. As a species, it is quite distinct from the *Q. Ilex:* the leaves are thicker, more rounded at the point, of a dull glaucous green, and the tree is altogether more compact and of a less graceful form. The great and essential difference however is in the acorns, which are eatable, and when in perfection are as good as or superior to a chestnut. To give this sweetness they must be kept, as at first they have a considerable taste of tannin, which however disappears in a few days. These are the edible acorns of the ancients, which they believed fattened the tunny-fish on the passage from the ocean to the Mediterranean; a fable only proving that the species grew on the delicious shores and rocks of Andalusia, which unhappily is no longer the case."

Q. Suber, Cork-Tree. Leaves ovate-oblong, bluntish, coriaceous, entire or sharply serrated, downy beneath. Bark cracked, fungous. The Cork-Tree is spread through all the warm parts of Spain, but is most abundant in Catalonia and Valencia, whence the principal exports have been made. In the property of forming a spongy soft substance on its bark, it surpasses all other European trees, and hence is of the greatest value for corks and for similar purposes. The form of the tree is said to be much more beautiful than that of the common evergreen oak, and in the districts suited to it attains a great height. The species bears the climate of London, but acquires little of its natural beauty in this country.

Q. faginea, Beech-Oak. Leaves on short stalks, obovate, with numerous uniform shallow lobes; downy beneath; when young somewhat heart-shaped and unequal at the base. Fruit sessile. Cup with downy close-pressed somewhat ciliated scales. Acorn conical or somewhat cylindrical. A native of Portugal, Spain, and Tangiers, and apparently unknown in our gardens. Mr. Barker Webb however, who has studied some of the European species with great care, regards it as identical with *Q. Turneri*, or *Q. Australis*, and if so, we possess it. The same learned botanist reduces to this the Aleppo Gall-Nut Oak, *Q. infectoria*, and he is probably right.

1, *Quercus regia*; 2, Beech-Oak (*Q. faginea*).

Q. coccifera, Kermes Oak. Leaves elliptic-oblong, rigid, smooth on both sides, with spreading, bristly, spinous teeth. Acorns ovate. Cup with spreading pointed scales. A native of the south-eastern parts of Europe, where it forms a small bush, resembling a dwarf holly. It is celebrated as being the haunt of the Kermes insect.

c. Mossy-Cupped Oaks (*Cerres*).

The species of this section are remarkable for their thin deeply

pinnatifid leaves, the long narrow loose scales of their cup, and their equally long deciduous stipules. In this as in other parts of the genus, there is much confusion and uncertainty regarding both the limits of species and the quality of their timber.

Q. Cerris, Turkey Oak. Leaves deciduous, on very short stalks, oblong, deeply and unequally pinnatifid; hairy beneath; lobes lanceolate acute, somewhat angular. Stipules longer than the footstalks. Cup hemispherical, with long loose hairy scales. An exceedingly common plant all over the south-east of Europe, where it seems to form some of the finest specimens of oak. It has an open, straight, graceful mode of growth, very different from the gnarled and tortuous appearance of native British oaks, than which it also grows much faster. It would seem to be unknown in Spain, where its place appears to be taken by the *Q. Hispanica* of Lamarck.

Q. Hispanica, the Spanish Oak. Trunk corky. Branches rather erect. Leaves nearly evergreen, lanceolate acute, with fine serratures or crenatures, which are sharp-pointed, coriaceous, deep-green, glaucous, and downy on the under side. Cups top-shaped, somewhat sessile, with shaggy, prickly, spreading scales. According to Mr. Barker Webb, this plant grows in Spain and by the Algerine river Monchique, and he reduces to it as synonyms the *Q. crenata* of Lamarck, *Q. pseudosuber* of Desfontaines, *Q. Ægilopifolia* of Persoon, and the Lucombe Oak of the English nurseries.

Q. Austriaca, the Austrian Oak. Leaves on longish stalks, ovate-oblong, slightly but copiously sinuated, downy and hoary beneath; lobes short, ovate-acute, entire. Stipules shorter than the footstalks. Cup hemispherical, bristly. It is found in Austria and Hungary.

Q. Ægilops, Great Prickly-Cupped Oak, or Valonia. Leaves ovate-oblong, with bristle-pointed tooth-like lobes, hoary beneath. Cup very large, hemispherical, with lanceolate, elongated, spreading scales. The Morea and adjacent countries produce this valuable tree, which yields the acorns called Velani, or Valonia, in commerce, of which nearly 150,000 cwt. are imported yearly for the use of tanners, and sold at from 12*l.* to 15*l.* a ton. The tree is reported to be handsome in its own country; but with us, although it has long been cultivated, it is an inelegant tree, of a stunted mode of growth. What has been said of its elegant appearance and so forth, seems to belong to *Q. Cerris*.

Great Prickly-Cupped Oak (*Quercus Ægilops*).

II. Oaks of the Levant.

Little has hitherto been ascertained regarding the species of this part of the world. The French traveller Olivier brought home with him a plant very near *Q. Cerris*, the Mossy-Cupped Oak, which he reported to be met with throughout great part of Asia Minor, and to furnish the wood employed in the arsenal of Constantinople. His specimens were examined by Lamarck, who called them *Q. crinita*, but little more is known about the species. Another plant, under the name of *Q. rigida*, has been published from Caramania, where the oaks are said to arrive at a great size and beauty; and *Q. infectoria*, the Common Gall-Oak, has long been known. But there can be no doubt that the mountainous regions intervening between the Turkish empire and India produce oaks that require investigation, and three perfectly distinct species have in fact been sent from Kurdistan. Of all that have yet been found in the countries of the East, we shall give a short account.

Q. crinita, Hairy-Cupped Oak. Leaves on long stalks, oblong, deeply pinnatifid, downy beneath, lobes lanceolate, bluntish, nearly entire. Cup hemispherical, downy, bristly. A tree of Asia Minor, found by Olivier, and figured in his 'Travels,' t. 12, and said to be the same as an Armenian species met with by Tournefort, and after him called *Q. Tourneforti*; but this is doubtful. It is described as a large tree yielding excellent timber, employed extensively by the Turks in naval constructions. There is however very little in the accounts hitherto given of the plant to distinguish it from the Common Turkey Oak, *Q. Cerris*, with which Mr. Loudon combines it, but not upon satisfactory evidence.

Q. infectoria, Oriental Gall-Oak. Leaves ovate-oblong, very smooth on both sides, deeply toothed, somewhat sinuated, deciduous. Fruit sessile. Cup tesselated. Acorn elongated, nearly cylindrical. A very common plant in Asia Minor, where its branches are attacked by an insect, the *Cynips scriptorum*, which punctures them, and causes the formation of the oak-galls so well known in commerce. It forms a scrubby bush rather than tree, and is of no value except for its galls. Its branches occasionally produce large brownish-red tubercles, spongy within, which are by some supposed to be the apples of the Dead Sea, whose appearance was tempting, but which contained only dust and ashes.

1, Stiff-Leaved Oak (*Quercus rigida*); 2, Sweet Acorn-Oak (*Q. Ballota*); 3, Oriental Gall-Oak (*Q. infectoria*).

Q. rigida, Stiff-Leaved Oak. Leaves oblong, undivided, with spinous serratures, smooth, glaucous beneath, heart-shaped at the base. Footstalks bearded at the summit. Scales of the cup rigid, spreading. A native of Caramania, of Kurdistan, and, according to Sibthorpe, of the Morea, but the last is doubtful. It is a handsome-looking plant, so far as can be judged from dried specimens, but nothing is known of its uses.

Q. Brantii, Brant's Oak. Branches, footstalks, and leaves underneath covered all over with thick short wool. Leaves heart-shaped, ovate-acute, with bristle-pointed teeth, ash-coloured, with starry down

on the upper side. This is described in the 'Botanical Register' as being a most remarkable plant; the full-grown leaves being six inches long, including the footstalk, and three inches and a half across at the widest part, which is near the base. They are as downy as those of a young plane-tree. The species appears allied to *Q. Ballota*, a Spanish species.

Q. castaneæfolia, the Chestnut-Leaved Oak. Leaves oblong-lanceolate, rather downy on the under side, coarsely serrated, with bristle-pointed lobes. Acorns nearly sessile, oblong, with the cups, when old, covered by reversed scales. A tree from the province of Mazanderan, reported to be very beautiful. The leaves are often from 4 to 5 inches long. Mr. Barker Webb states that it is the same as what has been called *Q. Libani*, and that it is remarkable for having large depressed fruit, with wide lozenge-shaped scales turned back at the point.

1, Chinese Oak (*Quercus Chinensis*); 2, Chestnut-Leaved Oak (*Q. castaneæfolia*).

Q. regia, the Royal Oak. Leaves stalked, ovate-lanceolate, heart-shaped, wavy, with coarse sharp unequal serratures, on each side green, shining, and smooth. The lobes of the leaves terminated by a conspicuous bristle. From Kurdistan. It is a noble species, with leaves as large as those of a Spanish chestnut, and very like them.

Q. mannifera, the Manna Oak. Leaves stalked, oblong, somewhat heart-shaped, cut; the lobes blunt, smooth above, downy beneath. Young acorns oval, stalkless, smooth. An inhabitant of the Kurd Mountains, where it was discovered by Mr. Brant, the British consul at Erzerum, who found that the Kurds obtain a sweet mucilaginous substance from its branches and leaves by steeping them in boiling water at the hottest season of the year, and afterwards evaporating the water. This substance is made into cakes, and sold in the markets of the town of Van under the name of Ghiok-Helvashée, 'the Sweetmeat of Heaven.' The species is very near *Q. sessiliflora*, especially a form of it which has been named *Q. Mongholica*.

Q. Iberica, the Georgian Oak. Leaves ovate-oblong, downy beneath, sinuated, with short blunt somewhat emarginate lobes. Acorns nearly sessile. Cups hairy, with sharp-pointed scales. A native of Georgia.

III. Oaks of the Himalayas, China, &c.

All travellers in the Himalayas testify to the abundance of oaks. The people employed by Dr. Wallich gathered a considerable number of species, and Dr. Royle assures us that they are found from moderate elevations up to the limits of trees. Among these, all from the lower regions are, no doubt, too tender for cultivation in Great Britain; but of the alpine species some may be expected to prove hardy.

Q. semicarpifolia, Marking-Nut-Leaved Oak. Leaves obovate, obtuse, coriaceous, entire; heart-shaped at the base; downy beneath; the young ones with spinous teeth. Acorns solitary or in pairs, on short downy stalks, depressed at the point, about twice as long as the shallow scaly cups. As this species occurs in the Himalayas at the upper limits of the forests, at even greater elevations than the Pines, it would, no doubt, suit the climate of England; and if so, its introduction would be very desirable, for it is stated to form a magnificent tree, whose timber is much esteemed by the natives.

Q. incana, the Himalayan Ilex. Leaves coriaceous, ovate-lanceolate, shining and smooth on the upper side, densely downy beneath, with coarse serratures which are not bristle-pointed. Acorns solitary, sessile, acute, but little protruded beyond the hemispherical downy cup, the scales of which are small and closely pressed. A beautiful tree, very like the evergreen oak of Europe. Its leaves are much more woolly on the under side. Dr. Wallich found it in Kumaon, where the people called it 'Munroo;' Dr. Royle states it to be the 'Ban' of the hill people, where he saw it, and that it occurs at moderate elevations. It is therefore in all probability tender.

Q. lanata, Woolly-Leaved Nepaul Oak. Leaves elliptic-oblong, deep green, sharply serrated, coriaceous; densely woolly beneath. Fruit in very short axillary solitary spikes. Cup scaly, without prickles. This is one of the handsomest oaks yet discovered. It is found wild in the Himalayas.

Q. annulata, Ring-Cupped Oak. Leaves obovate, taper-pointed, serrated in their upper half; somewhat glaucous and silky beneath. Acorns axillary, sessile, ovate, with the cup furrowed concentrically. Found in the Himalayas.

Q. Chinensis, the Chinese Oak. Leaves ovate-lanceolate, taper-pointed, with bristly shallow serratures, and very long footstalks; slightly downy on the under side. Acorns globose, sessile, in pairs. Cups with hoary lanceolate scales, the exterior of which are reflexed, and longer than the acorn. A beautiful Chinese species, found (by the botanists attached to the Russian mission to Peking) in mountainous places. It is said to have exactly the habit and appearance of a Spanish chestnut. We give a figure of it from specimens communicated by Dr. Bunge, its discoverer.

IV. Oaks of the United States of North America.

In general these are cultivated in England, where they are found tolerably hardy. They however evidently suffer from want of summer heat, and are by no means of the same value to us as the species of the continent of Europe; and it may be doubted whether any of them are ever, in their own country such noble trees as the finest specimens of *Q. pedunculata* and *Q. sessiliflora*. We shall only mention the kinds common in the plantations of Great Britain.

Q. alba, White Oak. Leaves oblong, deeply pinnatifid, glaucous beneath, lobes linear-oblong, obtuse, entire, dilated upwards. Fruit stalked. Cup depressed, warty. A very fine species, producing sweet acorns and excellent timber, and approaching nearer to the European forms than any other American species. Specimens of it in the American forests are often from 70 to 80 feet high.

Q. Prinus, Chestnut-Leaved White Oak. Leaves on longish stalks, obovate-acute, somewhat downy beneath, with nearly equal dilated callous-tipped tooth-like serratures. Cup contracted at the base. Acorn ovate. A tree of considerable beauty, varying considerably according to soil and situation, and hence divided by some writers into many species, called *Q. palustris*, *Q. montana*, *Q. monticola*, *Q. acuminata*, *Q. Castanea*, *Q. pumila*, *Q. Chinquapin*, *Q. prinoides*, *Q. tomentosa*, *Q. discolor*, &c., under all which names it is propagated in the nurseries. The wood is porous, and not of very good quality, but the broad bright green foliage is handsome.

Q. coccinea, Scarlet Oak. Leaves smooth, oblong, deeply and widely sinuated, on long stalks, lobes divaricated, acute, sharply toothed, bristle-pointed. Cup turbinate, half as long as the acorn. The middle States of North America abound in this and the following species, which derive their name from their leaves becoming in the autumn of a rich crimson colour. It forms a large and graceful tree, but the head wants massiveness. The wood is of very little value, and perishable; it is only employed for fuel, and for staves for casks intended to hold dry goods. It grows fast, and stands the climate of even the colder counties of England.

Q. rubra, Mountain Red Oak. Leaves smooth, oblong, sinuated, on long stalks, lobes acute, sharply toothed, bristle-pointed. Cup flat underneath. Acorn ovate. A specimen of this is said by Mr. Loudon to exist at Strathfieldsay 100 feet high; it is very like the last species, but its leaves become more purple in the autumn. Its wood is of bad quality.

Q. tinctoria, Dyer's Oak, Black Oak, or Quercitron. Leaves downy beneath, obovate-oblong, dilated, widely sinuated; lobes short, obtuse, slightly toothed, bristle-pointed. Cup flat underneath. Acorn globose. A native of Pennsylvania and of the mountains of the Carolinas and Georgia, where it becomes a very large tree, with a bark so dark-coloured as to have gained for it the name of Black Oak. The leaves are large and very handsome, becoming dull red or yellow in the autumn. Its wood is strong, but very coarse. The inner bark

abounds in a yellow dye of great brilliancy, which is known in trade under the name of Quercitron. Large quantities of it are annually imported from Philadelphia.

Q. Phellos, Willow Oak. Leaves membranous, linear-lanceolate, tapering to each end, entire, smooth, with a small point. Acorn roundish. Low swampy forests on the sea-coast of the southern states of North America. A large tree with something the aspect of a willow, whence its name. Its timber is stated to be strong, but very coarse. *Q. laurifolia* and *Q. imbricaria* are nearly related to it.

Q. virens, Live Oak. Leaves coriaceous, elliptic-oblong, revolute, entire, pointless; obtuse at the base, clothed with starry down beneath. Fruit stalked. Acorn oblong. A very valuable species, confined to the southern states of the North American Union, where it is most abundant upon the shores of creeks and bays. It is also abundant in Texas. The Live Oak yields the best oak of America, the timber being heavy, compact, and fine-grained; and is extensively employed in the American dockyards, although it does not usually acquire a large size. The acorns are stated to be remarkably sweet. It is much too tender to suit this climate; and consequently specimens are to be found only in curious collections in sheltered warm situations.

V. Oaks of Mexico.

These are extremely numerous, and must in many cases form highly ornamental trees. Several species have been introduced by the Horticultural Society, but we at present know nothing of their habits. It is to be feared that they will in general prove too tender for England.

Q. acutifolia, Sharp-Leaved Oak. Leaves heart-shaped, lanceolate, tapering to a very sharp point, with coarse pointed teeth, covered with rusty down on the under side, especially along the principal veins. Young acorns in spikes, which have a short footstalk. Forests of this tree occur on the road from Acapulco to Mexico, where it is called 'Aguatle.' It is described as a large tree producing timber of excellent quality.

Q. sideroxyla, the Iron-Wood Oak. Leaves oblong, somewhat wedge-shaped, obtuse at the base, armed towards the upper end with sharp-pointed teeth; hoary on the under side. Acorns sessile, ovate, seated in a roundish cup. Found in Mexico, near Guanajuato, and in other places, in dry barren places 6000 or 7000 feet above the sea. It forms a large tree of great beauty. Its timber is very hard, takes a fine polish, and is extremely durable when used under ground or when sunk under water.

Q. lanceolata, the Lance-Leaved Oak. Leaves lance-shaped, entire, wavy, shining on the upper side, strongly bearded beneath at the principal angles of the veins. Acorns oval, sessile, in goblet-shaped cups. Common in Mexico at the height of 5000 or 6000 feet. It is a large tree, producing a very hard wood, very durable when used under ground, and extensively consumed in mining operations.

Q. glaucescens, Blue-Leaved Oak. Leaves on very short stalks, wedge-shaped, obovate, entire near the base, slightly toothed and indented at the edge, glaucous, very smooth. Acorns in racemes. Common in Mexico at the height of 2000 feet above the sea. Its wood furnishes the greater part of the charcoal used in that country.

Q. obtusata, the Blunted Oak. Leaves oblong, blunt at each end, unequal at the base, bent inwards near the middle, on the under side strongly veined, and covered with a powdery down. Acorns spherical, in axillary racemes, almost entirely covered by a scaly cup. A fine tree, native of the Mexican mountains 6000 feet above the sea. Wood very compact and strong, and capable of taking a fine polish.

Q. macrophylla, Larged-Leaved Mexican Oak. Leaves obovate, crenate, tapering and heart-shaped at the base, downy beneath. Fruit spiked. This is doubtless the finest oak in the world. It inhabits the southern parts of Mexico and Guatemala, and has leaves 12 to 18 inches long, and broad in proportion. Its acorns are as large as French walnuts. They have been received in this country by the Horticultural Society, but unfortunately would not vegetate.

For detailed information concerning the species of oaks, the reader is referred to Blume's *Flora Javæ;* the article 'Quercus' in Rees's *Cyclopædia;* Webb's *Iter Hispanicum;* Humboldt and Bonpland's *Plantæ Æquinoctiales;* and Loudon's *Arboretum Britannicum*, vol. iv.

QUERQUE'DULA. [Ducks.]

QUE'RULA. [Muscicapidæ.]

QUERULI'NÆ. [Muscicapidæ.]

QUICKSILVER. [Mercury.]

QUILLWORT. [Isoetes.]

QUINCE. [Cydonia.]

QUINCITE. [Meerschaum.]

QUINQUINA, or QUINA, names given to the species of Plants which are now generally referred to the genus *Cinchona*. In the article Cinchona will be found an account of the species of *Cinchona*, as recognised by botanists previous to the investigations of M. Weddell. This traveller dwelt in the Cinchona districts of the Andes during the years 1845-6-7, and has since published a work on this subject, entitled 'Histoire Naturelle des Quinquines.' In addition to a highly interesting account of the districts, M. Weddell gives a full description of the methods of preparing the Cinchona Barks by the natives, who live in the forests. By dwelling on the spot he was enabled to correct much that was erroneous with regard to the nature and character of the species used in medicine. He also discovered the real plant which yields the yellow-bark, that furnishes the largest quantity of quinine. The following table from M. Weddell's work exhibits the names of Commercial Cinchona Barks, and the species from which they are believed to be obtained:—

I.—Gray Cinchona Barks.

§ 1. Loxa Cinchona Barks. (Crown Bark, Angl.—China-Loxa, Kron China, Germ.)	
Loxa Cinchona Bark, gray compact	*Cinchona Condaminea*, H. et B.
Loxa Cinchona Bark, brown compact (Dunkele Ten China, Germ.—China pseudo-Loxa, Bergen)	*C. scrobiculata*, H. et B.
Loxa Cinchona Bark, red chestnut.—Light Calisaya	*C. scrobiculata*, H. et B.
Loxa Cinchona Bark, red fibrous of the King of Spain. (Quina Estoposa, Pav. in collect., Lamb. Mus. Brit.)	
Loxa Cinchona Bark, yellow fibrous	*C. macrocalyx*, Pav.
§ 2. Lima or Huanuco Cinchona Barks. (Silver Bark, Gray Bark, Angl.—China-Huanuco, Graue China, Germ.)	
Lima Cinchona Bark, gray-brown. (Cascarilla Provinciana, Perux.)	*C. micrantha*, Ruiz et Pav. or *C. lanceolata*, Ruiz et Pav.
Lima Cinchona Bark, gray ordinary	*C. micrantha*, Ruiz et Pav. or *C. lanceolata*, Ruiz et Pav.
Lima Cinchona Bark, white	(?) *C. purpurea*, Ruiz et Pav.
Lima Cinchona Bark, very rugous, resembling the Calisaya Bark.—Cascarilla Negrilla, Peruv. (? Cascarilla Lagartijada, Laubert)	*C. glandulifera*, Ruiz et Pav.
Cinchona Bark, red of Jaen or of Loxa	(?)

II.—Red Cinchona Barks.

(Red Bark, Angl.—Rothe China, Germ.)

Red Cinchona Bark, becoming white in the air	(?)
Red Cinchona Bark of Lima	*C. nitida*, Ruiz et Pav.
Red Cinchona Bark true, non-verrucous (Cascarilla Roja Verdadera, Laubert)	*C. nitida*, Ruiz et Pav.
Red Cinchona Bark, officinal	*C. nitida*, Ruiz et Pav.
Red Cinchona Bark true, verrucous	*C. nitida*, Ruiz et Pav.
Orange-Red Cinchona Bark, verrucous	(?)
Pale-red Cinchona Bark, with a white surface	(?)
Brown Carthagena Bark	(?)
Red Carthagena Bark	(?)

III.—Yellow Cinchona Barks.

Yellow Cinchona Bark of the King of Spain (Cascarilla Amarilla del Rey, Laubert)	*C. Calisaya*, Wedd.
Calisaya Cinchona Bark, or Royal Yellow Bark (Königs China, Germ.—Yellow Bark, Angl.—China Regia, Bergen)	*C. Calisaya*, Wedd.
Orange-Yellow Cinchona Bark; Cinnamon Cinchona Bark (Quinquina—Cannelle), Light Calisaya (Cascarilla Claro-Amarilla, Laub.)	*C. micrantha*, Ruiz et Pav.
Pitaya Cinchona Bark (Quinquina de la Colombie ou d'Antioquia, Guib., 'Hist. Nat. des Drog.'—Cascarilla Parecida à la Calisaya, Laubert)	*C. Candaminea*, Humb. et Bonp.
Woody Carthagena Bark (Quinquina de Colombie Ligneux)	*C. Candaminea*, Humb. et Bonp.
Orange Cinchona Bark of Mutis (Spongy Carthagena Bark; New Spurious Yellow Bark, Pereira)	*C. lancifolia*, Mutis.
§ 3. Huamalies Cinchona Bark. (Rusty Bark, Angl.—China Huamalies, Braune China, Germ.)	
Huamalies Cinchona Bark, dull gray	*C. hirsuta*, Ruiz et Pav.
Huamalies Cinchona Bark, thin reddish	(?) *C. purpurea*, Ruiz et Pav.
Huamalies Cinchona Bark, white	(?)
Huamalies Cinchona Bark, ferruginous	*C. micrantha*, Ruiz et Pav.
Yellow Cinchona Bark of Cuenca	*C. ovalifolia*, H. et B.

IV.—White Cinchona Barks.

Ash-coloured Loxa Cinchona Bark (Ash-Bark, Angl. — Blasse Ten-China, Germ.—China Jaen, Berg.)	*C. ovata*, Ruiz et Pav.
Gray Cinchona Bark, pale ditto	*C. ovata*, Ruiz et Pav.
White Loxa Cinchona Bark	*C. ovata*, Ruiz et Pav.
White Fibrous Jaen Cinchona Bark	*C. ovata*, Ruiz et Pav.
Cuzco Cinchona Bark	*C. pubescens*, Vahl., or *C. cordifolia*, Mutis.
Arica Cinchona Bark	*C. pubescens*, Vahl., or *C. cordifolia*, Mutis.

Pale-Yellow Carthagena Cinchona Bark (Hard Carthagena Bark, Angl.—Quina Amarilla, Mutia.—China Flava Dura, Bergen) . . .	*C. pubescens*, Vahl., or *C. cordifolia*, Mutis.
Orange-Yellow Carthagena Cinchona Bark (Quinquina de Maracaïbo.—China Flava Fibrosa, Bergen) .	
Pitayon Cinchona Bark, or False Pitaya Cinchona Bark . . .	(?)

The following, according to M. Guibourt, are the most active barks:—

1. Calisaya Cinchona Bark.
2. Yellow Orange Bark.
3. Pitaya Bark.
4. Verrucous True Red Bark.
5. Non-Verrucous True Red Cinchona Bark.
6. Red Lima Bark.
7. Gray Lima Bark.
8. Verrucous White Huamalies Bark.

On the subject of distinguishing the various barks of commerce, M. Weddell points out the fallacy of the present method of distinguishing the sorts of bark by the colours red, yellow, and gray, as frequently the same barks at different ages have different colours. Having shown also the impossibility of a chemical classification, he proceeds to make the following remarks:—

"If a classification be absolutely needed, one which should be based on the anatomical structure of the bark would be found to be of far greater utility than either of the preceding, inasmuch as we shall find existing, even in the Cinchonas, a certain relation between the structural and chemical characters.

"The following are the data which my researches on the subject have furnished me with:—

"1. If a large piece of the *Cinchona Calisaya* met with in commerce be attentively examined, it will be found that the exterior surface is entirely deprived of its peridermis, and presents broad superficial furrows, short, more or less confluent, and divided by projecting ridges, the bases of which are of a fibrous texture, similar to the inner surface of the bark or of the layer which is immediately in contact with the wood. The examination of a transverse section shows that the texture of the bark is homogenous, and composed of ligneous fibres of almost equal thickness, uniformly distributed in the midst of cellular tissue gorged with resinous matter, tissue which may be said to isolate each fibre, being interposed in thin layers between them. Finally, when these fibres are examined longitudinally, we find that they are short and fusiform, and that their cut extremities are but loosely attached to each other, and are sometimes completely separate, and appear to float in the midst of the cellular tissue which surrounds them.

"2. If we take a similar piece of the bark of *C. scrobiculata*, we shall find that instead of these furrows of fibrous texture, which so well characterise the *C. Calisaya*, the exterior almost presents a smooth surface of a cellular texture, traversed here and there by slight linear indentations, the inner surface being, as in the preceding bark, of a fibrous texture. In the transverse section the fibres are more numerous than in the *C. Calisaya*, especially towards the inner surface; but they lessen in numbers rapidly near the exterior, and the outermost layer is entirely without them. These fibres, if examined in a longitudinal section, will be found to be of nearly double the length of those of the *C. Calisaya*, and their extremities are invariably attached one to the other, their ends being by this means more elongated.

"3. If we study with equal attention the bark of *C. pubescens*, we shall there find a peculiar structure. The external surface somewhat resembles the preceding bark, with the exception of a slight whitish marbling, formed by the continuity of the peridermis, and scissures which may result from desiccation. The internal surface is fibrous, as in the preceding barks; but a transverse section shows us that it is principally composed of cellular tissue, in which the fibres form but a small number of irregular and concentric series in the interior half of the bark; and that which draws attention at the first glance is the size of these fibres, each one being three or four times as large as those of either of the former varieties; the result being that several of them are attached and united together in bundles, which may be fully proved by the examination of a longitudinal section of this bark.

"As may be perceived, we have only spoken of Cinchonas which have been deprived of their peridermis, because it is in this state that they are now usually met with in commerce. If perchance they were again to be used with their natural coating, it would afford additional means whereby to distinguish them, but would not in any way affect those of which we have just treated; for nothing would be easier than to remove the peridermis and to expose the surface beneath. Be this as it may, the structure of all the Cinchona barks more or less resemble one or other of the three types we have spoken of, and on this plan there might be formed, without much difficulty, a series of groups comprehending all the known Cinchonas. The purpose however in noticing these peculiarities, has been to facilitate the comprehension of a very important fact in the diagnostics of the different kinds of Cinchonas; that of the vast difference they present in their mode of fracture. However singular it may in the first instance appear to be, it is easy to prove that, to a certain extent, the chemical composition of the bark operated upon may be determined by its mode of fracture; or, more properly speaking, there exists a relation between the chemical and the anatomical characters of the Cinchonas, this being constantly proved by a particular form of fracture: smooth or corky where it divides the tunic or cellular covering of the bark; fibrous, stringy, or woody in those cases where it has affected one or other of the three forms of liber before described. Another fact which is now fully proved is, that the bark containing the largest proportion of quinine is that of the *C. Calisaya;* and experience has shown us, that after the *C. Calisaya*, the barks possessing it in the greatest quantities are precisely those the structure of which most resembles this bark; for instance, those in which the dermis is reduced to a single liber by the successive exfoliation of the outer tunics, or at least by their adjunction to the peridermis. On the other hand, experience seems to have shown, to a certain extent, that the Gray Cinchonas (which we have generally found to be the young barks of other species) contain a larger proportion of cinchonine than of quinine; we also know that many old barks, which have retained the cellular coating they had when young, yield a proportionably larger quantity of cinchonine; from which circumstance we may conclude that quinine is contained in the liber, or, more correctly speaking, in the cellular tissue interposed between the fibres of the liber, and that the cinchonine is principally found in the tunic or cellular coating. As to the tannin, it is found in larger quantities in this latter part than in the fibrous tunic—a fact which is easily determined with reference to the fresh bark where the exterior layers of the derm are more styptic than the internal layers." ('Pharmaceutical Journal,' vol. ix.)

The following are the specific characters of the *Cinchona Calisaya:*—Leaves oblong or lanceolate, obovate, obtuse, attenuated at the base, rarely acute on both sides; smooth, polished, or pubescent beneath; scrobiculate in the axils of the veins; filaments usually shorter than one half the length of the anthers; capsule ovate, scarcely equal in length to the flowers. Seeds frequently frimbriate, denticulated at the margin. Of this there are two varieties:—

C. C. vera. A tree with obtuse oblong-ovate or oblong-lanceolate leaves.

C. C. Josephiana. A shrub with somewhat acute oblong-lanceolate or ovate-lanceolate leaves.

Both varieties are natives of Bolivia and Southern Peru.

(*Pharmaceutical Journal*, vol. ix.)

QUINSEY-WORT. [ASPERULA.]

QUISCALUS, a genus of Birds. [STURNIDÆ.]

QUI'SQUALIS, a genus of Plants of the natural family of *Combretaceæ*, which is indigenous in Amboyna, Java, and the Malayan peninsula, and extends into India. The genus is characterised by having a very long slender tube of the calyx, which is 5-fid at the mouth. Petals 5, oval, oblong, larger than the teeth of the calyx. Stamens 10, exserted, inserted into the faux of the calyx; the alternate ones shorter. Ovary ovate, oblong, 4-valved. Style filiform, obtuse. Drupe dry, 5-angled, 1-seeded. Shrubs with climbing branches. Leaves opposite, seldom alternate, entire, ovate. Spikes axillary and terminal. Flowers change in colour from white to red. The few plants of the genus are cultivated in this country with great ease in moist stove-houses in a mixture of loam and peat.

Q. Indica is the most common species; its fruit is reckoned a vermifuge.

QUITCH. [AGROSTIS.]

R

RABBIT. [LEPORIDÆ.]

RACAMINÆ. [VULTURIDÆ.]

RACCOON. [URSIDÆ.]

RACE-HORSE, a Bird. [MICROPTERUS.]

RADIATA. [RAYED or RADIATE ANIMALS.]

RADIOLA (from *Radiolus*, little ray, in allusion to the rayed capsules), a genus of Plants belonging to the natural order *Linaceæ*. It has a calyx of 4 sepals connected below, deeply trifid. There are 4 petals, 4 stamens, 4 capsules, with 8 cells and 8 valves.

R. milligrana is the only species of this genus. It is the *R. linoides* of some botanists, and is a British plant. The stem is from one to two feet high, repeatedly forked, with solitary flowers in the axils as

well as at the extremities of the branches. The flowers are small and white; the capsules light brown, and slightly depressed; the sepals deeply and acutely 3-cleft, connected below into a tube.

(Babington, *Manual of British Botany.*)

RADISH. [RAPHANUS.]

RADIUS. [SKELETON.]

RAFFLE'SIA is the name of a plant found in the hot damp jungle of Sumatra, growing parasitically on a kind of vine, and discovered by the late Sir T. S. Raffles, whose name it bears. It consists of a number of scales investing a fleshy calyx measuring a yard in diameter, and containing the organs of fructification within or beneath the rim of a huge fleshy central column. [RAFFLESIACEÆ.]

RAFFLESIACEÆ, *Patma-Worts*, a natural order of stemless leafless Parasitical Plants, consisting of flowers growing immediately from the surface of branches, and immersed among scales. The perianth is superior, with a 5-parted limb, thickened processes or calli either distinct or united into a ring being attached to the throat of the tube. The essential organs are combined in a column which adheres to the tube of the perianth. Anthers 2-celled, either distinct and opening by vertical apertures, or combined together so as to become a multicellular mass opening by a common pore. Ovary 1-celled; placentas parietal. Fruit indehiscent. The species are East Indian and South American plants, parasitic on the species of *Cissus* and on some *Leguminosæ*. There are 16 species. Some of them are said to be styptic. Their perianth has a fungoid appearance.

Rafflesia Arnoldi, a Sumatra parasite, is capable of containing 12 pints of fluid in its cup. The flower is said sometimes to have a weight of 14 lbs.

R. Patma is employed as an astringent and styptic in Java. *R. Horsfieldi*, *R. Cumingi*, and *R. Rochussenii* have similar properties.

The genera are *Rafflesia*, *Sapria*, *Brugmansia*, *Apodanthes*, and *Pilostyles*.

(Balfour, *Classbook of Botany*; Lindley, *Vegetable Kingdom.*)

RAGGED ROBIN. [LYCHNIS.]

RAGWORT. [SENECIO.]

RAIANIA, a genus of Plants so-called in honour of the great naturalist John Ray, is known by the staminiferous flowers having a bell-shaped perianth in six deep oblong pointed segments, most spreading in their upper part. Corolla none; stamens with six filaments, bristle-shaped, shorter than the calyx; anthers simple. Pistilliferous flowers, the perianth superior, of one leaf, bell-shaped, in six deep segments, permanent, withering; corolla none; pistil with the germen inferior, compressed, with a prominent border at one side, 3-celled; styles 3, the length of the calyx; stigmas obtuse; capsule membranous, of three cells without valves, crowned by the calyx; two of the cells barren, almost obliterated, without wings; the third fertile, compressed, extended into a very large half-ovate membranous wing; seed solitary, nearly elliptical, compressed.

R. hastata, Halberd-Leaved Raiania, is found in the island of St. Domingo. The root is perennial, sometimes large and ovate, sometimes 4 or 5 inches long and 2 inches thick, round at each end. Its substance resembles that of a radish without any internal fibres; the back thin, ash-coloured, a little rugged and warty, the flesh very white, tasting like a bean. The flowers small, whitish, in simple axillary drooping clusters.

R. cordata, Heart-Leaved Raiania, has ovate leaves somewhat heart-shaped at the base, 7-ribbed. It is a native of the West Indies, from whence it was sent to Kew Gardens in 1786, by Mr. Alexander Anderson. Plumier represents the habit of the root, stem, &c., much like the foregoing; but the leaves are regularly ovate, pointed, more or less heart-shaped at their base, and furnished with seven ribs continued from that part to the point. These ribs are connected by numerous transverse veins.

R. ovata, Ovate-Leaved Raiania, has ovate-pointed 3-ribbed leaves. It is a native of the hills of St. Domingo, and has a shrubby stem, turning thread shaped, sub-divided with slender smooth leafy branches. The leaves rather distant, stalked, smooth on both sides, pointed, entire, 3-ribbed, being ovate at the base. The flowers dioecious, the males in compound clusters, females in simple ones; all stalked and turned toward one side. Corolla very minute, yellowish-green in the male, reddish in the female blossoms.

R. angustifolia, Narrow-Leaved Raiania, is a native of the west part of St. Domingo, where it climbs upon high trees, flowering in May.

R. quinata, Five-Leaved Umbellate Raiania, has five leaves on a common stalk. It was observed by Thunberg about Nagasaki, and in Japan, flowering in April and May. The stem is twining, round, smooth, ash-coloured, and branched. Leaves several together, axillary, stalked, smooth. Flowers in umbels from the same buds as the leaves, on slender stalks, as long as the footstalks.

R. hexaphylla, Six-Leaved Clustered Raiania. Leaves six, on a common stalk, oblong-acute. Flowers racemose. It is a native of the country of Fakonia, in Japan, among bushes, flowering in April. The stem is round, striated, smooth, climbing. The flowers in axillary racemes, clusters snow-white. It differs from *R. quinata* in having mostly six leaflets on a stalk, which are acute, reticulated, with veins at the back, and larger than in that species. The flowers moreover grow in clusters, not in umbels.

RAIIDÆ, or RAIINÆ, a sub-order, or family of Plagiostomous Cartilaginous Fishes, of which the Common Ray is the type. The body of these fishes is horizontally flattened, and more or less discous; the dorsal fins are mostly placed on the tail; a peculiar cartilage, called naso-pectoral, arises from the nasal part of the skull, and extends towards or meets the anterior part of the crest or pectoral fin; the branchial openings are inferior.

This sub-order is divided into the following families or tribes:—

1. *Cephalopteridæ*, Horned Rays.—They have a muzzle distinguished by two horn-like processes; the mouth before or beneath very broad; teeth very small, in some wanting in upper jaw; tail as long as or longer than body, with a back-fin and spine. The genus *Cephalopterα* has large lateral eyes and a transverse mouth, with small teeth like a file.

C. Giorna is the only species known in the European seas. A specimen of this fish was once taken on the southern coast of Ireland. It has been described by M. Risso as frequent on the coast of Nice. It approaches the shore, and is most frequently taken in the month of July. In Italy the small ones are called Vachetta, and the larger ones Vacha. It dies immediately on being taken out of the water. It is eaten by the poorer classes at Nice, but is not tender. They grow to a prodigious size. Risso records a male weighing 800 lbs. and a female weighing 1200 lbs.

2. *Myliobatidæ*, Eagle Rays.—The head is partially disengaged from pectorals; mouth transverse; teeth large, mosaic-like; eyelids wanting; tail long, with a back-fin on root and a serrated sting behind. The genus *Myliobatis* has flat teeth; the central plates much longer than those which are lateral; pectoral fins wing-like; the tail armed with one fin upon the root, behind that a serrated spine.

M. aquila, the Whip Ray, the Eagle Ray, and the Mullen. This fish, though rare, has been found on the British coasts. Dr. Johnston has described a specimen found at Berwick-upon-Tweed. It inhabits the Mediterranean, and has been taken as far south as the Cape.

3. *Trygonidæ*, the Sting Rays.—The head is laterally inclosed by the pectorals; the teeth transversely elliptical; the tail without any fin, or merely a low vertical cuticular hair, and with one or more sharp serrated spines.

The genus *Trygon* has the characters of the family.

T. pastinaca, the Common Trygon, the Sting-Ray, the Fire Flaire, La Pastinaque of the French, is an example of this family. It was well-known to the ancients, who entertained many fictions with regard to the venom of the spines of these fish. It is not unfrequent on the British coasts. The powerful serrated spine on its tail is used as an organ of defence.

4. *Anacanthidæ*, Stingless Rays.

5. *Raiidæ*, the Skates.—The body is rhomboidal; tail depressed, slender, generally with a low terminal fin, and frequently with rows of small spines; skin smooth or with small curved prickles; teeth flat, pavement-like, and pointed in males in spawning time. The genus *Raia* has two small fins near the end of the tail; the eyes and temporal orifices are on the upper surface of the head; the nostrils, mouth, and branchial apertures beneath.

The Skates are very numerous on the British coasts, and some of the species are used as food. The young are deposited in a similar manner to the sharks, in their horny cases of a square form, with four projecting horns, giving them the form of a butcher's tray. These cases are very frequently picked up on the sea-shore, and are sometimes called sea-purses. In Cumberland they are called Skate-Barrows, on account of their form. As the young fish increases in size it at last separates the edges of the horny layers in which it is inclosed, and escapes into the ocean. The following are the British species of this genus:—

R. mucronata, the Long-Nosed Skate, remarkable for its long pointed nose.

R. oxyrhynchus, the Sharp-Nosed Ray, the White Skate, the Burton Skate.

R. intermedia, the Flapper-Skate.—This species was first taken in the Frith of Forth by Dr. Parnell, and first described by him.

R. batis, the Skate, the Blue Skate, the Gray Skate, the Tinker, La Raie Cendrée of the French. This is one of the commonest species on our coast. The preceding species as well as this, the Thornback, and the Homelyn, are all commonly called Skate.

R. marginata, the Bordered Ray. It has been only occasionally taken in Great Britain.

R. microcellata, the Small-Eyed, or Painted Ray. This is a rare species.

R. miraletus, the Homelyn, the Home, the Sand Ray, and Spotted Ray. It is one of the commonest species along the line of our southern coast. With the Thornback it is the most common species found in the London market.

R. spinosa, the Sandy Ray, Raie Râpe of the French. It has been only occasionally taken in the British Islands.

R. fullonica, the Shagreen Ray. This species is known by its rough back. It is only occasionally taken in the British Islands.

R. clavata, the Thornback, the Rough Ray. This Ray is easily distinguished by the spiny plates with which it is covered. Its flesh is regarded as the finest of all the Rays. It is in the best condition for the table about November.

R. radiata, Starry Ray. A rare species.

6. *Torpedinidæ*, the Torpedoes.—The head is very large and surrounded by pectorals, so as to form a circular disc; the tail is short, fleshy, depressed at the base, cylindrical at the extremity; mouth beneath; teeth pointed or flat. These fish are many of them remarkable for their power of giving electric shocks. [ELECTRICITY IN ORGANIC BEINGS.] There are two species of *Torpedo* found on the British coasts.

Torpedo vulgaris, the Old British Torpedo, the Common Cramp-Fish, the Numb-Fish, the Electric Ray, and the Cramp-Ray. This fish is only occasionally found on our coasts.

T. nobiliana, the New British Torpedo. This is identical with the *Torpedo* of the Mediterranean.

7. *Rhinobatidæ*, the Beaked Rays, have the muzzle generally beaked and pointed; the mouth undulated; the teeth rounded or elliptical, in some broader than long, and longer on summit of undulations; body smooth; caudal fin bilobular, or cut obliquely, forming one lobe. These fishes connect the Sharks and Rays. The species inhabit the Mediterranean, the Atlantic, and the coasts of Brazil. They are not found on the coasts of Britain.

8. *Pristidæ*, Saw Fishes.—The snout is produced into a long flat osseous saw-shaped blade, with teeth on the lateral edges; body flattened before, somewhat elongated posteriorly; skin with very small, flat, roundish, or 6-cornered scales; mouth beneath.

(Adams, Baikie, and Barron, *Manual of Natural History;* Yarrell, *History of British Fishes.*)

RAIL. [RALLIDÆ.]

RAIN, FOSSIL. Singular as may appear the notion that the impressions of rain should be recognisable and be recognised on the surfaces of stratified rocks, the opinion is held by some eminent geologists, on the evidence of specimens of New Red-Sandstone taken from the Storeton Quarries near Liverpool. In March, 1839, Mr. Cunningham, to whose researches in the Storeton Quarries we are indebted for much of our knowledge of the foot-prints of *Cheirotheria* and other ancient animals, communicated a paper on the subject to the Geological Society of London. "In examining some of the slabs of stone extracted at the depth of above 30 feet, Mr. Cunningham observed that their under surface was thickly covered with minute hemispherical projections, or casts in relief, of circular pits in the immediately subjacent layers of clay. The origin of these marks, he is of opinion, must be ascribed to showers of rain, which fell upon an argillaceous beach exposed by the retiring tide, and their preservation to the filling up of the indentations by sand. On the same slabs are impressions of the feet of small reptiles, which appear to have passed over the clay previously to the shower, since the foot-marks are also indented with circular pits, but to a less degree, and the difference Mr. Cunningham explains by the pressure of the animal having rendered these portions less easily acted upon." If these impressions on the clay be really the marks of rain or hail (a specimen is before us, and it certainly resembles such impressions on clay), perhaps the easiest way of comprehending the preservation of them is to suppose dry sand drifted by the wind to have swept over and filled up the foot-prints, rain-pits, and hollows of every kind which the soft argillaceous surface had received. (*Geological Proceedings*, 1839.)

RAISINS, Dried Grapes. [VITIS.]

RA'LLIDÆ, a family of Birds belonging to the *Grallæ* of Linnæus, *Grallatores* of Illiger. The species are commonly called Rails.

Brisson placed the Rails in the first section of his 17th order, with the Lapwings, the Jacana, the Pratincole, &c.

The genus *Rallus* of Linnæus consisted of Rails properly so called; and the species in the last edition of the 'Systema Naturæ,' as left by him, were *Crex aquaticus*, *C. Porzana*, *C. fuscus*, *C. striatus*, *C. torquatus*, *C. Philippensis*, *C. Benghalensis*, *C. Carolinus*, and *C. Virginianus*. The genus is placed in the order *Grallæ* (the fourth), between *Parra* and *Psophia*.

Latham also gave it a place among the *Grallæ* (his seventh order), between the Pratincole and the Jacana.

Lacépède arranged *Rallus* among his Oiseaux de Rivage, in his thirty-third order (birds with a straight and compressed bill), between the *Hians* and *Scopus*.

In M. Duméril's system *Rallus* is placed in the first family (Pressirostres or Ramphostènes) of his fifth order, Echassiers, between the Jacanas and Oystercatchers (*Hæmatopus*).

Illiger's *Macrodactyli*, belonging to his sixth order, *Grallatores*, include the genera *Parra*, *Rallus*, and *Crex*.

In Cuvier's fifth order, Echassiers, *Rallus* appears in its fifth family, Macrodactyles, between the Kamichis (*Palamedea*) and the *Fulicæ*.

M. Vieillot's second tribe (*Tetradactyli*) of his fourth order (Echassiers) includes, among many other families, the Macrodactyles, including the genera *Rallus*, *Porzana*, *Porphyrio*, and *Gallinula*. The Macrodactyles are placed between the Macronyches (*Jacana*) and the Pinnatipèdes (*Fulica*, *Phalaropus*, &c.).

M. Temminck places *Rallus* between *Scolopax* and *Gallinula*, in his thirteenth order (Gralles).

In M. De Blainville's system *Rallus* is also placed among the Macrodactyles, in the order *Grallatores*.

The Macrodactyles of M. Latreille form the sixth family of his fourth order, Echassiers, and consist of the Jacana, Kamichi, and Chauna.

M. Lesson makes the Rallusinées, the fourth family, according to him, of the Echassiers, consist of the genera *Jacana* (*Parra*), *Palamedea*, *Chauna*, *Glareola*, *Rallus*, *Crex*, *Gallinula*, *Porphyrio*, *Podoa*, and *Fulica*. The Rallusinées are placed between the *Scolopacidæ* and the *Charadriadæ*.

In Mr. Swainson's 'Synopsis' the *Rallidæ* are placed between the *Tantalidæ* and *Scolopacidæ*, and consist of the following genera. *Parra*, *Porphyrio*, *Fulica*, *Rallus*, *Gallinula* (with the sub-genus *Alecthelia*).

The genera of *Rallidæ* (which family he places between the *Scolopacidæ* and the *Phaleropodidæ*), enumerated by Prince Bonaparte in his 'Birds of Europe and North America,' consist of *Aramus*, Vieill., *Rallus*, Linn., *Ortygometra*, Leach, *Gallinula*, Briss. (*Stagnicola*, Briss.), *Fulica*, Linn., and *Porphyrio*, Ray.

The *Rallidæ*, in Mr. G. R. Gray's 'List of the Genera of Birds,' are the fifth and last family of the *Grallatores*, and immediately preceded by the *Palamedeidæ* (which embrace the genera *Parra*, *Chauna*, *Palamedea*, and *Alecthelia*). The order *Natatores* follows.

The following are the sub-families and genera of Mr. G. R. Gray's *Rallidæ*:—

Sub-Family I. *Rallinæ*.

Genera. *Ortygometra*, Ray (*Rallus*, Linn., *Porphyrio*, Briss., *Crex*, Bechst., *Gallinula*, Lath.).

Porzana, Vieill. (*Rallus*, Linn., *Gallinula*, Lath., *Zapornia*, Leach).

Rallus, Linn. (*Gallina* (*Gallinula* ?), Ray).

Ocydromus, Wagl. (*Rallus*, Forst.).

Sub-Family II.

Porphyrio, Briss. (*Fulica*, Linn., *Gallinula*, Lath.).

Gallinula, Ray (*Fulica*, Linn., *Hydrogallina*, Lacép., *Stagnicola*, Brehm.).

Fulica, Linn.

Sub-Family III. *Heliornithinæ*.

Heliornis, Bonn. (*Plotus*, Gmel., *Podoa*, Ill., *Colymbus*, Bodd.).

Podica, Less. (*Heliornis*, Vieill., *Podoa*, Boie, *Rhigetura*, Wagl.).

We proceed to notice some of the leading forms of this family:—

Rallidæ.—Feet very large; bill in general short, and greatly compressed; tail excessively short, nearly hidden by the coverts; hinder toe elevated. (Swainson.)

Parra.—Bill straight, slender, moderate; feet very long; toes and claws of enormous length; the latter straight or recurved; carpus generally armed with acute spurs. (Swainson.)

Parra Africana.

Mr. Swainson remarks that the Jacanas or *Parræ* are wading birds, somewhat analogous, both in structure and habits, to the European Water-Hen; but in their native haunts from not being disturbed, they are less shy. "The number of these birds," says Mr. Swainson, "on the lakes of Brazil, the elegance of their movements, and their fearlessness of man, excite an interest in the traveller who journeys through regions ornamented alone by nature. They are very light birds, and their long toes spreading over a wide surface enable them to walk on the floating leaves of aquatic plants with as much facility as if they were on land. In such situations their appearance is really delusive; for their pressure being sufficient to sink the surrounding leaf just below the surface, the birds actually appear to walk upon the water." ('Zool. Ill.,' second series).

The species are numerous in South America; some in India; and a few in Africa.

P. Africana. Deep cinnamon above; crown of the head naked; throat white; breast fulvous; neck and quills black; spur on the wing obsolete.

It has been found in Africa, Abyssinia (Bruce), Mozambique (Salt), Western Africa (Swainson, on the authority of Ward), South Africa (Smith).

The strong bony spur with which the wing is armed in the typical species, becomes so small in *P. Africana*, that it is hardly perceptible when the wing is closed. In another African species, *P. Capensis*, the spur or spine has become a small tubercle. The African Jacanas may therefore be referred to the aberrant group of this genus. Dr. Smith only met with one individual of *P. Capensis*, and he strongly suspects that is was in immature plumage. It was killed while seeking for its food upon some water-plants which coated the surface of a small river near Algoa Bay, and he has figured the bird standing on a leaf of a water-lily. He notices *P. Africana* as the only other species of the group which has yet been found in Southern Africa, and states that it never ranges so far to the westward as the Cape Colony, though it is often found to the westward of Port Natal.

Porphyrio.—Bill short, strong, high; the base dilated into a flat plate on the front of the head; the culmen arched. Nostrils large, basal, covered by a membrane, naked; the aperture terminal and oval. Feet very large. Toes without any lateral membrane. Claws large, slightly curved. (Sw.)

These birds live nearly like the Water-Hens, to which they are most closely approximated: like them, their habitual haunts are the fresh-waters; but the immense rice-fields and marshes of the south equally serve them for an asylum and retreat. More inclined by their appetite to cereal grains and plants, than aquatic herbs, the Porphyrios frequent the land more than the Water-Hens; they move with grace on the water, and run with elegance and swiftness on the land or over the plants which grow in the water. Their body is not so compressed nor so slender as that of the water-hens; their formidable bill, composed of a very hard substance, and nearly without a nasal fossa, which is covered by a membrane, serves them as an instrument for cracking the husks of grains and breaking the hardest stems; their feet, which they use to seize their food and convey it to their bill, are provided with very long toes, easily retractile, and with nails which bend also with some facility, which gives them a power of prehension. A brilliant plumage, where blue or a turquoise hue predominates, clothes the greatest number of the known species.

It is not clear what species of this genus was known to the ancients, who held it in high estimation. The *Porphyrio* does not appear to have been sought after for any other purpose than that of keeping it alive; indeed Ælian states that he never heard of one being served at any banquet. Pliny ('Hist. Nat.,' x. 46 and 49) speaks of the Porphyrios as 'laudatissimi in Comagene,' and says that their bill and long legs are red; the Balearic Islands are also named by him as a place whence they were sent to Rome. He speaks of their peculiar mode of drinking, their soaking their food in water and raising it to their bills in their claws; "Bibunt aves suctu, ex his quibus longa colla, intermittentes, et capite resupinato velut infundentes sibi. *Porphyrio* solus morsu bibit, idem est proprio genere, omnem cibum aqua subinde tingens, deinde pede ad rostrum veluti manu afferens."

But there was another quality which was supposed to reside in the *Porphyrio*, which made it both a highly prized and dangerous inmate. The bird was considered as a kind of guard over the women of the house in which it was domiciled: it was believed that it took notice of adultery, and that if the crime was committed, it would give notice to the master of the house by making signs as if it wished to strangle itself. It is to this that the old quatrain alludes in the 'Portraits d'Oyseaux:'—

> "Porphyrion declare l'adultère
> Fait au logis auquel on l'entretient:
> Car à ces fins tous les semblans ils tient
> De se vouloir estrangler et deffaire."

P. hyacinthinus (*Pollo Sultano*, Savi). Bill fine red; legs and feet fleshy red; irides lake-red; cheeks, throat, sides of the neck, and chest turquoise-blue; remainder of the plumage deep dull indigo-blue, having the edges of the greater and lesser coverts of the wings lighter in colour and more brilliant; under tail-coverts white. (Gould.)

Young of the Year.—Belly, till the month of October, white; occiput yellowish-brown; median part of the head whitish; mantle bluish-ash. Feet reddish-olive. At the time of the moult, which takes place towards the end of October, individuals are found in a state of transition from the livery of youth to that of the adult: early in May the rich blue plumage is complete. (Temm.)

"Independently of the southern and eastern parts of Europe, the marshes of which are the places of constant resort for this beautiful bird, its range is extended," says Mr. Gould, "over a great portion of Africa to the south, and as far as the mountains of the Himalaya to the east. In Europe it is especially abundant in the Grecian Archipelago, the Levant, and the Ionian Islands; it is less common in Dalmatia and Sardinia. The southern provinces of Hungary and Russia and the borders of the Caspian Sea may also be enumerated among its European localities." M. Temminck states that it is to be seen in many cities of Sicily (where, according to M. Cantraine, it is very common in the neighbourhood of Lentini), that it is not known in Dalmatia nor Calabria, and is rare in Sardinia; and that it is known in Catania under the name of Gallo-Fagiano.

Porphyrio hyacinthinus.

Mr. Gould states that, like the Water-Hen, or Common Gallinule, this species dwells on the borders of rivers and in all marshy situations. In its food it is partly herbivorous, feeding on various kinds of marine vegetables; still, as the robust and hard character of its bill implies, it prefers hard seeds and grain, to which are added snails, frogs, and other aquatic animals.

"Although its form," continues Mr. Gould, "would seem to deny the fact, its actions and appearance on the land are both elegant and graceful. It is extremely quick in all its movements, running with ease and swiftness; and from the great expansion of its feet, it is enabled to pass with facility over soft oozy mud, aquatic herbage, &c.; but although much agility characterises this species on land, its aërial evolutions are heavy, and apparently performed with considerable difficulty." M. Temminck states that it lives in the marshes where the water is not deep, and that its stupidity is such that when closely pursued it buries its head in the mud. M. Verneuil informed him that solitary individuals are sometimes found in Dauphiné; that of the museum of Grenoble was, he adds, killed in the marshes of Burgundy.

It breeds in marshes, much in the manner of the Common Gallinule, giving preference to the sedgy parts of the morass and partly inundated rice-fields, where it constructs a nest of aquatic plants, and lays three or four white and nearly round eggs. (Gould.)

Fulica.—Bill as in the *Porphyrio*, but more slender; the base straight; the gonys short and angulated. Feet very large; the toes margined with a lateral membrane, which is either narrow and of equal breadth or dilated into lobes. The natatorial type. (Sw.)

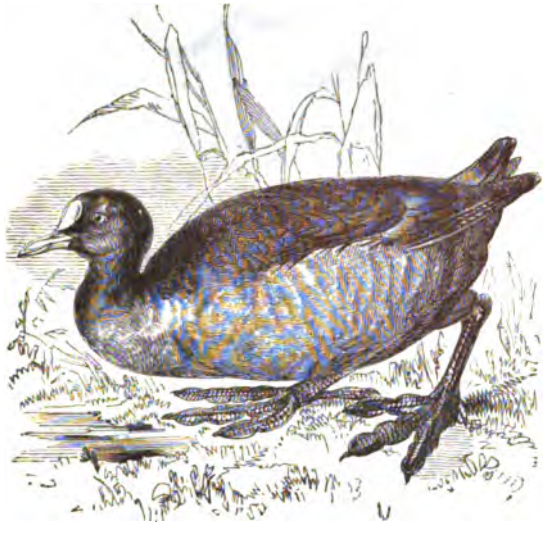
F. atra. It is the Foulque, Macroule, or Morrelle, of the French; Schwarzes Wasserhuhn of the Germans; Meir Koet of the Netherlanders; Folaga and Folacra of the Italians; Blas-Klacka of the Swedes; Vand-Hoene and Bles-Hoene of the Danes; Jâr Ddwfr Foel of the Welsh; and Coot of the English. Some have thought that it is the Κέπφος of Aristotle.

The head and neck are of a deep-black; upper parts slaty-black; all the lower parts bluish-ash; frontal plate very wide, pure white; bill white, slightly tinged with rose-colour; iris crimson-red; feet ash-colour, tinged with greenish, but of a yellow or greenish-red above the knee.

The sexes do not differ, excepting that in the female and the young the frontal plate is less developed, and that in the latter, after the autumnal moult, the lower parts are slightly tinged with reddish. Before the moult, the frontal plate of the young is hardly apparent, and that and the bill are greenish-ash; all the lower parts are whitish-ash: in this state it is, according to M. Temminck, *Fulica Æthiops*, Sparm.; Gmel.

It is found throughout Europe, in marshes, lakes, and gulfs; very abundant in Holland and in the lakes of the interior of France; less numerous in Germany and Switzerland. Dr. Von Siebold and M. Bürger saw it in Japan.

"The Coot," says Mr. Gould, "is indigenous to our islands, residing on all large sheets of water, but giving preference to those overgrown with rushes and margined with a belt of thick reeds and luxuriant vegetation." Such is the meer or pond before William of Wykeham's palace at Bishop's Waltham, where they abound. In such haunts it builds, early in the spring, a strong and solid nest of rushes, grasses, and water-plants. The large nest thus constructed rises above the surface of the water, on the bottom of which, when shallow enough, the base of the nest sometimes rests. Its more frequent situation however is in the reedy and rushy tufts and rank vegetation of the water's edge, so as to be concealed. The eggs, which are brownish-white, spotted with dark brown, range from seven to ten in number. The young, when hatched, are clothed in a black down, and take water very soon. As winter approaches the Coot seeks the open waters near the sea, and the mud-flats at Southampton are among the places visited by them in great numbers. The Coot swims and dives admirably, but flies heavily and with effort. Its food consists of worms, slugs, aquatic plants, insects, &c.



The Coot (*Fulica atra*).

Much cannot be said for it as an article of food, except when it is young, and then it requires much perseverance to get off the black down next to the skin.

Gallinula.—Bill short, straight, the margins not inflexed; the cutting edges of the upper mandible folding over the lower. Gonys very short, angulated. Toes simple, without any marginal membrane. The rasorial type. (Sw.)

G. chloropus is the Poule d'Eau of the French; Gallinella of the Italians; Wasserhuhn, Grünfüssige Rohrhuhn, and Braune Meerhun, of the Germans; Common Gallinule, Water-Hen or Moor-Hen of the English; and Dwfriar of the Welsh.

Water-Hen (*Gallinula chloropus*).

Old Male.—Head, throat, neck, and all the lower parts slaty-blue; upper parts deep olive-brown; external border of the wings, large longitudinal spots on the sides, and lower coverts of the tail, pure white; three or four of the feathers placed at the centre of the tail-coverts deep black; base of the bill and large frontal plate bright red, point of the bill yellow; iris red; feet yellowish-green; on the tibia a naked circle of a fine red.

The Old Female differs only in having the tints of the plumage a little less bright.

The Young, till their second autumnal moult, differ much from the old. The top of the head, the nape, the back, and the rump are olive-brown; quills deep brown, terminated by bright brown borders; tail deep brown; throat, front of the neck, and a spot below the eye whitish; rest of the lower parts bright gray; point of the bill olive-green, blending into olive-brown at the base; iris brown; feet olive, but tinged with yellowish on the tibia.

Young of the Year.—More of the whitish around the bill; and the lower parts with the tints less bright. Individuals in a state of transition from one period of age to another have the frontal plate more or less large, coloured with red or yellowish.

"One circumstance," says Mr. Gould, in his 'Birds of Europe,' "respecting this familiar bird appears to have escaped the notice of most ornithologists: we allude to the fact of the female being clothed in a dark and rich plumage, and having the base of the bill and the frontal shield of a bright crimson-red tipped with fine yellow; her superiority in these respects has caused her to be mistaken for the male, which, contrary to the general rule, is at all times clothed in a duller plumage, and has the upper surface more olive than in the female; the bill is also less richly tinted. We were first led to notice this fact in consequence of observing the birds sitting or rising from the nest to be those whose richly-coloured bills had induced us to believe them to be males, and which the dissection of a great number of individuals has now fully proved to us to be the females. Besides this difference, the sexes vary in size, the female being about one-fifth less than her mate."

This species appears to be not only dispersed over the whole of Europe, but extends its range over the greater portion of Africa and India; and, like the Peregrine Falcon and Barn-Owl, may be said to be universally distributed over the globe. "It is even questioned," says Mr. Gould, "whether those from tropical America, China, and the islands of the Pacific, which exhibit the most trifling marks of difference, should not be considered as identically one and the same species." It was seen by Dr. Von Siebold and M. Bürger in Japan; and M. Temminck remarks that the African variety, which is also found in the isles of Sunda, has the anterior border of the wing reddish; the lower tail-coverts, which in European, Asiatic, and Japanese individuals are of pure white or Isabella colour, have a reddish tinge in the variety from Africa and the Sunda Isles, which is also somewhat less than European and Japanese birds, and has the frontal plate larger. The variety from the Sunda Isles is, according to M. Temminck, *Gallinula orientalis* of Horsfield, ('Linn. Trans.,' vol. xiii.) The only difference between the Japanese bird and that of Europe is the Isabella tint of the lateral under tail-coverts in the former: in the European variety those feathers are white.

In our islands the haunts of the common Gallinule are rivers, meers, ponds, sedgy spots, and marshy places. The nest is formed of interlaced flags, weeds, &c., generally in the most concealed parts of the rushy rivulet or sedgy margined pond, and in it from five to nine pale yellowish-brown eggs spotted with red are deposited. Incubation continues for three weeks. The young are exposed to many enemies, for their parent has not only to guard them against birds of prey and the smaller *Carnivora*, rats, &c., but against the attacks of the pike. The food consists of aquatic insects, molluscs and worms, seeds, and water herbage. The flesh of a water-hen, in good season, after having had the advantage of a neighbouring wheat or barley stubble, is well flavoured, juicy, and sapid. The sportsman who is not well acquainted with their habits, often leaves them behind perched among the boughs of the trees or shrubs that overhang the water or closely adjoin it; for these birds when hard pressed not uncommonly get up into such retreats till the danger is passed. On its feet it is lively and not ungraceful; on wing it is heavy and slow.

Some of the African Gallinules, figured by Dr. Smith (*G. dimidiata* and *G. Jardinii* for instance), present certain differences which would appear to warrant subgeneric distinction.

Rallus.—Bill lengthened, slender; both mandibles in general slightly curved, and with their margins considerably inflected beyond the nostrils. The tenuirostral type. (Sw.)

R. aquaticus is the Rale d'Eau of the French; Porciglione, Merla Aquarola, and Merla d'Acqua, of the Italians; Wasser Ralle of the Germans; Water-Rail, Bidcock, Bilcock, Velvet-Runner, Brook-Runner, and Brook-Ousel, of the English; and Cwtair of the Welsh. It is the Raale Noir of Bélon, who gives the following synonyms:—'Ορτυγομήτρα, *Matrix Cothurnicum*, *Ralla*, Raale, Ralle, Roy et Mere des Cailles, and Re de Quaglie.

Throat whitish; sides of the head, neck, breast, and belly, leaden-ash colour; all the feathers of the upper parts red-brown, marked in the middle with deep black; sides deep black transversely striped with white bands; lower coverts of the tail white; bill red but clouded with brown at the point and above; feet brown flesh-colour; iris orange.

The Young of the Year have the middle of the belly of a red-

brown, and the abdomen is blackish-ash without the white bands. (Temminck.)

Mr. Gould remarks that the sexes are alike in plumage, but that the male is generally the largest. M. Temminck observes that they undergo a double moult, but that there is no marked difference between the two liveries.

It is distributed generally all over Europe, but it is more particularly abundant in the low districts of Holland, Germany, and France. In our Islands it is more plentiful than is generally believed from its very shy and retired habits. Dr. Von Siebold and M. Bürger saw the bird in Japan.

Water-Rail (*Rallus aquaticus*).

"Except when closely watched," says Mr. Gould, "the Water-Rail seldom takes to flight, but evades pursuit by quietly yet quickly traversing the bottoms of thick-set reed-beds and banks overgrown with luxuriant vegetation bordering the sides of pools and ditches, where it finds a covert through which its slender and compressed form enables it to pass with the greatest facility; besides which it possesses the power of swimming and diving, both of which materially aid its escape. Without denying the possibility of this bird being migratory, we have the strongest reason to believe that numbers remain with us during the whole of the year, frequenting during the summer season fen-land, morasses, ponds, and ditches, about which it incubates; resorting on the approach of winter to the sides of our large streams and rivers. Its nest is composed of rushes and vegetable fibres closely concealed among herbage, at a little elevation from the water; its nidification in fact closely resembles that of the Moor-Hen. Its eggs are of a yellowish-white colour, marked with spots of red-brown. Its food consists of worms, snails, soft insects, and their larvæ, which abound in swampy places; vegetable substances also form a part. The young, when first excluded from the egg, are covered with black down, and are observed to be in perfect possession of the powers of swimming, and providing for their own safety and subsistence, remaining however under the parent's care and protection."

The Water-Rail is a delicious bird for the table. The writer of the old quatrain in the 'Portraits d'Oyseaux,' thus alludes to its celerity in running:—

> "Le Rasle noir par les ruisseaux habite,
> Et est cogneu en diverse contrée.
> D'un bon coureur la vistesse est monstrée,
> Quand on le dit, comme un Rasle, aller viste."

Orex.—Bill shorter than the head, thick at the base, subcultrated, compressed; the culmen gradually deflecting from the forehead to the point of the bill; lateral furrow of the upper mandible broad, and occupying more than half its length; angle of the under mandible bending upwards; both mandibles of an equal length. Nostrils concave, lateral, linear-ovoid, pierced in a membrane occupying the mandibular furrow in the middle of the bill. Wings armed with a spine, and having the second and third quill-feathers the longest. Plumage soft, thick, and open in texture. Legs strong, of mean length, with the lower part of the tibiæ naked. Feet 4-toed, three before and one behind. Toes long, slender, and cleft to their base, without any lateral membrane; hind toe resting on the ground. Claws arcuate, compressed, and pointed. (Selby.)

C. pratensis, Bechst., *Rallus Crex*, Linn., is the Rale de Genet, or Roi des Cailles of the French; Re di Quaglie of the Italians; Wiessen-Knarrer and Wachtel-König of the Germans; Kwartel Koning of the Netherlanders; Vagtel-Konge, Aker-Rixe, and Skov-Snarre, of the Danes and Norwegians; Land-Rail, Daker-Hen, Bean-Crake, and Corn-Crake of the English; and Rhegen yr yd of the Welsh. Belon gives the following synonyms:—'Ορτυγομήτρα ἄλλη, Ralla, Re de Quaglie, Ralle Rouge, or Ralle de Genet. It has a large ash-coloured eyebrow, prolonged upon the sides of the head; all the feathers of the upper parts blackish-brown in the middle, bordered laterally with ash-colour, and terminated with reddish; the long feathers which extend on the quills entirely bordered by a large band of olive-reddish; coverts of the wings of a rusty-red; quills reddish externally; throat, belly, and abdomen white; breast olive-ash; sides reddish, striped with white; upper mandible brown, lower whitish; iris reddish-brown; eyebrows flesh-colour; feet flesh-colour, or reddish-brown.

The young have the tints less vivid, but brighter, with some white spots.

Land-Rail (*Orex pratensis*).

"The Land-Rail," says Mr. Gould, "appears to be extensively spread over the whole continent of Europe; it is very abundant in Holland, and not uncommon in France and Germany. It is a migratory species, arriving with us about the latter end of April or the beginning of May, when it scatters itself in pairs over the whole of the British Isles."

Worms, snails, insects and their larvæ, seeds, and grain form the food of the Land-Rail. It is very fond of grasshoppers. "Its habits," says Mr. Gould, "are extremely shy and retiring, selecting for its places of abode grassy meadows, fields of young corn, ozier-beds, and marshy grounds, seldom allowing itself to be seen; and were it not for the peculiar note of the male, which consists of a singular grating monotone—sometimes sounding as if beneath one's feet, and again appearing as if uttered at a distance—its presence would not be betrayed. In these its favourite places of resort and concealment it carries on the process of incubation, constructing its nest on the ground, and occasionally on small hillocks, the nest being composed of slender flags or grasses; the female laying from eight to twelve eggs, rather less than those of the moor-hen, to which, in the markings, they bear some resemblance, of a yellowish-white, covered with dull rust-coloured spots. The young when hatched are covered with a blackish down, and are soon able to follow the parent birds, attaining by the commencement of the shooting-season nearly the adult size and plumage." Its southward migration commences in October, when it passes over to the Continent.

After it is once flushed it is almost impracticable to force the Land-Rail to take wing a second time, until it has run through every part of the cover that holds it. It is easily shot when on wing, though its flight is generally very short, for it flies heavily, and with the legs hanging down. It will run before a dog with the greatest rapidity, and very frequently escapes by trusting to its legs alone.

When dressed on the same day on which it is killed, with the trail in, it is very delicious, and it has always been highly esteemed for the table.

In the old quatrain under the cut of the Land-Rail we read—

> "Au Ralle noir est ressemblant ce Ralle,
> Sinon de bec, de grandeur et coleur.
> A la Perdrix il ne cede en valeur,
> Mesme leur chair est en bonté egale."

In the 'Northumberland Household-Book,' Reys are among the birds admitted to his lordship's table, and are charged at twopence each, the same price as that of a quail, and double that of a teal. Drayton too, in his 'Polyolbion' (twenty-fifth song), notices—

> "The Rayle, which seldom comes but upon rich men's spits."

RAM. [Ovræ.]

RAMBEH, the Malay name of a fruit described by Mr. Jack as being common in the peninsula of Malacca, but unknown at Ben-

coolen, while the Choopa, which is nearly allied to it, is abundant at the latter, but is not found at the former place. The fruit is that of a tree called *Pierardia dulcis*, of the natural order of *Sapindaceæ*. Another species of the same genus is called *P. sapida*, from its also yielding an edible fruit. It is found in the district of Tippera, to the eastward of Calcutta, and also in China, where it is cultivated for its agreeable fruit, according to information obtained by Dr. Roxburgh from Chinese gardeners. It is remarkable that it should there be called Lutqua, as it is called Lutco by the Hindoos on the eastern frontier of Bengal.

RAMBOOTAN, the Fruit of *Nephelium lappaceum*.

RAMPHA'STIDÆ, a family of Scansorial Birds known by the common name of Toucans.

Bélon, at the end of the 28th chapter of his third book 'De la Nature des Oyseaux vivants le long des Rivières, ayants le Pied plat, nommez en Latin Palmipedes Aves' (A.D. 1555), gives a wood-cut of the bill of a Toucan, which, from the black patch at the end of it, was probably that of *Ramphastos Toco*. He describes the bill as belonging to a bird of the 'terres neufues,' which possesses that organ half a foot long, large as a child's arm, pointed and black at the tip, white elsewhere, and notched some little on the edges, hollow within, and so finely delicate that it is transparent and thin as parchment. Its beauty, he observes, has caused it to be kept in the cabinets of the curious. He further says that he has not seen the bird, but that he suspects that it is 'de pied plat,' and therefore he has placed it with the River Birds.

In the 'Portraits d'Oyseaux' also, the cut of this bill is placed at the end of 'Le Second Ordre des Oyseaux au pied plat.' Above it appears the following description:—

"Bec d'un Oyseau aquatique apporté des terres neufues.

"Si quelqu'un avoit fait un corps d'Oyseau à ce bec sans avoir grosseur suffisante, qu'on le juge fait à discretion, car nous l'avons mieux aymé laisser ainsi, que luy en feindre un."

Below the cut is the following quatrain:—

"Ce bec est gros comme le bras d'un enfant,
Creux par dedans, transparent comme verre;
Tenue et leger, venu d'estrange terre,
Noir par le bout, et blanc au demeurant."

The birds themselves do not seem to have found their way to England a century after the date of Bélon's works, for, in the Museum Tradescantianum, the standard collection of the time, and which, from the list of contributors, appears to have been the great receptacle for all curiosities, we read under the division (No. 2) of Beaks or Heads, "Aracari of Brazil, his beak four inches long, almost two thick, like a Turke's sword" (A.D. 1656). But if the bird itself had not been brought forward, it is probable that Tradescant knew its nature, from the description above given. Petiver (Tab. xliv. f. 13) gives a figure of the bird complete, and though it bears all the marks of the imperfect state of the arts at that time, as far as engravings of subjects of natural history are concerned, it is substantially correct, and the arrangement of the toes right. The description is, 'Toucan Surinamensis niger, ex albo, flavo, rubroque mixta,' taken from a Dutch painting in Mr. Clark's collection: this does not exactly agree with any authors I have yet read. Willughby (Tab. xx.) gives a figure of a Toucan (*Ramphastos Toco*, probably) under the name of "the Brazilian Pie of Aldrovandus, the Toucan of Marcgrave and others, the Xochitenacatl of the Mexicans: Nieremb." The figure is incorrect about the feet, to which three anterior toes are given, though Willughby, who cites Thevetus, Faber, Dal Pozzo, Lerius, Oviedo, and John de Laet, was evidently aware of the true organisation, namely two toes before and two behind.

Brisson placed the form in his 13th order, consisting of those birds which have four toes, two before and two behind.

Linnæus arranged the Toucans (*Ramphastos*) at the head of the second division (*Pedibus scansoriis*) of his second order, *Picæ*.

Latham also assigned to them the same situation.

Lacépède places *Ramphastos* at the head of the second order (Bec Dentelé) of his Grimpeurs, or Climbers.

Duméril arranged the form at the head of the Levirostres, or Cénoramphes, the second family of his third order, Grimpeurs.

The *Scansores* form the first order in the method of Illiger, and *Ramphastos* and *Pteroglossus* appear at the head of the second family, *Serrati*.

In Cuvier's system the Toucans are arranged in his third order, Grimpeurs, between the Anis [CROTOPHAGA] and the Parrots [PSITTACIDÆ].

The *Zygodactyli* are the first tribe of M. Vieillot's second order, *Sylvicolæ*, and the Toucans are placed in the fourth family, Ptéroglosses, between the Jacamars and Barbets.

M. Temminck arranges the form in the first family of his fifth order, Zygodactyles.

The Grandirostres form the fifth family of the Grimpeurs, the third order in the system of M. Latreille, and embrace the genera Toucan and Aracari, which are placed between the Proglosses (Wryneck, Woodpecker, &c.) and the Galliformes (*Musophaga*, *Touraco*).

The Toucans appear as the fifteenth family of the Normal Birds of M. De Blainville, and are placed between *Buceros* and *Picus*.

In M. Lesson's 'Projet' the *Ramphastidæ* succeed the *Picidæ*, and are the last family of the first tribe of his Insessores or Grimpeurs (*Heterodactyles*).

The genera of the *Ramphastidæ*, according to Mr. Swainson, are—*Ramphastos*, *Pteroglossus*, *Aulacorhynchus*, and *Scythrops*.

Mr. G. R. Gray ('List of the Genera of Birds') makes the *Ramphastidæ*, the first family of the Scansores, with the following genera:—

Ramphastos, Linn. (*Pica*, Gesn., *Tucana*, Briss.).
Pteroglossus, Ill. (*Ramphastos*, Linn.).
Selenidera, Gould (*Ramphastos*, Linn.; *Pteroglossus*, Wagl.).
Aulacoramphus (*Ramphastos*, Linn.; *Pteroglossus*, Sw.; *Aulacorhynchus*, Gould).
Scythrops, Lath.

Mr. Gould, in his beautiful monograph of the *Ramphastidæ*, divides them into two great sections:—

1. Caudâ breviore, quadratâ; rostro maximo. Nigri, gutture caudæque tegminibus discoloribus. *Ramphastos*. (The Toucans.)

Of these Mr. Gould records 11 species, arranged in four subdivisions, according to the distribution of their colouring.

2. Caudâ longiore, graduatâ; rostro majore. Viridescentes; capite, gastræo, tegminibusque caudæ superioribus in plurimis discoloribus. *Pteroglossus*.. (The Araçaris.)

Of these Mr. Gould records 22 species, arranged in twelve subsections, also according to the distribution of their colouring.

The Toucans and Araçaris appear to be restricted in their geographical range to tropical America, and there they live retired in deep forests, mostly in small companies. Their flight is straight but laborious, and not graceful; while their movements, as they glide rather than hop from branch to branch, are elegant.

Mr. Vigors gives the following account of a Toucan (*Rhamphastos Ariel*, Vig.), which he kept in a state of domestication for many years. After alluding to an account of an individual which ate animal food in domestication by Mr. Broderip, he says, "I have not allowed it to be indulged in that disposition to animal food which so strikingly belongs to this family. I find in fact that it thrives sufficiently well upon a vegetable diet; and I fear that if it should once be allowed any other, it would be difficult to restrain its inclination for it within moderate limits. Eggs are the only animal food with which it has been supplied since it came into my possession. Of these it is particularly fond, and they are generally mixed up in his ordinary food, which consists of bread, rice, potatoes, German paste, and similar substances. He delights in fruits of all kinds. During the period when these were fresh, he fed almost exclusively on them; and even in the present winter months he exhibits great gratification in being offered pieces of apples, oranges, or preserved fruits of any description. These he generally holds for a short time at the extremity of his bill, touching them with apparent delight with his slender and feathered tongue; and then conveying them by a sudden upward jerk to his throat where they are caught and instantly swallowed. His natural propensity to preying upon animals, although not indulged, is still strongly conspicuous. When another bird approaches his cage, or even a skin or preserved specimen is presented to him, he exhibits considerable excitement. He raises himself up, erects his feathers, and utters that 'hollow clattering sound' noticed by Mr. Broderip, which seems to be the usual expression of delight in these birds; the irides of his eyes at the same time expand, and he seems ready to dart upon his prey, if the bars of his cage permitted his approach. On one occasion, when a small bird was placed by chance over his cage at night, he showed great restlessness, as if aware of the neighbourhood of the bird; and he would not be composed until the cause of his anxiety was discovered and removed.

"When in his cage, he is peculiarly gentle and tractable, suffers himself to be played with, and feeds from the hand. Out of his cage, he is wild and timid. In general he is active and lively; and, contrary to what might be expected, from the apparent disproportion of the bill and the seemingly clumsy shape of the birds of this genus, as they are usually set up or represented in figures, his appearance is not only graceful, but his movements, as he glides from perch to perch, are light and sylph-like; so much so as to have suggested to an intelligent friend who witnessed them the specific name which I have ventured to assign him. He keeps himself in beautiful plumage, his lighter colours being strikingly vivid, and the deep black of his upper body in particular being always bright and glossy. For this fine condition he seems to be much indebted to his fondness for bathing. Every day he immerses himself in cold water with apparent pleasure, even in this severe weather; and in no respect indeed does he appear to suffer by the transition from his own warm climate to our uncongenial atmosphere.

"Besides the 'hollow clattering noise,' as my friend Mr. Broderip so expressively terms the usual sounds of these birds, he utters at times a hoarse and somewhat discordant cry when he happens to be hungry, and to see his food about to be presented to him. On such occasions he stands erect, raising his head in the air, and half opening his bill as he emits this cry. These are the only sounds I have heard him utter; and in neither can I say that I have detected any

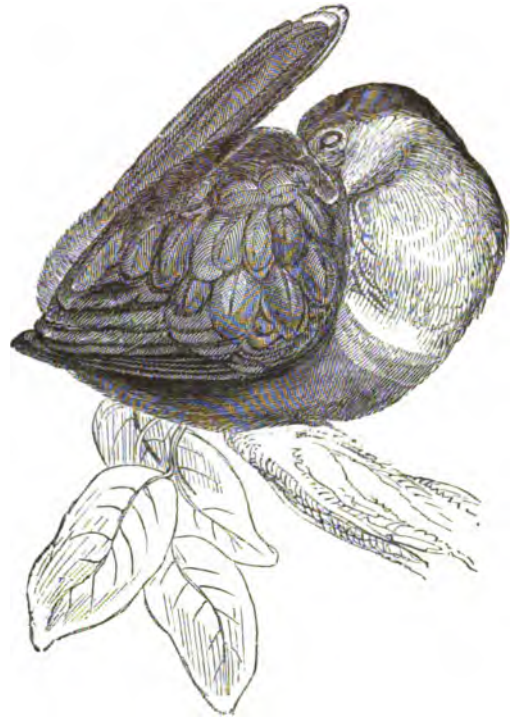
similarity, or even approach, to the word Toucan, as has sometimes been asserted, and from whence the trivial name of the genus has been supposed to originate. Neither have I been able to verify another observation which has been advanced respecting these birds, that the bill is compressible between the fingers in the living bird. The bill, notwithstanding the lightness of its substance, is firm, and capable of grasping an object with much strength. The mode in which Mr. Broderip describes his Toucan as having broken the limbs of the bird which he was about to devour, by 'a strong lateral wrench,' sufficiently shows that the bill is not deficient in power. Indeed I generally observe that my bird takes what is offered him rather by the sides than by the point of his bill; and I suspect that much of the powers of that member are centred in this lateral motion. The serration of the edges also may be supposed to tend to these peculiar powers. The manner in which he composes himself to rest is represented in the accompanying plates. Since the cold weather has commenced, he has been brought into a room with a fire, and the unusual light seems to have interfered with his general habits; he does not go to rest as early or as regularly as was his custom; and he sometimes even feeds at a late hour. During the warmer months however, when he was more free from interruption, his habits were singularly regular. As the dusk of the evening approached, he finished his last meal for the day; took a few turns, as if for exercise after his meal, round the perches of his cage; and then settled on the highest perch, disposing himself, almost at the moment he alighted on it, in the posture represented, his head drawn in between his shoulders, and his tail turned vertically over his back.

Toucan at roost; first stage.

"In this posture he generally remained about two hours, in a state between sleeping and waking, his eyes for the most part closed, but opening on the slighest interruption. At such times he would allow himself to be handled, and would even take any favourite food that was offered him without altering his posture further than by a gentle turn of the head. He would also suffer his tail to be replaced by the hand in its natural downward posture, and would then immediately return it again to its vertical position. In these movements the tail seemed to turn as if on a hinge that was operated upon by a spring. At the end of about two hours he began gradually to turn his bill over his right shoulder, and to nestle it among the feathers of his back, sometimes concealing it completely within the plumage, at other times having a slight portion of the culmen exposed. At the same time he drooped the feathers of his wings and those of the thigh-coverts, so as to encompass the legs and feet; and thus nearly assuming the appearance of an oval ball of feathers, he secured himself against all exposure to cold."

All are now agreed that in a state of nature the *Ramphastidæ* are omnivorous.

The incubation of most if not all of this family takes place in the holes of trees, a habit that was very early known. We find Willughby, after quoting Faber for proof that in the structure of their feet, &c., the Toucans resemble the Woodpeckers, "to the genus whereof the toucan, as Faber in this place proves, doth undoubtedly belong," continuing thus:—"for it not only hath a like situation of toes, but also in like manner hews holes in trees to build its nest, as Fryer Peter Alvayss, and other Indians and Spaniards, who had long lived in America, told Faber for a certain truth; and Oviedus, in the forty-third chapter of his summary of the history of the West Indies, published in Italian, writes, adding that he thinks there is no bird secures her young ones better from the monkeys, which are very noisome to the young of most birds. For when she perceives the approach of those enemies, she so settles herself in her nest as to put her bill out at the hole, and gives the monkeys such a welcome therewith that they presently pack away, and glad they escape so. From this quality of boring the trees, this bird is by the Spaniards called 'carpintero,' and by the Brazilians 'tacataca,' in imitation, I suppose, of the sound it makes." The feathered structure of the tongue is also there noticed



Toucan at roost; second stage.

Mr. Gould remarks that the true Toucans, unlike many of the Araçaris, offer no sexual difference in the colour of the plumage; but the females are rather less than the males in all their proportions. He adds that the young of both genera assume at a very early age the adult colouring; but that their large bills, as might be expected, are not fully developed for a considerable period.

The colours of the bill, which are generally very vivid during life, become, in many instances, greatly changed and deteriorated by death: this should be borne in mind by those who describe species from dead specimens, especially if they have been a long time preserved.

In the 'Monograph' by Mr. Gould, Professor Owen has given an account of the anatomy of these birds, of which we give the following summary.

Professor Owen remarks that the organs of digestion in the Toucan present a general simplicity of structure, which accords with its geographical position and power of assimilating both animal and vegetable food, so abundantly provided by nature in a tropical climate. The size of the œsophagus and general width of the intestinal canal correspond to the magnitude of the beak. There is no lateral dilatation of the crop, nor is the gizzard so encroached upon by its muscular parietes as to render such a reservoir for the alimentary substances necessary. The proventriculus communicates with the gizzard by a wide aperture. The muscular coat of the gizzard does not exceed half a line in thickness; the lateral tendons are small, but very distinct. The lining membrane is of a horny texture, and was stained of a deep yellow colour. The pyloric orifice is remarkably contrasted in its diminutive size with the ample entrance to the gizzard; a structure which facilitates the regurgitation of the alimentary substances. The description then goes on to state that as the regurgitated morsels have been observed to undergo a second mastication, the digestive processes exhibit in this bird an analogy to that of the Ruminants, and that as the thin parietes of the gizzard of this omnivorous bird are sometimes unequal to the comminution of the food, the utility of the extraordinary developed beak becomes apparent, which thus compensates by additional mastication for the absence of the grinding

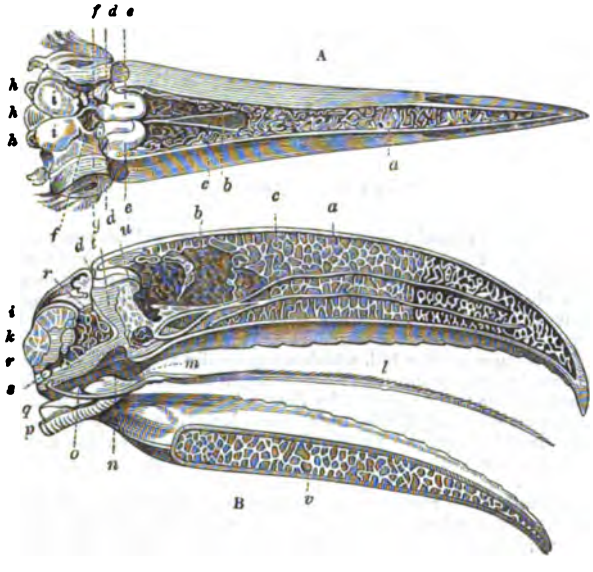
structure so peculiar to the stomachs of the true vegetable-feeders. ('Cat. Mus. Coll. Chir.')

The length of the tongue, one of the most remarkable among birds, in a full grown *Rhamphastos Toco* was six inches. The posterior ridge, or backward-projecting process, was broad and finely notched, and situated about four lines from the glottis. Anterior to this process, Mr. Owen describes the tongue as being soft and minutely papillose for the extent of four lines, and here he thinks most probably the sense of taste resides: the rest of the organ consists of a transparent horny lamina, flattened horizontally, and supported by the anterior process of the os hyoides, which forms a ridge along the middle of its inferior surface. At about four inches from the extremity of the horny lamina the margins become obliquely notched, and these notches, becoming deeper and closer together towards the extremity, occasion the bristled appearance on each side of the tongue: these bristles were applied to the food in the cases of the captive Toucans above recorded. The cornua of the os hyoides are one inch and a half in length.

Upper surface of Tongue of Toucan. (Owen.)

l, The fringed or feathered portion; *m*, orifice of larynx; *n*, orifice of pharynx; *o*, cornua of the os hyoides; *p*, trachea or windpipe; *q*, gullet.

Professor Owen observes that the osseous portions of the mandibles of the Toucan are disposed in a manner adapted to combine with the great bulk of those parts a due degree of strength and remarkable lightness, and the bony structure is consequently of a most beautiful and delicate kind. "The external parietes are extremely thin, especially in the upper beak: they are elastic and yield in a slight degree to moderate pressure, but present considerable resistance if a force is applied for the purpose of crushing the beak. At the points of the mandibles, the outer walls are nearly a line in thickness; at other parts in the upper beak they are much thinner, varying from 1-30th to 1-50th part of an inch, and in the lower beak are from 1-20th to 1-30th part of an inch in thickness. On making a longitudinal section of the upper mandible, its base is seen to include a conical cavity, about two inches in length and one inch in diameter, with the apex



A, Section of the cranium and upper mandible of *Rhamphastos Toco*. *a*, The cancellated structure of the beak; *b*, the cavity at the base; *c*, branches of the fifth pair of nerves; *d*, *d*, external orifices of the nostrils; *e*, osseous parietes of the nasal passages; *f*, osseous tubes protecting the olfactory nerves; *g*, pituitary membrane exposed, and branches of the olfactory nerves radiating from it; *h*, superior semicircular canals of the internal ear; *i*, *i*, hemispheres of the cerebrum. (Owen.)

B, Vertical longitudinal section of the head. The same letters indicate the same parts as in the previous figure. *k*, cerebellum; *l*, the tongue; *m*, glottis; *n*, internal aperture of the nostrils; *o*, os hyoides; *p*, trachea; *q*, œsophagus; *r*, beginning of the spinal chord; *s*, articulating surface of occipital bone; *t*, nasal septum or partition; *u*, air-cell anterior to the orbit, from which the air passes into the mandible; *v*, cancellated structure of the lower jaw. (Owen.)

directed forwards. The walls of this cone consist of a most beautiful osseous net-work, intercepting irregular angular spaces, varying in diameter from half a line to two lines. From the parietes of this cone a network of bony fibres is continued to the outward parietes of the mandible, the fibres which immediately support the latter being

almost invariably implanted at right angles to the part in which they are inserted. The whole of the mandible anterior to the cone is occupied with a similar network, the meshes of which are largest in the centre of the beak, in consequence of the union which takes place between different small fibres as they pass from the circumference inwards. It is remarkable that the principle of the cylinder is introduced into this elaborate structure: the smallest of the supporting pillars of the mandibles are seen to be hollow or tubular, when examined with the microscope. The structure is the same in the lower mandible, but the fibres composing the network are in general stronger than those of the upper mandible." (Owen.)

Professor Owen states that the medullary membrane lining these cavities appears to have but a small degree of vascularity. Processes of the membrane, accompanying vessels and nerves, decussate the conical cavity at the base of the beak. The principal nerves are two branches of the fifth pair, which enter at the lower part of the conical cavity, and diverge and ascend as they pass forward to the end of the bill, giving off branches, which are distributed to the horny covering, and supply it with insensibility. "The air," says Professor Owen, "is admitted to the interior of the upper mandible from a cavity situated anterior to the orbit, which communicates at its posterior part with the air-cell continued into the orbit, and at its anterior part, with the maxillary cavity. The nasal cavity is closed at every part, except at its external and internal apertures, by the pituitary membrane, and has no communication with the interior of the mandible."

Smell.—"The organ of smell is confined to the base of the upper jaw. The canal, which is traversed by the air and odorous particles in inspiration, forms a sigmoid curve in the vertical direction. The external orifice is on precisely the same perpendicular line as the internal one. It is situated at the posterior surface of the upper mandible, where it is raised above the level of the cranium; the orifice is consequently directed backwards, secure from all injury that might happen to it in the act of penetrating dense or interwoven foliage. The olfactory canal is at first of almost a cylindrical form, and about two lines in diameter. It passes forwards for about half an inch, receiving from the mesial aspect the projection of the first spongy bone; it then bends downwards and backwards, and is dilated to admit the projections of the two other spongy bones: from this point it descends vertically to the palate, at first contracted, and afterwards dilating to form the internal or posterior orifice. The first or outermost spongy bone is almost horizontal, and has its convexity outwards. The second is nearly vertically placed, with its convexity directed backwards: it terminates in a narrow point below. The third or superior spongy bone makes a small projection towards the mesial plane about the size of a pea. These spongy bones are formed by inward projections of the inner and posterior osseous parietes of the nasal passage: they are cellular, and air is continued into them from the cranial diplöe; but the parietes of the nasal passage are entire and smooth, and lined by a delicate pituitary membrane. The inner table of the skull is continuous with the parieties of the nasal cavity, by means of the bony canal which accompanies and protects the olfactory nerves, and which represents, as it were, a single foramen of the cribriform plate of the *Mammalia*. The communication of the cavity of the cranium with that of the nose is thus similarly formed, and is only obstructed in the recent state by the pituitary membrane, on the posterior cul-de-sac of which the olfactory nerve distributes its branches in a radiated manner. These branches were confined, as Scarpa has observed in other birds, to the pituitary membrane covering the septum narium and the superior spongy bone."

Hearing.—"The external orifice of the meatus auditorius is situated about half an inch behind the lower boundary of the orbit. The membrana tympani closes it so obliquely that its plane is directed almost backwards; its anterior edge is consequently about three lines from the external orifice, while its posterior margin is at least six lines from the same point. It is convex outwardly, as in birds generally. The apparatus of the internal ear is easily exposed, the semicircular canals being lodged in a delicate reticulation of the diplöe of the cranium. These parts, with the osseulum of communication and the cochlea, do not present any deviations from the ordinary structure worthy of notice."

Sight.—The sense of sight in the *Ramphastidæ* appears to be sufficiently well developed, but requires no special observation.

Respiratory and Circulating System.—Mr. Owen found the trachea narrow and simple in its structure, the rings somewhat flattened, and decreasing in diameter towards the inferior extremity, from which a single pair of muscles passes off to the sternum. The length of the lower fourth of the tube, and the state of tension in the bronchia are regulated by a pair of small muscles, which, arising from the sides of the tracheal cartilages, are inserted into the bone of divarication at the extremity of the trachea; this part of the tube is subjected to variations in length, as is indicated by the tortuous character of the recurrent nerves attached to the sides of the trachea in this part. The lungs, small in proportion, are of the usual form and structure, and the abdominal air-cells are also small. The heart is more oblong than it is in birds generally; its apex, as it were, truncate; and its length one inch.

Urinary and Genital System.—The kidneys, composed of three

lobes, of which the middle one is smallest, are an inch and a half in length, with a surface convoluted, though in a less marked degree than it is in reptiles. Between the anterior extremities of these glands Mr. Owen found, in a female *Ramphastos Ariel*, the ovary of a triangular shape, and apparently healthy. The ova were like minute granules, and disposed in a convoluted manner. The supra-renal glands were imbedded in the posterior part of the ovary. The oviduct, of the size of a crow-quill, commenced by the usual fimbriated and wide aperture, was slightly tortuous at the commencement, and then continued straight to the cloaca.

Osseous and Muscular Systems.—Certain parts of this system bear upon peculiar functions performed by the Toucans, and are thus described by Professor Owen:—"The pectoral muscles as in the *Psittacidæ*, are but feebly developed, and the keel of the sternum is of moderate size, not projecting more than half an inch from the plane of the bone. The sternum has four notches at its posterior margin. The clavicles, or lateral halves of the furcula, are here, as in the *Psittacidæ* and *Struthionidæ*, separate; they are an inch in length, slender, pointed at their lower ends, and joined to each other and to the sternum by a ligament only."

Foot of Toucan. *a*, Seen from below.

"The peculiar motions of the tail called for a particular examination of that part. It is difficult to state the precise number of the caudal vertebræ, in consequence of the terminal ones being anchylosed, requiring for this purpose the examination of a young specimen at a period before the anchylosis takes place. In the skeleton of a Black-Billed Toucan which I have examined, it would appear that three vertebræ are thus anchylosed, making the entire number of coccygeal vertebræ nine. The Woodpecker has also nine caudal vertebræ, and this seems to be the greatest number found in birds. The first six of these vertebræ in the Toucan are articulated by ball-and-socket joints, the ball and the socket being most distinct in the last two joints. That between the sixth and the anchylosed vertebræ is provided with a capsule and synovial fluid; the others have a yielding ligamentous mode of connection. The spinous processes of these vertebræ, both superior and inferior, are of moderate size, but smallest in the sixth, where the greatest degree of motion takes place. The transverse processes, on the contrary, are large and broad, so as almost wholly to prevent lateral motion. The first of the anchylosed vertebræ is broad and flat, and of a rounded form, supporting the two coccygeal glands: the last of these processes is compressed laterally, and of the ordinary ploughshare form. The caudal vertebræ can be inflected dorsad till their superior spines are brought into contact with the sacrum; in the opposite direction they can scarcely be bent beyond a straight line; and it is to this structure of the bones and joints that is to be attributed the capability in the Toucan of turning its tail upon its back (as represented in the 'Zoological Journal,' vol. ii., pl. xv.), the muscles presenting comparatively few peculiarities, since the motion alluded to is remarkable rather for its extent than the vigour with which it is performed. The principal elevators of the tail are the sacro-coccygei superiores (sacro-suscaudiens of Vicq d'Azyr). They arise from two longitudinal ridges on the inferior and convex part of the sacrum, and are inserted into the superior spines of the first six vertebræ by detached tendons terminating broadly in the anchylosed vertebræ. The principal antagonists of these muscles, the sacro-coccygei inferiores (sacro-souscaudiens of Vicq d'Azyr), pass over the first five vertebræ, and terminate in the sixth and anchylosed vertebræ; their origins are wider apart than in the preceding pair of muscles, coming off from the margin of the sacro-sciatic notches. In the interval are situated small muscles passing from the transverse processes to the inferior spines of the first six vertebræ. From the limited nature of the lateral motions of the tail, the muscles appropriate to these movements are feeble, especially in comparison with those which are observed in the birds that spread their tail-feathers in flight, in order to regulate their course during that vigorous species of locomotion. These muscles are in number two on each side, arising from the posterior extremities of the ischia, and inserted into the expanded anchylosed vertebræ. From the disposition of these muscles it is obvious that after the proper elevators have raised the tail to a certain height, they also become dorsad of the centre of motion, combine their forces with the elevators, and by this addition of power terminate the act of throwing up the tail by a jerk. Mr. Vigors, in his observations on the living animal, observes, that 'in these movements the tail seemed to turn as if on a hinge that was operated on by a spring.'" (Owen, in Gould's 'Ramphastidæ.')

We now proceed to give some examples of the Toucans and Araçaris.

Ramphastidæ.—Bill enormous, vascular within; the margins serrated. Wings short, rounded. Feet with two toes before and two behind. (Sw.)

Ramphastos.—Bill smooth. Nostrils entirely concealed, and placed at the edge of the thickened frontlet of the bill. Wings short, rounded; the four outer quills graduated and abruptly pointed. Tail short, rounded. (Sw.)

R. Toco appears to be one of the largest species, being 27 inches in total length. The bill measures 7½ inches; the wings 10 inches; the tail, 7 inches; and the tarsi are 2 inches in length. A beautiful figure of the bird, by Lear, is given in Mr. Gould's magnificent work. The range of the species is very wide, perhaps wider than that of any other, being distributed throughout the whole of the wooded districts from the river Plata to Guyana.

R. Cuvieri. Beak brownish-black on the sides, with a large basal belt and culminal line of greenish-yellow, the basal belt being bounded behind by a narrow line of black, and before by a broader one of deep black, which is only apparent in certain lights; the top of the head and whole of the upper surface black, with the exception of the upper tail-coverts, which are bright orange-yellow; cheeks, throat, and chest white, with a tinge of greenish-yellow, terminated by a band of scarlet; under surface black; under tail-coverts scarlet. Total length 24 inches; bill, 7¼ inches; wings, 9 inches; tail 6½ inches; tarsi, 2 inches. (Gould.)

This is a very rare bird and is found in the densely wooded districts on both sides of the Amazon.

Ramphastos Cuvieri. (Gould.)

Pteroglossus.—Bill smooth, less compressed; nostrils vertical, naked, round, pierced on the upper surface of the bill, on the edge of the frontlet. Wings short, rounded. Tail lengthened, graduated. (Sw.)

P. Humboldtii. Bill large in proportion to the body; a band of black occupies the culmen from the base to the tip; the remainder of the upper mandible of a dull yellowish-orange, with the exception of an indefinite mark of black which springs from each serrature, and a fine line of the same colour surrounding it near the base; lower mandible black, with the exception of the base, which is surrounded with pale yellowish-orange; the head, back of the neck, throat, and chest black; all the upper surface, except a spot of scarlet on the rump, of a dull olive; primaries blackish-brown; under surface pale straw-yellow with a slight tinge of green; thighs chestnut; naked space

Head of Araçari. (Gould.)

round the eyes and tarsi lead colour. Total length about 16 to 17 inches: bill 4, wing 5¼, tail 6¾, tarsi 1⅛ inches. (Gould.)

It is a native of Brazil, probably near the Amazon.

Pteroglossus Humboldtii. (Gould.)

P. pluricinctus. Male.—A broad band of black advances from the nostrils along the whole of the culmen, and forms a narrow belt down the sides of the upper mandible at its base; the elevated basal margin of the bill is yellow; the sides of the upper mandible beautiful orange-yellow, fading into yellowish-white towards the tip; under mandible wholly black with a yellow basal ridge; head, neck, and chest black; whole of the upper surface, except the rump, which is scarlet, dark olive-green; breast marked with two broad bands of black, the upper separated from the throat by an intervening space of yellow dashed with red; a similar but broader space separates the two bands of black, the lower of which is bounded by scarlet, advancing as far as the thighs, which are brownish-olive; under the tail-coverts light yellow; naked space round the eyes, tarsi, and feet, dark lead-colour.

The female differs from the male in having the ear-coverts brown, and a narrow belt of scarlet bordering the black of the throat. Total length 20 inches: bill 4½, wings 6½, tail 8½ inches. (Gould.) It is a native of Brazil.

Pteroglossus pluricinctus.

Upper figure, female; lower, male. (Gould.)

RAMPHO'STOMA. [CROCODILIDÆ.]

RAMPION. [CAMPANULA.]

RAMSON, the common name of the *Allium ursinum*, a species of Garlic found wild in many parts of Great Britain, and formerly cultivated in gardens; but its use is superseded by the *Allium sativum*, a native of Sicily, which is the Garlic now in cultivation. [ALLIUM.]

RAMTILLA, a genus of Plants belonging to the natural order *Compositæ* and the sub-tribe *Helianthæ*, so called from the Indian name Ram-Tilla, by which the oil of its seed is designated. The plant is remarkable for the number of names by which it has been described by botanists. Of these we need only mention the *Verbesina sativa* of Roxburgh, and the *Ramtilla oleifera* of De Candolle. Cassini had however previously formed it into a new genus, and, under the name of *Guisotia*, "dedicated it to the celebrated historian, then minister of public instruction." This name, being prior to that of *Ramtilla* by a year or two, is now retained as that of the genus. De Candolle, having obtained specimens and seeds from various countries, discovered that the Indian plant was identical with one from Abyssinia, which has been mentioned by Bruce under the name of *Polymnia frondosa*. The fact is interesting in a plant cultivated in both countries for the same purposes, and forming one of the links which indicate the connection which existed in early times between India and Upper Egypt. This plant is cultivated in different parts of India, from October to March, in fields, for the sake of the seed, from which an oil is expressed, and used as a substitute for that of the *Sesamum*, which is considered the best kind. It is used both in dressing food and as a lamp oil.

RANA. [AMPHIBIA.]

RANDIA (named after Isaac Rand, M.D., once a demonstrator of botany at the Chelsea Botanic Gardens), a genus of Plants belonging to the natural order *Rubiaceæ*.

R. dumetorum, the Bush-Randia, is a thorny branching small shrub or tree, with oval leaves, rather blunt, cuneate at the base, and smooth. The flowers are very sweet-scented, sessile, solitary, mostly terminal; the calyx has oblong lobes, rather shorter than the villous corolla. The fruit is smooth, yellow, resembling a small crab-apple, firm and fleshy. The seeds are oval, numerous, and lying in mucus. The fruit when bruised and thrown into water intoxicates and even kills fish,

having the same effect as the *Cocculus Indicus*, which is not however known in the East Indies, where this plant grows. In the form of powder it is a powerful emetic. An infusion of the bark of the root is employed to produce nausea in bowel complaints.

R. uliginosa, the Bog-Randia, has almost terminal opposite thorns, tetragonal branches, oblong leaves somewhat cuneated, glabrous. The flowers solitary, sessile, almost terminal. It is a native of the East Indies, in moist places. The flowers are large, white, and fragrant, and in twos or threes at the top of the branchlets. The berry is about the size of a pullet's egg, ash-coloured or olive-gray, and 2-celled. The seeds are flattish, nestling in the pulp. The flowers of this species render it deserving of a conspicuous place in the hot-house.

(Lindley, *Flora Medica.*)

RANELLA. [SIPHONOSTOMATA.]

RANGIFER. [CERVIDÆ.]

RANICEPS, a genus of Subbrachial Malacopterygious Fishes, belonging to the family *Gadidæ*. It has the following characters:—Head depressed; body compressed; two dorsal fins, the first very small, the second dorsal and the anal fins elongated; ventral fins small, the first two rays lengthened and separated.

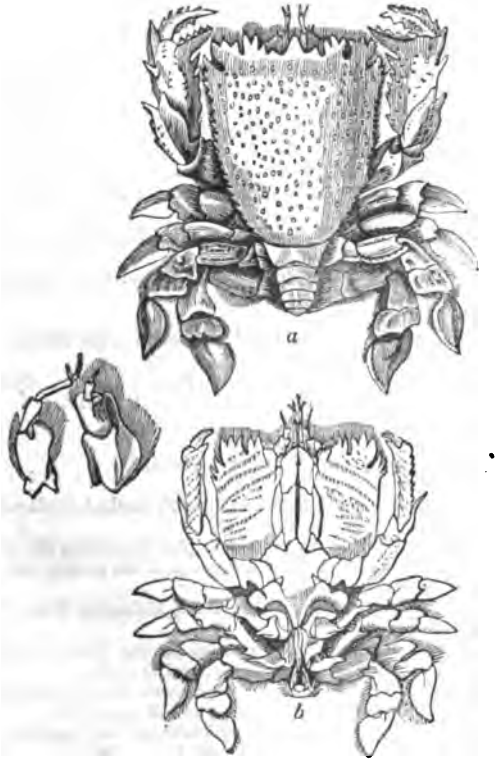
R. trifurcatus, the Lesser-Forked Beard, the Tadpole-Fish. Pennant describes two species of *Raniceps* as belonging to the British Fauna, *R. Jago* and *R. trifurcatus*. Dr. Johnston, of Berwick, was the first to suspect they might be the same fish; and Mr. Yarrell, after comparing Dr. Johnston's specimens with descriptions by Mr. Couch, of Cornwall, comes to the conclusion that the two species mentioned by Pennant are one and the same. It is a rare fish; but Mr. Thompson records a specimen as taken in Ireland, and Dr. Parnell describes it in his 'History of the Fishes of the Frith of Forth.'

(Yarrell, *History of British Fishes.*)

RA'NIDÆ. [AMPHIBIA.]

RANINIDÆ, a tribe of the family *Apterura*, belonging to the section of Anomourous Decapod Crustaceans.

This tribe, in its general form and in the conformation of its feet, approaches very closely to the *Hippidæ*, and especially to the *Albuneæ*. [HIPPIDES.]



Ranina dentata.

a, seen from above; *b*, seen from below.

The carapace is convex laterally, nearly straight from before backwards, wide and truncated anteriorly, and gradually narrowed backwards. The ocular peduncles are lodged in the orbits, but are bent (coudés), and composed of three moveable pieces. The internal antennæ have no fossets, and are not capable of bending themselves back under the front; the external antennæ are very short and very stout at their bases. The external jaw-feet are very much elongated, but not pediform, and behind their insertion the pterygostomian regions of the carapace unite themselves to the sternal plastron, without leaving any aperture for the entry of the water into the branchial cavity. The sternal plastron is very large anteriorly, but becomes linear between the third or fourth last pair of feet. The anterior feet are very much compressed, and their immoveable finger projects but very little, so that the moveable finger is bent back against the anterior border of the hand, nearly as in the subcheliform feet.

M. Milne-Edwards makes this tribe consist of three genera, thus characterised:—

Raninians having the sternal plastron:
- Linear between the base of the feet of the second pair: Carrying on the external border a great auriculiform prolongation. — *Ranina.*
- Second joint of the external antennæ not enlarged externally — *Ranilia.*
- Very wide between the base of the second pair of feet, which are widely separated from the third pair. — *Raninoides*

Ranina dentata may be taken as an example of the tribe. It inhabits the Indian Seas; Mauritius.

Rumphius states that it comes to land, and creeps even to the tops of houses.

Cancer dorsipes, figured by Rumphius, and confounded by most modern authors with *Raninoides lævis* and *Albunea Symnista*, appears to belong to this genus.

In the neighbourhood of this tribe M. Milne-Edwards places *Eryon Caribensis* of Fréminville.

The fossil designated by Ranzani as *Ranina Aldrovandi* belongs, in the opinion of M. Milne-Edwards, to the tribe of Raninians, and may be referred to the genus *Ranina*.

RANUNCULACEÆ, *Crowfoots*, a natural order of Exogenous Plants. The species are herbs, rarely shrubs, with an acrid watery juice, and generally with much-divided exstipulate leaves, the petioles of which are dilated and sheathing; sepals 3 to 6, usually deciduous, sometimes deformed; petals 3 to 15, sometimes anomalous, at other times suppressed; stamens hypogynous; anthers adnate; carpels numerous, 1-celled, or united into a single many-celled pistil; ovary one- or more-seeded, the ovules sutural, styles simple; ovules anatropal; fruit either consisting of dry achenia, or baccate with one or more seeds, or follicular with one or two valves. Seeds albuminous, when solitary either erect or pendulous; embryo minute; albumen horny. The Buttercup or Crowfoot Family characterise a cold damp climate, and when met with in the tropics, they occur on the sides and summits of mountains. There are about a thousand known species, of which 1-5th is found in Europe and 1-7th in North America. The plants of this order have narcotic acrid properties, and are usually more or less poisonous. The acridity varies at different seasons, and in different parts of the plant; it is frequently votatilised by heat, and destroyed by drying. Some of the species are bitter and tonic. Dr. Wright remarks that notwithstanding the ancient reputation of this order as medicinal agents, nearly the whole have fallen into disuse, owing to the uncertainty of their action.

The illustrative genera are—*Aconitum*, which furnishes Aconite, or Monk's Hood. [ACONITUM.] *Clematis.* [CLEMATIS.] *Coptis.* [COPTIS.] *Delphinium*, the species of which are known as Larkspurs. [DELPHINIUM.] *Helleborus*, the Hellebore of the ancients, famed as a drastic purge. [HELLEBORUS; PÆONIA.] *Nigella.* [NIGELLA.] *Ranunculus*, Crowfoot, or Buttercup, whence the order is named. [RANUNCULUS.]

(Lindley, *Vegetable Kingdom*; Balfour, *Classbook of Botany.*)

RANUNCULUS (from 'rana,' a frog, because many of the species inhabit humid places frequented by that reptile), a genus of Plants, the type of the natural order *Ranunculaceæ*. It has 5 sepals, occasionally 10, with a nectariferous excavated scale at the base. The stamens and ovaries are numerous, the achenia ovate, somewhat compressed, mucronate, arranged on globose or cylindrical receptacles. The species are mostly acrid, and if applied when fresh to the skin will produce blisters; this quality is destroyed by drying or by heat.

R. aquatilis, Water-Crowfoot, has a floating stem and submersed leaves divided into numerous capillary segments spreading on all sides. The floating leaves are reniform, from 3- to 5-parted, the lobes wedge-shaped, toothed at the top, the petals obovate, larger than the calyx, the flowers white. It is a native throughout Europe, Western Asia, North Africa, and also in America and England, in pools and stagnant waters. It is the Βατράχιον τέταρτον of Dioscorides, 2. 206. Sometimes it produces very large flowers, and makes a handsome show in ponds and ditches. The curious variety in the floating and immersed leaves adds greatly to its beauty. Dr. Pulteney contradicts the assertion of its deleterious qualities, and says that it is not merely harmless but nutritive to cattle, and tells us that on the borders of the Avon the cottagers support their cows and horses almost wholly on this plant. Hogs are also fed upon this plant, and appear to thrive on it, so that it seems we cannot class this species with others of the same genus as having poisonous qualities.

R. flammula, Flame-Crowfoot, is a smooth plant with a rooting decumbent stem, branched, leafy, and hollow, sometimes hairy near the top. The leaves are on flat channelled half-sheathing stalks, alternate, usually ovate, lanceolate, but varying much in breadth, often serrated. The flowers are terminal, opposite the leaves and of

a bright yellow colour. The leaves are vesicant. Dr. Withering recommends the distilled water as an instantaneous emetic in cases of poison. Lightfoot says the bruised leaves are used to raise blisters in the Isle of Skye and the Highlands of Scotland. It is a native of Europe, Asia, North America, and Great Britain.

R. glacialis has stalked radical leaves, palmated and trifid, the lobes rather blunt and thick; the stem generally 1-flowered; the calyx very hairy, the carpels compressed and sharp-edged; the petals white. It is a native of the higher Alps of Europe, among rocks, near the limits of perpetual snow, and of Lapland and Iceland. The mountaineers of Dauphiny call this Carlive or Caraline, and employ an infusion of it in hot water as a powerful sudorific in colds and rheumatism.

R. acris, Buttercup, has a fibrous root, the stem about two feet high, erect, round, hollow, leafy, clothed with close-pressed hairs, branched above and many flowered. The radical leaves are on long upright footstalks, in 3 or 5 deep lobes, the stem-leaves are nearly sessile, with fewer and narrower segments, the uppermost much smaller, in 3 linear-entire lobes, or sometimes simple and linear. The flowers are of a bright yellow, on round even stalks covered with close hairs and not furrowed. The calyx is hairy, spreading, and deciduous; the carpels smooth, lenticular, with a slightly curved point. This species is extremely acrid and dangerous. Mr. Curtis says that even pulling up the plant and carrying it to some little distance has produced inflammation in the hand. Cattle in general will not eat it, but sometimes when they have been turned hungry into a field they have fed upon it, and in consequence their mouths have become sore and blistered. According to Linnæus sheep and goats eat it, but cows, horses, and swine refuse it. When made into hay however, its noxious qualities are lost. It is commonly called Buttercup, under a notion that the yellow colour of butter is owing to these plants. A double variety of this species is cultivated in gardens under the name of Bachelor's Button.

R. sceleratus, Celery-Leaved Crowfoot, has a fibrous root, the radical leaves with 3 stalked trifid and cut leaflets, furrowed peduncles and reflexed calyx, the heads of the fruit oblong, the carpels minute and wrinkled. The flowers very small and pale yellow, numerous, on solitary stalks, either terminal, axillary, or opposite the leaves. The bruised leaves raise blisters on the skin, which are not soon healed, and are said to be used by impostors to cause ulcers on their bodies, and thus excite compassion. It is one of the most virulent of our poisonous indigenous plants. The distilled water of this species is highly acrimonious, and when cold deposits crystals which are scarcely soluble, and are of an inflammable nature. The deleterious qualities are however dispelled in decoction, and accordingly the shepherds of Wallachia boil and eat it.

R. Thora has an extremely acrid and poisonous root, and is native of the Alps of Europe. It is said to yield the juice formerly used by the Swiss hunters to poison their darts; wounds so produced speedily become fatal.

R. ficaria, Pilewort, has a root with fasciculated tubers, cordate stalked leaves, angular, or crenate, or leafy; single flowered stem, usually three sepals, and smooth blunt carpels. The flowers are golden yellow, and it is a native throughout the whole of Europe in meadows, bushy places, and about hedge-banks; it is plentiful in Britain. The young leaves of this plant, according to Linnæus, are used as greens in Sweden. A notion that the root is efficacious in the cure of piles gives it its common English name. We usually find the flower closed from five to nine in the evening, and in wet weather. It is the Χελιδόνιον of Theophrastus, 'Hist. Plant.,' 7. 14, and the Χελιδόνιον μικρόν of Dioscorides, 2. 212, and of Pliny, 'Hist. Nat.' 258.

R. arvensis, Corn-Crowfoot, has a fibrous root, the radical leaves 3-cleft, dentate, the stem-leaves once or twice ternate, with linear lanceolate segments, the calyx erecto-patent, the carpels margined, beaked, and spinous; the flowers are pale yellow. It is native throughout Europe, and is also found in North America. It is very acrid and dangerous to cattle, though they are said to eat it greedily.

M. Brugnon, who has given a particular account of its qualities, relates that three ounces of the juice killed a dog in four minutes. Several sheep were killed by eating this herb at Turin, which first led to an investigation of the matter.

R. bulbosus, like others of the genus, is extremely acrid, and raises blisters and produces extensive inflammation of the skin. Gilibert states that it vesicates with less pain than cantharides and without affecting the urinary passages.

R. Asiaticus, Common Garden Ranunculus, has ternate or triternate leaves, the segments toothed or deeply trifid, the stem erect, simple, or branched at the base, the calyx spreading, afterwards reflexed, the spikes of the carpels cylindrical. It is a native of the Levant, and is referred to by Dioscorides, 2. 206. Three varieties of this favourite plant in our gardens have been described, which some have regarded as species:—1. *R. A. vulgaris*, with the stem branched at the bottom, the leaves ternate, the segments trifid, cut, acute. The flowers of this variety are generally formed double, and have all colours except blue. It is called the Persian Ranunculus. 2. *R. A. sanguineus*, with a simple stem, ternate leaves, and obtuse toothed segments. The flowers are orange or yellow. This is called the Turkey Ranunculus. 3. *R. A. tenuilobus*, with a somewhat branched stem, and multifid leaves with linear acute lobes. It is a native of the island of Cyprus, and has white or yellow or purple flowers.

The *R. lanuginosus* of Linnæus is the Βατράχιον τέταρτον χροαβέστερον of Discorides, loc. cit. The *R. muricatus*, Linn., is the Βατράχιον τρίτον of Discorides, loc. cit.

(Don, *Dichlamydeous Plants*; Lindley, *Flora Medica*; Fraas, *Synopsis Floræ Classicæ Plantarum*; Burnett, *Outlines of Botany*.)

RAPA. [Brassica.]

RAPA'CES. [Raptores.]

RAPE. This plant, which is of the Cabbage Tribe, is cultivated like cole, or colza, for the sake of its seeds, from which oil is extracted by grinding and pressure. It is also extensively cultivated in England for the succulent food which its thick and fleshy stem and leaves supply to sheep when other fodder is scarce. [Rape, in Arts and Sc. Div.; Brassica.]

RA'PHANUS, a genus of Plants belonging to the natural order *Cruciferæ*. It is mostly remarkable for containing the common radish, *Raphanus sativus*. This plant, a native of China, has been cultivated in this country for upwards of 250 years, and has given rise to numerous varieties, which are divided into long-rooted or spindle-shaped, and round or turnip-rooted. They are also denominated spring, summer, autumn, or winter radishes, according to the season in which the respective sorts are found best adapted for use; [Radish, in Arts and Sc. Div.]

R. Raphanistrum, Jointed-Charlock, is a British species. It has moniliform pods, striated, shorter than the very long beak, the leaves simply lyrate. The petals are veined white and lilac. It is a native of corn-fields.

R. maritimus, Sea-Radish. It has moniliform striated pods, longer than the beak; the radical leaves are interruptedly pinnate. The petals are yellow. It is a rare inhabitant of the sea-coasts of Britain.

RAPHIOSAU'RUS, a genus of Fossil Reptiles from the lower parts of the Cretaceous System. (Owen.)

RAPHUS, Brisson's name for the Dodo. [Dodo.]

RAPTATO'RES, Illiger's name for his third order of Birds, comprehending the Birds of Prey.

His *Raptatores* consist of the following families and genera:—

Nocturni.—*Strix.*

Accipitrini.—*Falco, Gypogeranus, Gypætus.*

Vulturini.—*Vultur, Cathartes.*

This order is placed by Illiger between the *Ambulatores* and *Rasores*.

The *Accipitres*, Linnæus's first order, include the genera *Vultur, Falco, Strix*, and *Lanius*.

RAPTO'RES, the name assigned by Mr. Vigors to the Birds of Prey. [Raptatores.]

The *Raptores* of Mr. Vigors form his first order, and the following families are arranged by him under it:—Vulturidæ, Falconidæ, Strigidæ, *Gypogeranidæ* (?).

The *Raptores* of Mr. Swainson comprise the families of *Vulturidæ Falconidæ*, and *Strigidæ*.

Mr. G. R. Gray also makes the *Raptores* consist of the families *Vulturidæ, Falconidæ*, and *Strigidæ*.

RARA. [Musophagidæ.]

RASO'RES. The *Rasores* of Illiger contained the following families and genera:—

Gallinacei.—*Numida, Meleagris, Penelope, Crax, Opisthocomus, Pavo, Phasianus, Gallus, Menura, Tetrao*, and *Perdix*.

Epollicati.—*Ortygis* (*Turnix*), *Syrrhaptes*.

Columbini.—*Columba*.

Cepturi.—*Crypturus* (*Tinamus*, Latham).

Ineptl.—*Didus*.

The order, which is the fourth in Illiger's method, is placed between the *Raptatores* and *Cursores*.

The order *Gallinæ* of Linnæus was placed between the *Grallæ* and the *Passeres*, *Struthio* being the last genus of the former, and *Columba* the first of the latter order.

The genera of *Gallinæ* are *Didus, Pavo, Meleagris, Crax, Phasianus, Numida*, and *Tetrao*.

The *Rasores* of Mr. Vigors consist of the families *Columbidæ, Phasianidæ, Tetraonidæ, Struthionidæ*, and *Cracidæ*.

The *Rasores* of Mr. Swainson comprehend the families *Pavonidæ Tetraonidæ, Struthionidæ, Columbidæ*, and *Megapodiidæ*.

The *Rasores* of Mr. G. R. Gray embrace the families *Cracidæ, Phasianidæ, Tetraonidæ, Chionidæ*, and *Tinamidæ*.

RASPBERRY. [Rubus; Raspberry, in Arts and Sc. Div.]

RAT. [Muridæ.]

RATANY, RHATANY, or RATANHI'A. [Krameria.]

RATA'RIA. [Acalephæ.]

RATEL. [Ursidæ.]

RATTLE, RED (*Pedicularis sylvaticæ*). [Pedicularis.]

RATTLE, YELLOW. [Rhinanthus.]

RATTLESNAKE. [Crotalidæ.]

RATTLESNAKE-FERN. [Botrychium.]

RATTLESNAKE-WEED. [Eryngium.]

RAUCHWA'CKE (in Geology), one of the calcareous members of the Zechstein Formation of Germany, the equivalent of the Magnesian Limestone Formation in England. It is either compact, cellular, or dolomitic. Associated with gypsum and with beds called stinkstein,

asche, zechstein, and kupferschiefer, it makes a series of five terms which may be classed and arranged in comparison with English types and names. This is done by Von Meyer, after Sedgwick, thus:—

German.	English.
Asche (friable marl), and	Thin-bedded limestone of Knottingley.
Stinkstein (thin-bedded fetid limestone).	Coloured marls and gypsum.
Rauchwacke (limestone).	Yellow magnesian limestone.
Zechstein (limestone).	Compact limestone.
Kupferschiefer (copper-slate).	Marl-slate.

We may perhaps prefer to view the asche, stinkstein, and rauchwacke, as altogether only one feeble upper group comparable with the upper laminated and cellular limestones of Knottingley, and the zechstein as equivalent to our yellow magnesian limestone, in which case the Kupferschiefer is on the parallel of our marl-slate. These formations contain the remains of the genus of fishes named *Palæoniscus*.

RAVEN, the common name of the *Corvus Corax*. We subjoin a cut of the head and foot of this species omitted in the article CORVIDÆ, where an account of this bird is given.

Head and Foot of Raven.

RAYED or RADIATE ANIMALS, RADIATA, a class of Invertebrate Animals. It embraces the orders *Echinodermata* [ECHINODERMATA], *Acalephæ* [ACALEPHÆ], *Entozoa* [ENTOZOA], *Polypifera* [POLYPIFERA], *Porifera* [SPONGIADÆ], and *Infusoria* [INFUSORIA.] It has the following characters:—The nervous system when present is without ganglia, and is composed of single filaments, which are disposed in a circular form around the buccal orifice. The organs of the body are arranged in a radiate manner around the digestive cavity. The organs of digestion consist of a single sac or short alimentary canal. The animals are mostly aquatic, breathing by gills, and usually free. Professor Owen in 1835 proposed a binary arrangement of these animals, according as the nervous system was filamentous or altogether absent. He observed that in those *Radiata* of Cuvier in which the nervous system could be most unequivocally traced in a filamentary form, likewise presented an alimentary canal suspended in a distinct abdominal cavity, and with a very few exceptions, provided with a distinct outlet. The nerves were accompanied with a corresponding development of the muscular system. The following is Professor Owen's plan:—

Sub-Kingdom RADIATA.

Nematoneura. *Acrita.*

Class *Radiaria*, Lamarck.

Echinoderma, Cuv. *Acalephæ*, Cuv.

Class *Polypi*, Cuv.

Ciliobrachiata, Farre; *Anthozoa*, Ehr.; *Nudibrachiata*, Farre.

Class *Entozoa*, Rudolph.

Cœlelmintha, Owen. *Sterelmintha*, Owen.

Class *Infusoria*, Cuv.

Rotifera, Ehr. *Polygastria*, Ehr.

Some of the animals thus placed amongst the *Radiata* are removed by other naturalists. Thus the *Ciliobrachiata* of Farre are now frequently referred to the *Mollusca* [MOLLUSCA], and the *Rotifera* to the *Articulata*.

(Owen, *Lectures on Comparative Anatomy.*)

RAZOR-BILL. [AUK.]

RAZOR-FISH. [PYLORIDIA.]

REALGAR. [ARSENIC.]

REAUMURIACEÆ, *Reaumuriads*, a natural order of Plants belonging to the Exogenous class. It has a 5-parted calyx, surrounded externally by imbricated bracts; 5 petals, hypogynous, unequal-sided, sometimes having a pair of membranous plates planted upon their middle; definite or indefinite, hypogynous, monadelphous, or polyadelphous stamens, with or without a hypogynous disc; the anthers ovate, turned inwards, and bursting longitudinally; 2-4-5 carpels, partially separate from each other, surrounding a central placenta which passes into the base of each; 2 or 4 ascending anatropal ovules, with filiform or subulate styles; a capsular fruit with 2 to 5 valves and as many cells, unless the number is diminished by abortion; shaggy definite erect seeds, with a straight embryo surrounded by a small quantity of mealy albumen, and the radicle next the hilum. The species of this order are small shrubs, with fleshy scale-like leaves, which are alternate and have no stipules, and are overspread by resinous sunk glands.

This little order consists of three genera, *Reaumuria*, *Hololachna*, and *Eichwaldia*, which were formerly referred to *Tamaricaceæ*; they have however but little affinity with that order. Their true affinities seem to be with *Hypericaceæ*, near to which Lindley has placed them. The species are generally natives of the coast of the Mediterranean, and of salt plains in the milder parts of Northern Asia.

The genus *Reaumuria* was named by Haselquist in honour of René Antoine Ferchault de Reaumur. It has a 5-parted involucred calyx; 5 petals, permanent, furnished at the base on each side with a ciliated appendage; numerous pentadelphous stamens; 5-6 stigmas; a 5-valved 5-celled capsule, with valves easily separating from the septa, and shaggy seeds.

R. vermiculata has subulate semi-terete imbricated leaves, crowded on the branches. It is a native of Sicily, Bombay, and Egypt. This plant resembles *Salsola fruticosa*. It is used at Alexandria as a remedy for the itch, being bruised and applied externally, and a decoction taken internally.

R. hypericoides has lanceolate flat rather remote leaves. It is a native of Syria and Persia. These plants are elegant little shrubs of easy culture, which thrive well in a mixture of sandy loam and peat; and young cuttings will grow freely in sand under a hand-glass.

Hololachna (from ὅλος, 'entire,' and λάχνη, 'wool,' or 'thick hair') has a 4-5-parted calyx; 4-5-petals; 8-10 hypogynous monadelphous stamens inserted into an hypogynous gland; 2-4 short subulate styles; the capsule 2-4-angled, 2-4-valved, 2-4-celled; the seeds few, large, surface shaggy. The only species is *H. Songarica*, found by Ehrenberg in the Soongarian desert of Siberia. In cultivation this plant requires to be watered with salt-water. All the plants of this order abound in saline matter in their tissues.

(Lindley, *Vegetable Kingdom*; Don, *Dichlamydeous Plants*; Lindley *Flora Medica*.)

RECEPTACLE, in Botany, is that part of the flower on which any of the other organs rest. It represents the internodes of the stem and branches in their changed condition. It assumes a variety of forms, and enters very variously into the forms of flowers and fruits. [FLOWER; CALATHIDIUM; FRUIT.]

RECEPTACULI'TES, a genus of Fossils proposed by Defrance synonymous with *Ischadites* of Murchison.

RECURVIROSTRA. [AVOSET.]

RED-BREAST. [ERYTHACA.]

RED-DEER. [CERVIDÆ.]

RED-EYE. [LEUCISCUS.]

RED LEAD. [LEAD.]

RED MARL. An argillaceous red portion of the series of rocks between the Coal and Lias is thus termed in geology. Almost identical marls, similarly associated with red-sandstones, lie also in the upper part of the coal, and below the coal and mountain limestone. Nor would it be always easy to distinguish in specimens, or even in sections on a large scale, the upper red marls immediately below the lias of the Trent or the Avon from the red marls above the non-magnesian limestone of Knottingley, those above the magnesian limestone of Pontefract, those below the same limestone near Wetherby, those in the upper part of the coal formation of Manchester, or below the whole of the coal and mountain limestone in Monmouthshire.

RED-SANDSTONE FORMATION. In geology the term Red-Sandstone is used in a variety of senses, partly with reference to the mere colour of certain rocks, and partly as expressing rocks of certain geological periods. Thus we have in the latter sense New Red-Sandstone, Lower Red-Sandstone, and Old Red-Sandstone; and on the continent, Alter Rother Sandstein, Neuer Rother Sandstein, le Vieux Gres Rouge, le Nouveau Gres Rouge, &c. The Red-Sandstone also means, in some geological works, either the upper part or the whole system of the rocks, calcareous, argillaceous, and arenaceous, which occurs in the series of strata between the coal formation and the lias. If we

regard the analogy of the geological nomenclature most generally used, this latter sense will appear too inconvenient to be adopted; as substitutes we have the Pœcilitic System, from the various colours of the component masses; and the Saliferous System, from its frequently containing salt.

Sandstones or Gritstones, generally speaking, consist of abraded and worn pieces of quartz, felspar, mica, and other minerals, such as commonly occur in granite, gneiss, or mica-schist, and other rocks associated with these. The size of these pieces is sometimes such as cause the mass to deserve the title of conglomerate (as part of the millstone-grit of Derbyshire), and sometimes the grains are so fine and confluent, that the mass is not unlike some sorts of quartz rock (as the ganister of the Yorkshire coal-field). In regard to induration, there is every degree from uncoherent sand, through friable and argillaceous sandstones, to compact grits and indurated quartzose rocks. In colours they admit of every shade from whiteness, through gray tints by carbonaceous admixture, through yellow and brown hues by admixture of carbonate and oxide of iron, and through reds, blues, and purples of different kinds by diffusion of oxides of iron, manganese, &c.

In this most complex series of detrital deposits, red-sandstones present some remarkable characters when regarded as to the nature and diffusion of red colour, the association of this with other tints, the relation of their hues to organic life, and to other geological phenomena.

Red-sandstones occur in the basin of the Allier in France, in tertiary strata; in the plastic clay group of the Isle of Wight; generally in the strata below the lias and above the coal; in the upper parts of the coal formation of Derbyshire and Lancashire; in the millstone-grit series of Lancashire; in the mountain limestone of the north of England; generally in the strata called old red-sandstone, above the strata of the Silurian districts; in the midst of the green and purple slates of north and south Devon; in the midst of older rocks in the Lammermuir, Cavan, and Longmynd ridges; but the most perfect and abundant types are in those parts of the series which lie above and below the carboniferous rocks, and constitute the New and Old Red-Sandstone groups.

The essential peculiarity of these reddened rocks is apparently a general diffusion in their mass, and especially round their constituent grains of quartz, of red peroxide of iron (with also often some oxide of manganese?). If by means of muriatic acid the iron be removed from the red-sandstone of Manchester, what remains is a mass of mostly white and even translucent quartz grains, which had been invested by the red oxide of iron. Singularly enough, amidst a great series of such red-sandstones and red-clays, nothing is more common and even characteristic than to find oval, round, or irregular patches of light-green colours, apparently due to the protoxide of the same metal. Nor is it at all rare to find perfectly white bands alternating with red or green stripes; and this applies almost equally to the sandstones, clays, gypsum-bands, and salt layers.

A very remarkable and general fact observed in studying these red rocks is the paucity of the remains of animals of every grade

The explanation of this fact, which seems most probable, is that water in which by any cause abundance of peroxide of iron has been diffused, is rendered thereby unsuitable for the due performance of the vital functions of aquatic creatures, especially such as take the water into their bodies for respiration, or are nourished by the flowing of currents to the mouth.

The last point on which it seems here necessary to remark is the frequent concurrence of red-sandstones and clays, fibrous and lamellar gypsum, fibrous and lamellar rock salt. Most of the rock-salt, of Europe at least, is associated with red earthy deposits; but there are great exceptions, as at Salzburg and Wieliczka. This frequent concurrence will be found of great importance in reasoning on the physical agencies whereby the peculiarities of red-sandstones were occasioned.

As building materials, few of the red-sandstones are to be recommended, and even the white layers which accompany them are seldom of much value. The cathedrals of Carlisle and Chester, and the noble old churches of Coventry, offer a striking warning to the architect; though on the other hand, part of the ancient wall of Penrith Castle, still standing and in good preservation, shows that even among these justly suspected strata, some portions, either by their freedom from salt, or some other cause, are to be excepted from censure.

The term Red-Sandstone is more especially applied to two formations, the Old Red-Sandstone, or Devonian [OLD RED-SANDSTONE], and the New Red-Sandstone Rocks. The latter are also sometimes called Saliferous, on account of the salt they contain, and they are also called Triassic.

"It is in Cheshire and the southern part of Lancashire, and the northern part of Shropshire, which together form an extensive and rich plain, watered by the Dee, the Mersey, and the Weaver, that the uppermost beds of the New Red-Sandstone are chiefly developed; and by a minute examination of these beds, and those of Warwickshire, the saliferous marls have been identified with the uppermost strata of the foreign Triassic System. Throughout this range the beds are nearly horizontal, the dip rarely exceeding ten or twelve degrees, and being constantly towards the east, or a few degrees north or south of that point. They are however affected by some important faults. The whole district abounds with salt-springs, which are more especially plentiful in Cheshire; and in that county also there occur extensive masses of rock-salt in a solid state, their total thickness amounting to not less than sixty feet. These alternate with beds of gypsum; with numerous bands of indurated clay of a blue, red, or brown colour; and with sandstones, frequently marly, and of a red colour.

"The red-marl district, with brine springs, is continued southward into Worcestershire, and northward into the valley of the Iden, and the same part of the formation extends also eastward, occupying for the most part the plains through which the Humber and its tributaries make their way to the German Ocean. In Somersetshire and Devonshire similar sandstones recur, and lie unconformably, overlapping the inclined edges of the older rocks, or abutting against them, but uniformly composed of the same materials, remarkable throughout for the ochraceous colour pervading them. Between Sidmouth and Seaton, in Devonshire, the red marls contain gypsum in abundance; and near Teignmouth the cliffs, which are of considerable height, consist of alternations of argillaceous beds of sandstone and of conglomerate.

"The beds which are lowest in position of the upper new red-sandstone are chiefly found in the middle of England, and consist of thick masses of whitish soft sandstone. In some places (as in Staffordshire) these are surmounted by conglomerates, composed of rounded pebbles of quartz rock, and other fragments, chiefly of Silurian rocks and old red-sandstone. The total thickness of this part of the formation is considerable, but has not been accurately calculated. It is only to be distinguished from the overlying saliferous marls by small differences of mineral character." (Ansted.)

Viewed on the great scale, the New Red-Sandstone system of rocks is one of the most varied and interesting we are acquainted with. There are peculiarities in its limestones, sandstones, and clays, as well as in its gypseous and salt deposits; the occurrence and nature of its organic contents, and the relation which it bears altogether to earlier and later classes of rocks, are worthy of careful study.

Sulphate of lime is found perhaps as frequently and under almost as many curious circumstances in the stratified rocks, as carbonate of lime, in mealy aggregations, acicular prisms, broadly foliated crystals (selenite), fibrous masses and beds, and marmoroid or alabastrine rocks. It lies in strata of almost every age, and is not absent from diluvial, alluvial, and recent deposits. The mode of its occurrence is in a considerable degree characteristic of each particular mineral type. While long prismatic crystals appear in cavities of shells and in recent excavations (as in the gallery of Felling Colliery, Newcastle), the solitary broad flaky crystals of selenite abound in blue-clays of the tertiary and secondary series (which receive their colour from protoxide of iron), and the fibrous gypsum marks, spots, and irregular lines in the red-clays (coloured by peroxide) of the Saliferous system, the fibres being (in agreement with a general law of structures) arranged so as to lie at right angles to the broader surfaces which bound the mass. The marmoroid texture is most commonly found in real however irregular beds, as at Montmartre, and in some points near Fairburn in Yorkshire, on the line of the York and North-Midland railway. At these places fibrous, marmoroid, and flaky sulphate of lime may be obtained in association.

From what is known to take place at the present day, and from appearances in the distribution of the gypsum and selenite in masses of clay and cavities of shells, &c., it appears that in a great proportion of cases these crystallised masses owe their origin to the processes of segregation since the deposition of the earthy masses in which they appear. In no other way is it at all conceivable or even possible that the irregular masses of gypsum which appear in red-marl at Axmouth, Aust Passage, and the Trent's mouth could be formed. The marls in which they here lie were deposited as fine mud, and if we suppose merely a slow extrication of the liquid, so that its contained salts might remain, the arrangement of these salts in such irregular masses during crystallisation presents no particular difficulty.

Salt shows itself in the Cheshire mines as either granular, broadly laminated, or fibrous; in great beds or minutely mixed with marls, nearly as gypsum is, and probably in regard to its origin, similar suppositions will apply, the solid beds (of limited extent however and irregular area) being due to a great evaporation of liquid over the previously-deposited marls. That such water, in the case of rock-salt generally, was derived from the sea, is almost certain, from the occurrence of iodine and bromine in the brine-springs connected with them. (Daubeny's Memoir in 'Phil. Trans.') But it does not follow that the area in which the salt was found was, at the time of its formation, or for some time previously or subsequently, connected with the sea. Lagoons may have been the theatre of the evaporation supposed, and earthy sediments, such as occur in Cheshire and Poland, may have been drifted in by fresh-waters or the sea, according to circumstances, and it is not difficult to imagine a repetition of the processes, such as might produce the two great beds of rock-salt in Cheshire. It is not known that organic remains of any kind accompany the salt of Cheshire, but this is almost true of the whole range of the red-marls, in which these deposits lie.

We find, then, associated together, abundance of red-oxide of iron,

salt, and gypsum, but few or no organic remains. The prevalence of red-oxide of iron in any of the strata is accompanied by a paucity or total absence of organic remains. In the new red-sandstone these red strata extend through several hundred feet of thickness, and it is found in general terms, that the types of organic life above and below are widely different. Similarly the thick series of old red-sandstone contains few organic fossils, and separates two distinct groups of these productions. Some great physical changes then must be supposed to have occurred previous to and during the saliferous period, and to have influenced both chemical and vital phenomena.

M. Adolphe Brongniart ('Prodrome d'une Histoire des Végétaux Fossiles,' 1829), viewing the series of fossil plants, gives four great periods of ancient vegetation:—The first extending from the earliest strata to the new red-sandstone strata; the second including these strata; the third including the oolites and chalk; the fourth the tertiary strata. Of these the flora of the second period (chiefly terrestrial) is very limited, and may be looked upon as a transition group of plants connecting the earlier and later periods. Similarly the series of marine *Invertebrata* which lie in the new red-sandstone have characters intermediate between the early (palæozoic) and later races of pre-adamitic life.

Although the fossils of this rock are but few, they are highly interesting. It is amongst these rocks that we find the first traces of an air-breathing animal. This creature, which was at first called *Cheirotherium*, is now known by the name of Labyrinthodon. It belongs to the amphibious tribe of Reptiles. [Amphibia.] Footmarks of an extinct reptile have also been found in the red-sandstone of America, and described by Dr. Lea.

The equivalents of the British beds of new red-sandstone on the continent of Europe are—the Keuper Marls, or Marnes irisées, the Muschelkalk, and the Bunter Sandstein, or Grès Bigarre, of Germany and France.

RED SNOW. [Snow, Red.]

REDPOLE [Linota.]

REDSTART. [Sylviadæ.]

RED-WING. [Merulidæ.]

REED. [Phragmites.]

REED, SEA. [Psamma.]

REED-BUNTING. [Emberizidæ.]

REED-BUR. [Sparganium.]

REED-MACE. [Typhaceæ.]

REED-WARBLER. [Salicaria.]

REED-WREN. [Salicaria.]

REGENIA. [Montoridæ.]

REGULUS. [Cockatrice.]

REGULUS, a genus of Birds belonging to the family *Sylviadæ*. The genus is thus defined by Mr. Yarrell:—Beak slender, straight, the edges dilated at the base, compressed towards the point; nostrils basal, lateral, oval, partly covered by small feathers directed forwards. Wings of moderate length; the first quill-feather very short; the second shorter than the third; the fourth or fifth the longest in the wing. Legs rather slender; feet with three toes before, one behind; the outer toe joined at its base to the middle toe; claws curved and sharp. There are three British species of this genus.

R. cristatus, the Golden-Crested Regulus, Golden-Crested Warbler, or Kinglet.

R. ignicapillus, the Fire-Crested Regulus, Fire-Crested Wren.

R. modestus, the Dalmatian Regulus. This is a very rare species.

There are three other species natives of North America.

(Yarrell, *British Birds*.)

REH BOC. [Cervidæ.]

REIN-DEER. [Cervidæ.]

REIN-DEER MOSS. [Cladonia.]

REMAINS, ORGANIC. [Organic Remains.]

REMBUS. [Licinus.]

REMIPES. [Hippides.]

REMOPLEU'RIDES, a singular fossil genus of *Trilobites* found in the Silurian Strata of Tyrone by Portlock, who describes it in his 'Geological Report' on Tyrone.

REMORA. [Echeneis.]

REPRODUCTION IN PLANTS AND ANIMALS. The term Reproduction has been employed to denote those processes in organic beings by which the individual being is produced, developed, and maintained. It has thus been employed to express processes which are functionally distinct, and have very different ends in the economy of creation. The constant reproduction of the same tissues in the same part, is the means by which the form of the individual being is maintained during its life, and is the result of the ordinary processes of nutrition. This function is carried on throughout the whole animal and vegetable kingdom, until the death of a part or the whole of the being occurs. The power however of reproducing the same tissues, varies in different beings, and we find that although it is possessed even to the restoration of a lost limb amongst the lower animals, no such power is possessed by the highest.

The term Reproduction has also been applied to the origination of the germ from which individual plants and animals grow. The process employed in the initiation of life, seems to be essentially distinct from those engaged in carrying it on: hence the propriety of distinguishing in terms between that production of cells by which the life of the individual is maintained, and the arrangements by which its existence as an individual is ensured. It has been proposed to restrict the term Generation to the latter process.

Although formerly great difficulties existed in distinguishing between these two processes from the want of sufficient observations, recent researches seem to have supplied all that is necessary. In the ordinary reproduction of the tissues of plants and animals each cell has the power of producing other cells, or a large number of the same kind of cells are developed simultaneously, but in generation it is necessary that two cells should take part. At one time it was supposed that this process did not take place in the generation of the lower animals and plants, but recent investigations have shown that the union of two cells is necessary to so large a number of the forms of lower plants and animals, that it is a fair inference that this is a universal necessity in the generation of organic beings. The two cells thus engaged have been called the germ-cell and the sperm-cell. The germ-cell is that in which the process of growth of the new being commences, whilst the sperm-cell is that which communicates the growing tendency to the other. These cells are of different sizes and forms in the animal and vegetable kingdoms, and are placed in very various positions in relation to other organs, and the means by which they are brought together are very various, but in all cases they perform the same fundamental function.

The discovery of the necessity of the union of these two cells, for the production of a new being, has gone far to settle the question of "equivocal" or "spontaneous generation." Ever since the extended use of the microscope in the investigation of the structure of the organic beings, it has become more and more apparent that there was no basis for the supposition that organic beings came into existence independent of a preceding organism. The only cases in which it is now pretended that such an origin of organic life could take place, are those in which the minuter forms of animal and vegetable life occur in infusions exposed to the atmosphere. But this occurrence admits of easy explanation, when it is remembered how exceedingly minute many of these organisms are, and that they are frequently produced from ova much smaller than themselves. Such organisms are easily taken up into the atmosphere, and can be thus conveyed from one spot to another. That such is the fact is proved by the experiment of passing atmospheric air through red hot tubes or strong sulphuric acid, when it is found that water exposed to such air never affords any indications of the existence of organic beings, whilst the same water exposed to ordinary atmospheric air will, in a few hours, teem with living beings.

Although the subject of the generation of animals and plants has been regarded as a subject of much mystery, the facts it presents are now as well understood as any other branch of physiological inquiry. The greatest mystery is the mystery of all nature, and that is the reason of the assumption of a particular form by what appears to be the same combination of elements. No difference can be discerned in the cells of the flowers of the oak and the apple, but the one always produce oak-trees, whilst the others always produce apple-trees. It is the same with the cells of animals, without the slightest appreciable external difference; the one set of cells will develop the form of one species of animal, and another set, another species. This fact has led some inquirers to the assumption of the existence of a 'vital principle,' of a distinct and independent essence giving to each species its definite form and character. There is no objection to such an hypothesis, provided it is not made use of to explain phenomena which are clearly under the influence of chemical and physical forces. As so much misunderstanding prevails with regard to the word 'vital principle,' it is better perhaps to discard it, and to speak of the limitation of form to which each species is subject, as under the control of a 'formative force.' This formative force being the ultimate fact in the history of each individual plant and animal, and regulating the chemical and physical processes, the result of which is usually called life, it has been proposed to call this a germ-force, or a germinal capacity; but as it is very clear that it is the same force that is in action to produce the whole life or growth of the plant or animal, there is no necessity for distinguishing its first effects, as observed in the act of generation.

In studying then the phenomena of generation, there are three conditions which have to be regarded.

Firstly, the Formative Force, which is peculiar in every species, and identical in all the generative cells produced in that species.

Secondly, the Physical Conditions in which the generative cells are placed. These are more especially heat and light, and the condition of the cell-membrane through which absorption takes place.

Thirdly, the Elements which are supplied for the nourishment of the new being, and which by their Chemical Properties are capable of exercising an influence on the form and development of the plant or animal.

Each of these circumstances is found exercising varying degrees of influence in plants and animals. Thus, amongst the lower forms of both the animal and vegetable kingdom, the formative force appears to exercise less influence than among the higher. This is seen in the very varied forms which the same species of plant and animal assume under different circumstances. In fact, till very recently, many of the

forms of *Fungi*, *Algæ*, and Infusorial Animalcules, which had received different generic names, are now found to belong to the same species. These variations are found to be chiefly produced by the influence of the third set of circumstances. The highest animals and plants are however liable to great modifications of the activity of the formative force by the operation of both physical and chemical circumstances. Many insects are not hatched till a certain amount of external temperature takes place. Plants will not produce their leaves without the influence of light. Tadpoles are not developed into frogs and toads when deprived of light and heat. The ordinary bee is converted into a queen-bee by the speciality of its food. The *Brassica oleracea* of the sea-shore is converted into red and white cabbages, cauliflowers, and broccoli by garden culture. All cultivated plants exhibit more or less modification of their growth under the influence of physical and chemical circumstances. The dog, the pig, the horse, the sheep, and man himself present varieties which are manifestly dependent on external circumstances, and not on any change in the character of the formative or species-making force.

That there is no change in the character of this force is seen in the tendency which all the forms of a particular species have to recur to a definite type, or to cease to exist. This is seen especially in the case of cultivated plants and domesticated animals, which are subject to the greatest varieties of form, but which nevertheless retain through all, the evidence of a specific formative force. Thus, closely allied as are the species of apple and pear (the *Pyrus malus* and *Pyrus vulgaris* of botanists), and subject as they are to so great variations that above a thousand forms of apple have been produced in Great Britain alone, there is not the slightest tendency in any of these cases towards confusing the specific character of the apple-tree and the pear-tree. So with our domesticated animals. The horse and ass will even breed together, but the hybrid is not prolific, and there is no tendency on the part of the one species to degrade or develop into the other. All the facts that are known with regard to the nature of the formative force lead to the conclusion that it is specific and not general, and that it is regulated by the same laws throughout all time.

In what is called the alternation of generations (GENERATIONS, ALTERNATION OF), it might be supposed that an exception occurred to the ordinary process of generation. It will be seen however that in all the cases in which this phenomenon occurs, that it results from modifications of the ordinary processes of reproduction, and the unusual disposition of the sperm-cells and germ-cells.

Having made these general remarks, we shall now proceed to speak more particularly of the process of generation as it occurs in plants and animals, restricting this term to the phenomena which take place as the result of the union of two cells. That reproduction in plants which occurs as the result of the growth of the same tissues from single cells, when it results in the production of a bud, is termed Gemmation or Sprouting. This kind of reproduction also takes place in the animal kingdom, and amongst many of the lower animals the power of reproducing new individuals * by a process of budding is seen. To this process of forming new beings as it were, from single cells, Professor Braun of Berlin has applied the term 'Verjungung,' which has been translated by Mr. Henfrey 'rejuvenescence.'

Amongst plants the lowest position must be assigned to the families *Diatomaceæ* and *Desmidieæ*, and it is amongst these that the most clear evidence has been obtained of the union of cells in order to the production of the zoospores from which the new beings are developed. [DESMIDIEÆ; DIATOMACEÆ.] The union of two cells is also seen in a large number of *Confervaceæ*, especially in the groups to which the *Zygnemata* belong. [ZYGNEMA.]

Although amongst the *Algæ* the production of spores can be traced in so large a number of cases to the union of two cells, their multiplication more ordinarily takes place by means of zoospores or zoosporoid bodies, which are perfectly homologous with the buds or sprouts of the higher forms of plants.

In the *Fungi* we meet with a variety of reproductive organs. As these have been investigated very recently, we give the following extract from Dr. Sanderson's account of the vegetable ovum in the 'Cyclopædia of Anatomy and Physiology':—

The simplest form of reproductive organs in the *Fungi* are those in which the spores occur on a basis or basidium. This form of organ is best seen in Geaster. The next form of reproductive organs in the *Fungi* is in the form of a vesicle or bag, which is called a theca, or ascus. "Of these, the first which we shall mention belong to a group of subterranean plants, of which the Truffle is the best known example. The receptacle of the Truffle consists of a fleshy mass, throughout which numerous sinuous cavities are interspersed. Each cavity is partly lined, partly filled with the theca and the cells upon which they are supported. This receptacle, like that of all other *Fungi* with which we are acquainted, originates from a pre-existing mycelium. In its unripe condition it displays on section a number of sinuous empty cavities, which either communicate with each other, or open at one or more points of the external surface. As the Truffle advances towards maturity the cavities are obliterated by the formation of a whitish tissue, so that on section, we observe the whole to consist of two substances—the one translucent, of firm consistence, and of a dark-brown colour; the other white and opaque. The former, which corresponds to the partitions which, in the young state of the Truffle, separated the cavities, is continuous with the external tissue which composes the envelope or peridium, and constitutes the vena interna of Vittadini. The laminæ which it forms consist of filaments running, for the most part, parallel to each other. The white substance which occupies the original cavities of the tuber is formed of closed tubes, which are given off in great numbers from the surfaces of the laminæ. These tubes, which are the terminations of the filaments of which the laminæ are composed, are of two kinds. Some are of equal diameter throughout, and divided at intervals by septa; others much shorter are dilated at their extremities, and contain spores (thecæ). Each theca is an obovate vesicle, and contains two, three, or more spores, never more than eight. Each spore is invested with a beautifully reticulate or sometimes warty epispore, within which may be distinguished a smooth inner membrane, immediately inclosing the oleaginous contents.

"The ascophorous *Fungi* are represented in their simplest form by the *Uredineæ*, a family which has been studied by numerous observers on account of the destructive properties of the plants belonging to it. The mass which is formed by the growth of the reproductive organs of *Uredo* under the epidermis of the leaves of the plants upon which it grows parasitically, may be aptly compared to a pustule, a grumous-looking substance, occupying, as it were, the place of the pus. On more minute examination of the cavity, we find that it is bounded by a kind of irregular wall, or lining of pyriform cells, the smaller ends of which rest upon a reticular cushion of mycelium. These are probably the enlarged extremities of the mycelium filaments, with which many of them can be distinctly traced to be connected. Towards the base of the cavity other cells are developed, resembling those first mentioned in their general form, as well as in their relation to the mycelium. In these however the membrane is produced inferiorly, so as to form a tabular pedicle; while in the club-shaped upper extremity it is lined by a considerable deposit of granular protoplasma, so that here the central cavity is very much smaller than that of the external membrane. It is in this cavity that the spore is formed, at first not exceeding it in size, but afterwards increasing at the expense of the protoplasma, so as almost to fill the theca. In other genera, as in *Phragmidium*, there are pedicled cells of a similar form, and originating in a similar manner, which however, instead of one spore, develop a number in their interior; these spores are arranged in linear series, and are formed in the same manner. The protoplasma however never disappears completely, but remains as a more or less consistent membrane, glueing the ripe spore to the spore-case which encloses it. Some of the *Uredineæ* possess a cyst which reminds us of the perithecium of the *Sphæriaceæ*, to which they are evidently closely related. The cyst is formed (*Æcidium*) of a single layer of roundish cells.

"From the *Uredineæ* we pass by a natural transition to the Discomycetes and Pyrenomycetes. These plants have been investigated with much success by Messrs. Tulasne, who have shown that they possess the closest relationship not only to the Lichens, but to the most simple thread *Fungi*. The very remarkable facts which these observers have discovered, render the study of these plants more satisfactory and instructive, than that of any other family of the class. The Pyrenomycetes are represented by *Sphæria*, the receptacle of which consists, as is well known, of a spherical cyst, which is open above. Its wall is frequently prolonged upwards into a tubular beak, which projects beyond the surface of the bark or wood in which the whole plant is imbedded. The membrane of the cyst (perithecium) is usually composed of polygonal tabular cells; it is lined by an inner layer, formed of the commencements of the paraphyses and thecæ, and of the filaments with which they are connected. The thecæ are obovate cells, the membrane of which is of extreme delicacy. When fully formed, they contain from three to eight oval spores, the epispores of which are in the early condition delicate and pellucid, but by degrees become brown and opaque. The contents of the spores, as is observed throughout the higher *Fungi*, consist of a fluid loaded with oily granules. The thecæ are arranged with their long axes perpendicular to the inner surface of the perithecium from which they spring, and are intermixed with a greater or less number of slender cylindrical paraphyses. The whole perithecium is usually enveloped in the filamentous stroma or mycelium, from which it takes its origin. The Discomycetes are represented by the *Peziza*; between these and the *Sphæriæ* there are differences of external form, which, though they strike the superficial observer as important, are in reality trivial. While the receptacle of the *Sphæria* is a cyst with an apical aperture, that of the *Peziza* is a cup-shaped disc, the concave surface of which looks upwards. This surface is lined with an ascophorous membrane, which resembles in every respect that of a *Sphæria*.

"Along with the *Peziza* and *Sphæriæ*, and those allied genera which resemble them in producing their spores inclosed in thecæ, there are other forms also included in the Pyrenomycetes and Discomycetes, which, while they resemble those last named in the general outline

* The right use of the term 'individual' in Natural History is a difficulty. If the term is restricted only to the direct produce of the germ-cell and sperm-cell, then all trees propagated by slips belong to the same individual. In order to confine the term individual to such cases, it has been proposed among animals to give the term zooid or zoonites to the independent structures which result from sprouting, gemmation, or fission.

and structure of their receptacles, differ from them completely in the mode of origin of the spores. The simultaneous occurrence of some of these forms, along with their ascophorous analogues, or, in other instances, the successive development of both kinds of receptacles in the same position, had been frequently observed, and had given rise in the minds of some mycologists to the suspicion of the existence of a relation more close than was generally admitted. This suspicion did not, however, take a sufficiently distinct form to lead to observation, until the MM. Tulasne, in a series of researches scarcely completed, showed that the genera in question, hitherto considered as distinct, were in fact identical, and that receptacles containing thecæ and paraphyses, are produced on the same stroma, or, in other words, on the same individual plant, as those which contain acrogenous spores.

"The earliest researches of MM. Tulasne were directed to the Pyrenomycetes. In some species of *Sphæria*, they found not only that the same stroma produces receptacles with acrogenous spores, which are followed by others bearing thecæ, but that, under certain circumstances, it may give rise to spore-bearing organs of a much simpler character; namely, branching filamentous pedicles, bearing at their terminations single spores, and rising directly from the mycelium filaments, with which they are continuous. In this condition the plant cannot be distinguished from a thread fungus, and has been hitherto described as such.

"The later observations of MM. Tulasne, which are much more in detail, refer almost entirely to Discomycetes. In a species of *Rhytisma*, a genus of Discomycetes, which inhabits the epidermis of the leaves of plants, the stroma at first presents the appearance of a black spot of various extent on the surface of the leaf. In the substance of this stroma the first receptacles are formed; they are cushion-shaped capsules, furnished with apical apertures, like those of *Sphæria*, and are entirely occupied by a pulpy nucleus, which consists of slender branched filaments, often so long as to project considerably beyond the aperture. These filaments bear at their extremities innumerable minute linear sporules, which are enveloped in an abundant mucilage, and are expelled from the ripe capsules in the form of a long cirrhus. After the capsules, which are developed during the early summer months, have discharged their contents, they are succeeded by the lirelliform discs of the perfect *Rhytisma*. These do not arrive at maturity until the following spring, and bear upon their upper surface thecæ and paraphyses, like those of a *Peziza*. In other genera MM. Tulasne found that the ascophorous receptacles are preceded by capsules, which produce, instead of the linear sporules above mentioned, cylindrical spores of a much larger size, each of which is supported at the extremity of a pedicle of its own.

"Thus in the plants under consideration we find that, without counting the sporules which are produced by filaments rising directly from the stroma, there are no less than three varieties of spore-like structures, which can be easily distinguished from each other. All of these may be produced upon the same individual, and one is recorded in which a capsule of a *Peziza* was found, which bore, among the normal thecæ, paraphyses with innumerable slender linear sporules at their extremities. As has been already hinted, the capsules which contain acrogenous spores, have been hitherto considered as belonging to genera distinct from those represented by the ascophorous receptacles with which they were found associated. The genus *Cytispora* is characterised by a structure which corresponds completely with that of the capsules described above in *Rhytisma;* and other genera, as, for example, *Sporocadus*, have a similar relation to the capsules, containing the larger variety of pedunculated cylindrical spores."

We know less of the reproductive organs of the Lichens; they however closely resemble those of the *Fungi*. The following is a summary of the reproductive organs found in these two orders:—1, Sporules which are formed by the constriction and separation of the extremity of a simple cylindrical filament. 2, Spermatia, with their supporting pedicels. 3, Stylopores, with their styles. 4, Thecæ, or asci. 5, Basidia, with their basidia-spores. Although the evidence is as yet imperfect, there is still good reason for supposing that the asci and spermatia are truly sperm-cells and germ-cells, whilst the other organs represent the germs or buds.

An account of the reproductive organs of the higher *Cryptogamia* will be found under the articles FILICES and MUSCI. That the organs there described may be regarded as containing the two elementary cells, which we have called germ-cells and sperm-cells, is now matter of little speculation. Mr. Henfrey in a report made to the British Association in 1851, says, in regard to the question of sexes,—"We have several kinds of evidence:—

"1. The inferences to be deduced from the universality of the existence of two kinds of organs in connection with the reproductive process. We have seen that these exist in all the families at some period or other of the life of the representative of the species. In the Mosses and the *Hepaticæ* they occur in the fully developed plant. In the Ferns and *Equisetaceæ* they occur upon cellular structures of frondose character developed from all the spores, which frondose bodies or pro-embryos have an existence of some permanence, especially in the *Equisetaceæ*. In the *Lycopodiaceæ*, the *Isoëtaceæ*, and *Rhizocarpeæ*, the pistillidia occur upon very transitory cellular structures produced from one kind of spore, the larger, while the smaller spores at once develop in their interior cellules containing moving spiral filaments such as occur in the antheridia of the other families.

"2. The inferences to be deduced from the observations on the development of those plants in which the two kinds of organs, occurring in distinct places, can be separated. Strong evidence has been brought forward that the dioecious Mosses, as they are called, do not produce sporangia when the pistillidia are kept apart from the antheridia by natural accident. The majority of observers state that the large spores of the *Rhizocarpeæ* do not germinate if the small spores are all removed from contact with them; a few counter-statements however do exist. Again, the majority of authors, and all the recent ones, state that only the large spores of the *Lycopodiaceæ* and *Isoëtaceæ* produce new plants; while some older writers believed that they had seen the small spores do so.

"3. The direct observation of a process of fertilisation, of which we have only testimony from two authors, Suminski and Mercklin, in reference to the Ferns alone; since the assertions of Schleiden in regard to the *Rhizocarpeæ* have been demonstrated by Nägeli, Hofmeister, and Mettenius to have been based on very imperfect observation."

To the question as to the homologues of the organs in the higher *Cryptogamia*, Professor Henfrey gives the following answer:—

"In the Mosses and *Hepaticæ* the pistillidia occur upon the plant when the vegetative structure is perfect, and the immediate product of the great cell is a sporangium. If a process of fertilisation take place here, we may regard the antheridia and pistillidia as analogues of the anthers and pistils of flowering plants, the sporangia of their fruits; or with Hofmeister we may regard the phenomenon as an instance of an 'alternation of generations,' where the pistillidium would be looked upon as an ovule, producing (in the sporangium) a new individual of totally different character from that developed from the spore (the leafy Moss plant in the usual acceptation of the term).

"In the Ferns and *Equisetaceæ*, we find the spores producing a frondose structure of definite form, upon which are developed antheridia and pistillidia, or 'ovules.' Here then we seem to have one generation complete, and the new development from the pistillidium or 'ovule' appears in a totally new form, producing stem and leaves which have a distinct individual form and existence, and produce the spores after a long period upon temporary parts of the structure, on the leaves; and by no means cease to exist when those are matured. Here we seem to have a real 'alternation of generations;' and Hofmeister compares the whole permanent plant of the Fern, or *Equisetum*, to the sporangium of the Mosses and *Hepaticæ*. In all the other families, the *Lycopodiaceæ*, *Isoëtaceæ*, the *Rhizocarpeæ*, the pro-embryo is a very transitory production, and is developed from a different spore from the spiral filaments. This pro-embryo is clearly analogous to that of the Ferns and *Equisetaceæ;* and if the existence of sexes be a fact, we have here a dicecious condition as contrasted with a monoecious condition in the two last-named families. Hofmeister here again assumes that the pro-embryo developed from the large spore is an intermediate generation between the two perfect forms of the plant.

"It is rather difficult to decide upon the real analogies of these structures with those of the flowering plants. The resemblance of structure is so close between the pistillidia of the Mosses and *Hepaticæ*, and the 'ovules' of the other Vascular Cryptogams, that they must be regarded as analogues, and then the former could not well be conceived to be analogous to the pistils of flowering plants, but rather to ovules; if this be the case, the sporangium must be considered the analogue of the perfect plant in the Fern, &c., and the leafy stem as the analogue of the pro-embryo of the Ferns, &c. The pistillidium of the Mosses can indeed hardly be regarded as analogous to the fruit of a flowering plant, as in that case the spores would be ovules produced long after fertilisation; and on the other hand, if we consider the pistillidia of the Moss as an ovule, which it might be, analogous to that of the *Coniferæ*—in which a large number of embryonal vesicles or rudiments of embryos are produced after fertilisation on the branched extremities of the suspensors—then we seem to lose the analogy between the product of the pistillidium of the Moss and that of the ovule of the Fern, unless we would regard the entire plant of a perfect Fern as analogous to the ovule of a Conifer."

We close this part of our subject with a tabular view (given in the next page), of the analogies in the development of different classes of plants, drawn up by Dr. Sanderson.

The process of generation is much more clearly apprehended in the flowering plants. Here we have two sets of organs whose functions are clearly and definitely the preparation of germ-cells and sperm-cells. The organ in which the germ-cells are prepared is called the Pistil [PISTIL], whilst the Stamen [STAMEN], in that part of its structure called the Anther, elaborates the sperm-cells. In the pistil the germ-cells are called Ovules, or Seed-Buds; whilst in the anther the sperm-cells are called Pollen, or Pollen-Grains. In the growth and development of both these sets of organs great differences are observed, but their function is always the same.

TABULAR VIEW OF ANALOGIES IN THE DEVELOPMENT OF DIFFERENT CLASSES OF PLANTS.

ALGÆ, FUNGI, AND LICHENS.	HEPATICÆ AND MOSSES.	FILICES.	RHIZOCARPEÆ.		LYCOPODIACEÆ.		PHANEROGAMIA. GYMNOSPERMIA.		PHANEROGAMIA. ANGIOSPERMIA.	
	SPORE-CELL.	SPORE-CELL.	MACROSPORE.	MICROSPORE.	MACROSPORE.	MICROSPORE.	EMBRYO-SAC.	POLLEN-CELL.	EMBRYO-SAC.	POLLEN-CELL.
Germination results in the formation of a *Confervæ*, Mycelium, or Hypothallus.	Germination results in the formation of a filamentous Protonema.	Germination results directly in the formation of the Spore-Cell.	Germination consists of the development within the inner membrane of the spore of the Macrospore.	Germination consists in the bulging out of the inner membrane of the Microspore.	Germination as in Rhizocarpeæ.	The same.		Germination represented by the growing out of the inner membrane, so as to form the pollen-tube.		The same.
Frond, Receptacle, Thallus.	Frondose or Leafy Stem.	Prothallium.	Prothallium.		Prothallium.					
Globule of *Chara*.	Antheridium.	Antheridium.		Absent.		Absent.	Absent.	Absent.	Absent.	Absent.
Antherozoids of *Chara*, Zoöspores, *Spermatia*, &c.	Antherozoids.	Antherozoids.		Antherozoids.		Antherozoids.		Absent.		Absent.
									Absent.	
Nucule of *Chara*.	Archegonium.	Archegonium.	Archegonium.		Archegonium.		Corpusculum.			
GERM-CELL of *Chara*.	GERM-CELL.	GERM-CELL.	GERM-CELL.		GERM-CELL.		GERM-CELL.		GERM-CELL.	
	Divides into two transversely.	Mode of division uncertain.	Mode of division uncertain.		Divides into two transversely, and is thus transformed into		Divides into two transversely, and is thus transformed into		Mode of division the same.	
	Inferior of the two cells which result from the above division.	Uncertain.	Uncertain.		Suspensor.		Suspensor.		Suspensor.	
	Fruit-Stem.	*Embryo.*	*Embryo.*		*Embryo.* Cellular Tissue occupying the cavity of inner membrane of spore.		*Embryo.* Albuminous body.		*Embryo.* Endosperm.	
	Spore-bearing Fruit-Stem.	*Spore-bearing Plant.*	*Spore-bearing Plant.*		*Spore-bearing Plant.*		*Ovule-bearing Plant.*	*Anther-bearing Plant.*	*Ovule-bearing Plant.*	*Anther-bearing Plant.*
	Sporangium. Primary Parent-Cell divided into four special Parent-Cells, each containing a *Spore*.	Sporangium. The same.	Sporangium. The same.		Sporangium. The same.		Ovule.	Anther. Primary Parent-Cell divides into four special Parent-Cells, each containing a pollen-grain.	Ovule.	Anther. The same.

The history of the development of the ovule of *Orchis Morio* may be taken as an example of the germ-cells of the flowering plants. In this plant the ovule springs from a placental surface as a single projecting cell, which by subdivision forms at last a central cell called the nucleus, and this becomes surrounded by a layer of cells. This nucleus, or central cell, becomes the embryo-sac, or germ-cell. The pollen-cells from the anthers having fallen on the stigma, now pass down the passage of the style, and at last, through a little opening in the ovule called the micropyle, come in contact with the outside of the apex of the embryo-sac. Within the embryo-sac are to be observed at this time threesmall cells called embryonal vesicles. "Soon after the pollen-cell has reached the embryo-sac, one of the embryonal vesicles begins to enlarge, and becomes divided by a cross septum into two cells; and while the upper one grows out in a filamentous form through the micropyle by a continued process of cell-division, the lower cell enlarges and divides repeatedly, so as to form a cellular globule." (Henfrey.) This is the embryo. The prolonged part subsequently dies away.

The development of the pollen-cell is more uniform in the different families of plants. The part of the stamen called the anther at first appears in the young flower-bud as a little cellular papilla. In process of time this papilla divides into two portions. These are the rudiments of the future loculi, or valves. In each half, a single axile vertical column of cells soon becomes distinguished by their greater size and granular contents. In each of these cells the nucleus disappears, and is replaced by two others; this being followed by a division of the cell-contents, which form the primordial utricle, into a new cell round each nucleus. This process is repeated, and a mass of cells is thus formed which become the parents of the true sperm-cells or pollen-grains. The walls of these parent cells now become thickened, their nuclei disappear, but are replaced by four permanent nuclei, which become each invested with a primordial sac. In this manner each of the parent cells is divided into four compartments. A cellulose integument is afterwards formed over each compartment, which now become the pollen-grains. Like the nucleus or embryo-sac of the ovule, these pollen-grains have no further power of independent development or growth, but by contact with each other the embryo of the seed is produced. When the anther is fully developed, the external case which contains the pollen bursts, and pollen-grains are distributed upon the surface of the stigma. No sooner does the pollen-grain arrive upon the stigma than it loses its spherical shape, and becomes elongated, forming the so-called pollen-tube. It is this tube which, passing down the style, becomes applied to the embryo-sac, and is the cause of the development and growth of the embryo. A question has however arisen as to whether the pollen-tube acts dynamically upon the embryo-sac, or becomes part and parcel of the new embryo.

Schleiden maintains that if the pollen-tubes be followed into the ovule, it will be found that usually one, and rarely more, penetrates the intercellular passages of the nucleus and reaches the embryo-sac, which being forced forward, is pressed and indented, and by its folding-in, forms the embryo in the first stage of its development. A bag is thus formed consisting of a double membrane, the indented embryo-sac, and the membrane of the pollen-tube itself. Schleiden infers the identity of the embryo and the pollen-tube from the three following circumstances:—1, The constantly equal diameter of the pollen-tube when it is just within it. 2, The invariable chemical similarity of their contents shown by the reaction produced by the application of

water, oil of sweet almonds, iodine, sulphuric acid, and alkalies. The general contents of the grain of pollen are starch, and this either proceeds unchanged downwards through the pollen-tube, or else passes along after being changed by a chemical vital process into a transparent and colourless fluid, which becomes gradually more and more opaque; and is coagulable by the application of alcohol; out of this, by an organising process, the cells are produced which fill the end of the pollen-tube, extending in *Orchis Morio* far beyond the ovule, and thus forming the parenchyma of the embryo. 3, The identity of the embryo and the pollen-tube is further supported by the fact, that in such plants as bear several embryoes, there is always precisely the same number of pollen-tubes present as we find embryoes developed.

These views of Schleiden, with his conclusion that the pollen-tube should be regarded rather as the representative of the female than of the male in the animal kingdom, have been adopted by Wydler of Berne and others.

On the other hand, observations were made by Messrs. Mirbel and Spach, on another class of plants, in which they did not meet with the structure described by Schleiden, and consequently they object to the general application of his conclusions. They examined the development of the ovule of the *Zea Mays* (Common Maize). In this plant there is no true embryo-sac, but they found the commencement of the embryo, which they call the primary utricle, and which Schleiden described as the result of an involution of the sac, existing in the cavity of the nucleus. In this plant also, only one, and not two membranes, as described by Schleiden, existed in the embryo. They also found in other plants the primary utricle existing in the interior of the embryo-sac, and at a period anterior to the act of impregnation. They therefore conclude that the pollen-tube does not become the embryo, and that no involution of the embryo-sac takes place. The ir conclusions are probably as much too general as those of Schleiden.

Mr. Griffiths, in a paper published in the 'Linnean Transactions,' gives the result of a long series of investigations on the development of the ovulum in the genera *Santalum*, *Osyris*, *Loranthus*, and *Viscum*. From his observations on these plants, which differ from those investigated by Schleiden, and Mirbel and Spach, he has arrived at conclusions somewhat different from those of any of these observers, and he carefully refrains from drawing an inference from the facts which he has observed that would apply to the whole vegetable kingdom. "The first process," he says, "in the development of the seed subsequently to the penetration or application of the boyau (the pollen-tube) to the embryo-sac would, in *Santalum*, *Osyris*, *Loranthus*, and *Viscum*, appear to consist of the formation of cellular tissue. This may be applied, I believe, to most if not to all instances. This cellular tissue appears to have two different origins; one, and this is the earliest in development, being perhaps referable to the embryo-sac, while the other appears directly referable to the anterior ends of the pollen-tubes." Thus far he agrees with Schleiden, that the pollen-tube penetrates into the embryonal sac, and that the embryo is derived from its intruded extremity, his observations on *Santalum* and *Loranthus* confirming this fact, whilst *Osyris* is an exception confirmative of the rule. "But none of my observations," says Mr. Griffiths, "have tended to confirm Schleiden's idea of the inflection of the embryo-sac before the pollen-tube; and it appears to me sufficiently obvious, that if such were the case the cylindrical bag (the primary utricle of Mirbel), constituting the embryo in its first stage of development, would consist of three membranes or layers, namely, the first, or outer, of the ordinary and uninflected membrane of the sac; the second, of its inflected portion; the third, that of the pollen-tube itself." He also expresses his conviction that the primordial or primary utricle of Messrs. Mirbel and Spach is the sac of the embryo, which no doubt often and perhaps generally exists before fecundation.

Dr. Giraud, has published a paper in the same volume of the 'Linnean Transactions.' He made a series of observations upon the ovulum of the *Tropæolum majus*. He concludes from his observations on the *Tropæolum majus*, "that in this plant the primary utricle and the future embryo never have any structural connection with the extremity of the pollen-tube at their first origin, or at any subsequent period of their development, as is sufficiently obvious from the fact that the pollen-tube is never brought into contact with the embryo-sac. As the primary utricle makes its appearance before impregnation has occured, it cannot be possible that the organ has ever formed the extremity of the pollen-tube, as is believed by Schleiden and Wydler. Moreover, as the primary utricle takes its origin wholly within the embryo-sac, and at the earliest period of its formation is not in contact with that membrane, it cannot have been formed by the pollen-tube pressing before it a fold of the embryo-sac in its passage into the cavity of that structure, as Schleiden has maintained."

In the 'Annals of Natural History,' 1852, Professor Henfrey has published a paper on the Reproduction of the higher *Cryptogamia* and *Phanerogamia*, in which he states that he has not been able to observe the penetration of the pollen-tube into the embryo-sac.

We now pass to the consideration of the function of Reproduction amongst Animals. General Reproduction occurs in many of the lower animals in the same manner as plants. There is a common reproduction of destroyed tissues which frequently extends to the production of an entire limb. This is seen amongst the *Radiata*, especially the *Echinodermata*, also amongst the *Articulata*. The highest families of animals in which this kind of reproduction occurs regularly are the Reptiles, in which instances are recorded of legs and tails being renewed. Occasional instances occur in which the limbs of higher animals are reproduced. The case of a Thrush, in which such renewal had taken place in a leg, was brought before the British Association meeting at Hull. A case is also related in which an abnormal finger in a human being having been removed, it was again reproduced almost entire.

Reproduction by division into two, or by gemmation, the Fissiparous and Gemmiparous methods of Reproduction, occur to a very considerable extent among the lower animals. These modes of reproduction do not essentially differ, and both occur in the same families of animals. [HYDRA; ACALEPHÆ; POLYZOA.] The individuals which are thus produced by fission or by gemmation are called Zooids. This process occurs in unicellular as well as multicellular plants and animals, and the single cells produced by the division of the *Desmidieæ*, the *Diatomaceæ*, and the *Vorticelleæ*, are as much entitled to the term Zooids as the more complicated forms of the *Acalephæ*.

The true generative act is performed in animals in the same manner as plants. In order to the production of the new individual it is necessary that there should be a union of germ-cells on the one hand with sperm-cells on the other. We shall not here attempt to describe the various forms of organs in the animal kingdom in which these sperm-cells and germ-cells occur. They are described in considerable detail in this work under the head of the families, and sometimes of the genera and species of the various animals described. We shall however describe generally the nature of these cells. The germ-cells and sperm-cells in animals are usually produced from tissues and organs that are structurally different, but as in plants these organs may be placed on different individuals, or on the same. When the two sets of cells are found on the same individual, or zooid, they are said to be Hermaphrodite; but if these cells are found on different individuals they are said to be Monosexual. The term hermaphrodite is also applied to plants; but when their sperm-cells and germ-cells are placed on different flowers, as happens sometimes in the *Phanerogamia*, they are called Monœcious and Diœcious.

The sperm-cells in the animal kingdom assume a more definite form than those of the vegetable kingdom. In the higher *Cryptogamia*, where they assume the form of self-moving filaments, they most closely resemble those of the animal kingdom. These filaments are formed in the interior of cells, from which they escape by bursting. They usually present an elongated filamentous appearance, with a slight dilatation at one extremity. At one time they were regarded as a kind of animalcule, and called 'spermatic animalcules,' and were supposed to have an interior organisation. This is not the case, and they have no more claim to be regarded as animalcules than moveable blood-discs, or ciliated epithelium-scales. The movements performed by these bodies are in many instances due to the presence of cilia, which are found upon their surface. The movements of such filaments would vary according to the disposition of the cilia. In other cases the movement seems due to molecular activity. The object is very obviously to bring the spermatozoon, as these spermatic filaments have been called, into contact with the germ-cell. These movements soon cease after the filaments have been removed from the matrix in which they have been formed. Some agents rapidly destroy these movements, whilst others renew them after they have apparently ceased. This subject has been recently investigated by Kölliker, and the results which he has arrived at in regard to the movements observed in the spermatic filaments of *Mammalia*, are embraced in the following propositions:—

1. In the spermatic fluid, taken from the epidermis and vas deferens, motile spermatic filaments exist in very great abundance.

2. In water and aqueous solutions of all innocuous indifferent substances and salts, the motion of the filaments ceases, and they form loops.

3. These filaments, thus furnished with loops, are not dead, as has hitherto been generally believed; for, on the contrary, they revive completely upon the subsequent addition of concentrated solutions of innocuous indifferent substances (sugar, albumen, urea), and of salts.

4. In all animal fluids, when considerably concentrated, or highly saline, which are not too acrid nor too alkaline, nor too viscid, the motions of the spermatic filaments are unimpaired; this is the case, for instance, in blood, lymph, alkaline or neutral urine, alkaline milk, thin mucus, thick bile, the vitreous humour—but not in saliva, acid or strongly ammoniacal urine, acid milk or mucus, the gastric juice, thin bile, and thick mucus. When the proper degree of concentration of the latter fluids is successfully attained, and their reaction is rendered neutral, they are innocuous.

5. In all solutions of indifferent organic substances moderately concentrated, the filaments move with perfect facility—thus in all kinds of syrup, in albumen, urea, glycerin, salicin, amygdalin. More concentrated solutions of these substances cause the motion to cease, but it is restored upon their subsequent dilution with water. Too dilute solutions act in the same way as water (vide 2 and 3).

6. Certain solutions, as they are termed, of indifferent organic

substances act like water, however much they may be concentrated, such as solutions of gum arabic, vegetable mucus (gum tragacanth, mucilage of quince-seeds), and of dextrin. Concentrated solutions of other substances, in this case also, restore the motions.

7. Many organic substances cause the motions of the filaments to cease, owing to their chemical action upon them, such as alcohol, creasote, tannin, and ether; others owing to their mechanical effects, as most oils. Narcotics, in certain degrees of concentration, are not injurious.

8. Metallic salts are injurious, even in extremely dilute solutions; such, for instance, as a solution containing 1-10,000th of corrosive sublimate.

9. Most of the alkaline and earthy salts are innocuous in certain degrees of concentration, which in some is greater and in some less; so little hurtful, in fact, are they, that the filaments may be kept alive in them for from one to four hours. Among these may be enumerated solutions of common salt; chloride of potassium; sal ammoniac; nitrate of soda; nitrate of potass, containing 1 part to 100; moreover, solutions containing from 5 to 10 parts in 100 of phosphate of soda; sulphate of soda; sulphate of magnesia; chloride of barium. As regards some of these salts, the fact had been previously noticed by older writers, and more recently by Quatrefages, Newport, and Ankermann. Solutions unduly diluted have the same effect as water, and cause the formation of loops, but the filaments are revived upon the addition of a concentrated solution of the same salts and of indifferent substances (sugar, urea, &c.). Stronger saline solutions than are required, also interfere with the motions; but, in this case likewise, the filaments are capable of revival upon the addition of water. These salts can scarcely be regarded properly as revivifiers, as was asserted not long since by Moleschott and Ricchetti, for filaments which have become quiescent in indifferent substances, as sugar, for instance, are not revivified again by them; and their action is widely different from that of the real excitants — the caustic alkalies. It cannot be denied that their influence is very favourable, and that (but perhaps owing only to their rapid diffusion in the water) they produce motion in a seminal mass more rapidly than other less diffusible substances, such as sugar and albumen; on which account the above-named authors ascribe revivifying properties to them—a fact which, before them, had been made known, as regards common salt, by Quatrefages, and by Newport, for carbonate of soda and potass; which latter salts, moreover, in certain experiments, caused the motion to cease in 10′ or 15′, almost like the caustic alkalies.

10. Acids, even in very small quantity, are injurious; such as hydrochloric acid, in the proportion of 1-7,500th.

11. Caustic alkalies (soda, potass and ammonia, not lime and barytes), in all degrees of concentration, from 1-31th to 6-10th are special excitants of the spermatic filaments. Whether the latter have become quiescent spontaneously, as in old sperm-fluid, or have ceased to move in indifferent solutions, the above substances recal the most active movements which are not distinguishable from the vital. But these motions cease after two or three minutes, and from this quiescence the filaments cannot be roused by any means. When mixed with indifferent substances in small proportions (from 1-1000th to 1-500th), as, for instance, in syrup, the caustic alkalies afford a means by which the motions of the spermatic filaments may be maintained for a long time.

12. The sperm-fluid dried in indifferent substances, and in saline solutions, may, in certain cases, have its motion restored by dilution with the same fluid, or with water.

The cells which give origin to the spermatic filaments are found upon the surface of the organs which secrete them. At first they are not to be distinguished from ordinary epithelial cells, but they increase in size, and at last present a corpuscle (seminal corpuscle) in their interior. These corpuscles are filled with granular matter, which is gradually converted into the spermatic filament, which is at first coiled up, and lies in contact with the inner surface of the wall of the corpuscle. The spermatic filaments usually present themselves in clusters, which arises from their tendency when set free from their cells to arrange themselves in this manner.

The size of the spermatic filaments varies. In human beings they are from 1-500th to 1-600th of an inch in length. The head is about 1-5000th to 1-8000th of an inch long, and is about half as wide.

In the females of most animals it is not difficult to find a large cell, which is called an ovum or egg. If this ovum be examined in the *Mammalia*, it will be found to present a vesicle, which is called the germinal vesicle, and this vesicle presents a spot, called the germinal spot. There seems to be little doubt that this vesicle is truly the germ-cell. In the *Mammalia* the ova are found in an organ called the ovary.

"If the structure and formation of the human ovary be examined at any period between early infancy and advanced age, but especially during that period of life in which the power of conception exists, it will be found to contain, on an average, from fifteen to twenty small vesicles or membranous sacs of various sizes; these have been already alluded to as the follicles or vesicles of De Graaf, the anatomist who first accurately described them. At their first formation, the Graafian vesicles are small, and deeply-seated in the substance of the ovary; but as they increase in size, they make their way towards the surface; and when mature they form little prominences on the exterior of the ovary, covered only by the peritoneum. Each follicle is formed with an external membranous envelope composed of fine fibro-cellular tissue, and connected with the surrounding stroma of the ovary by networks of blood-vessels. This envelope or tunic is lined with a layer of nucleated cells, forming a kind of epithelium or internal tunic, and named membrana granulosa. The cavity of the follicle is filled with an albuminous fluid, in which microscopic granules float; and it contains also the ovum or ovule. The ovum is a minute spherical body situated, in immature follicles, near their centre; but in those nearer maturity, in contact with the membrana granulosa, at that part of the follicle which forms a prominence on the surface of the ovary. The cells of the membrana granulosa are at that point more numerous than elsewhere, and are heaped around the ovum, forming a kind of granular zone, the discus proligerus.

"In order to examine an ovum, one of the Graafian vesicles, it matters not whether it be of small size or arrived at maturity, should be pricked, and the contained fluid received upon a piece of glass. The ovum then, being found in the midst of the fluid by means of a simple lens, may be further examined with higher microscopic powers. Owing to its globular form, however, its structure cannot be seen until it is subjected to gentle pressure.

"The human ovum is extremely small, measuring, according to Bischoff, from 1-240th to 1-120th of an inch. Its external investment is a transparent membrane, about 1-2500th of an inch in thickness, which, under the microscope, appears as a bright ring, bounded externally and internally by a dark outline: it is called the zona pellucida or vitelline membrane, and corresponds with the chorion of the impregnated ovum. It adheres externally to the heap of cells constituting the discus proligerus.

"Within this transparent investment, or zona pellucida, and usually in close contact with it, lies the yelk, or vitellus, which is composed of granules and globules of various sizes, imbedded in a more or less fluid substance. The smaller granules, which are the more numerous, resemble in their appearance, as well as their constant motion, pigment granules. The larger granules, or globules, which have the aspect of fat globules, are in greatest number at the periphery of the yelk. The number of the granules is, according to Bischoff, greatest in the ova of carnivorous animals. In the human ovum their quantity is comparatively small.

"The substance that combines the globules and granules of the yelk is in many animals quite fluid. The yelk then completely fills the cavity of the zona pellucida, and escapes in a liquid form when that membrane is ruptured: but in ova of the human subject, and some animals, the yelk is much more consistent, and sometimes escapes as a solid globular mass when the zona pellucida is torn. It is, according to Bischoff, solely owing to this firm consistence of the yelk that it in many cases preserves its form when a watery fluid passes by imbibition through the zona pellucida, and that an interval is then apparent between the yelk and that membrane. From the appearances resulting from the action of water on the ovum, and from other circumstances, it has been thought that the mass composing the yelk is surrounded by another membrane within the zona pellucida, but the evidence for such a view is not satisfactory.

"In the substance of the yelk is imbedded the germinal vesicle, or vesicula germinativa. This vesicle is of greatest relative size in the smallest ova, and is in them surrounded closely by the yelk, nearly in the centre of which it lies. During the development of the ovum the germinal vesicle increases in size much less rapidly than the yelk, and comes to be placed nearer to its surface. In a mature ovum of the rabbit it is about one-sixtieth of a line in diameter (Bischoff): its size in the human ovum has not yet been ascertained, owing to the difficulty of isolating it. It consists of a fine transparent structureless membrane, containing a clear watery fluid, in which are sometimes a few granules.

"At that part of the periphery of the germinal vesicle which is nearest to the periphery of the yelk is situated the germinal spot, a finely-granulated substance, of a yellowish colour, strongly refracting the rays of light, and measuring, in the *Mammalia* generally, from 1-3600th to 1-2400th of an inch (Wagner)." (Kirkes and Paget, 'Handbook of Physiology.')

The act of fecundation is effected in the same manner in animals as in plants, that is, by the contact of the sperm-cells with the germ-cells. Much discussion has taken place as to how this occurs, but the following account may be regarded as embracing the facts most generally accepted:—As the germinal vesicle becomes fitted for fecundation, it loses its pellucid character, arising from the development of a large number of cells in its interior. It is at this period that the spermatic filaments, coming in contact with it, produce that tendency to growth which results in the formation of the new being. The nature of this contact has been a question. Mr. Newport however, in a series of very carefully-conducted experiments upon the *Amphibia*, comes to the conclusion that the spermatic filament penetrates the vitelline membrane, and comes directly in contact with the germinal vesicle. There is no special foramen for the admission of the spermatic filaments, but they pierce through this membrane, and may be seen floating about in the yelk. Mr. Newport found that a single sperma-

tozoon did not produce fecundation, but that the penetration of several were required for this purpose.

In the human female the ova are brought from the ovaries along the Fallopian tube into an organ called the uterus. It grows rapidly after reaching the uterus; it at first consists of two sacs, one inclosing the other, and the inner containing a liquid. When it is about half a line in diameter a new element becomes visible in it; a round, opaque, granular disc is seen, with a dark spot in its centre, upon the surface of the internal globule or sac. This spot, which is seen either on or through the inner membrane of the ovum, corresponds with the cicatricula of the egg, and is the first rudiment of the fœtus.

In birds the cicatricula, or germ-spot, lies upon the surface of the yolk: soon after the commencement of incubation it expands and separates into two layers; the outer is called by Pander the serous layer, and subsequently forms the osseous, nervous, muscular, and tegumentary systems of the body; the inner, which is in contact with the yolk, is called the mucous, which (together with a third developed between the two others, and named the vascular layer) appears to give rise, by the changes which it undergoes, to the intestinal, respiratory, vascular, and glandular systems. The mucous layer of the germinal membrane gradually expands over the yolk, till it nearly incloses it in a sac, which towards the body of the chick contracts into an oblong canal, which extends the whole length of the embryo, and becomes the future alimentary tube. The sac containing the yolk, and communicating with the intestines, is called the intestinal vesicle, or yolk-bag, and towards the close of incubation is drawn into the belly of the chick, and its contents are used as nourishment. The lower end of the alimentary canal (the cloaca of birds) shoots out into a sac which is termed the allantoïs, or allantoïd membrane. After a time arteries and veins are seen ramifying upon this sac, which protrudes more and more out of the body of the chick, till at length it forms a double bag, laid immediately under the membrane of the shell. On this sac the blood-vessels are so distributed that their contents are influenced by the atmosphere through the porous egg-shell and its membrane, and thus a true respiratory organ is established.

The original structure of the ovum, and the early development of the embryo, in *Mammalia*, appear to be much the same as in the egg of a bird; though there are some characteristic differences. When a human ovum of any magnitude is examined, the embryo is seen suspended in a loose bag filled with fluid, called the amnios, which is a shut sac: this sac is the outermost product of the serous layer of the germinal membrane; for its formation a membrane is reflected from the sides and extremities of the embryo (the reflection, according to Velpeau, not commencing before the twelfth day), so as to inclose a space behind it. As the walls of the trunk close in front, the circle at which the amnios is attached to the body of the embryo gradually contracts, till at length it is limited to the edge of the umbilical opening; it then invests the umbilical cord, and spreads out from its placental extremity into an ample sac filled with fluid, in which the fœtus floats. The mucous layer of the germinal membrane in *Mammalia* is supposed from analogy to form a sac, as in birds, containing a yolk, or substance subservient to the nourishment of the fœtus in its early stage. Whether this view of its formation and use be correct or not only rests on analogy; but in the early part of gestation a small sac or bladder, which from its being filled with a whitish fluid has been called the vesicula alba, may be found on the placenta, at or near the extremity of the umbilical cord, and exterior to the amnios; from this sac a fine tube may be traced along the cord to the navel, and in some animals it has been seen communicating with the intestinal canal. This tube becomes obliterated so early (Velpeau says in the sixth week of gestation) that its communication with the intestines was long undetected, though the sac was known to the older anatomists. The intestinal vesicle finally differs in *Mammalia* and birds in this circumstance, that in the former it is not drawn into the body of the fœtus, but remains without between the membranes, and gradually wasting becomes obliterated by the third month. The duct of the umbilical vesicle is accompanied along the cord by an artery and vein, which are called the omphalo-mesenteric vessels; the artery communicates with the superior mesenteric, and the vein with the vena portæ. The allantoïs exists in all mammals as well as in birds, though its use in the former, which are furnished with a placenta, is not obvious. In some animals, as in man, it becomes obliterated at a very early period, as soon as the sixth week, but in others, as the *Carnivora*, &c., it attains a large size, and continues during the whole period of fœtal existence. In *Mammalia* it communicates with the fundus of the bladder, and the remains of the duct by which it is connected is denominated the urachus The channel of communication between the allantoïs and the bladder, or cloaca (in birds), at first is short, so that the sac lies directly against the body of the embryo, but it afterwards becomes elongated, like the corresponding duct of the umbilical vesicle.

In man, after impregnation has taken place, a spongy membrane is formed on the inner surface of the uterus by an exudation of lymph. This membrane, called decidua, lines the whole of the uterus before the descent of the ovum; but when this passes down through the Fallopian tube it gradually pushes the deciduous membrane before it, inverting one portion of it which surrounds the ovum, and is called the decidua reflexa; this grows with the ovum till it fills the cavity of the uterus, and comes in contact with the other portion called the decidua vera, lining the walls of the uterus.

The point at which the decidua is reflected upon the ovum is where the placenta is fixed to the uterus. The ovum has two proper membranes, the amnios, which we have described, internally, and an outer membrane, which is called the chorion; this latter membrane in man, during the first two months of pregnancy, has a shaggy external surface, being covered with vascular villi, which become united with the membrana decidua, which is also thick and vascular. This thickening and vascularity of both these membranes gradually diminishes, and becomes concentrated on one part, usually towards the fundus of the uterus; this thickened part is called the placenta. In ruminating animals the thickening and vascularity of the chorion is confined to a number of circular and spongy elevations varying in number from thirty to one hundred, which are called cotyledons. These vascular processes dip in between corresponding processes attached to the uterus of the mother, which are called maternal cotyledons, the surface of which is supplied with numerous vessels derived from the uterine arteries and veins. The result of this arrangement is that a large vascular surface of the maternal system is applied to an equally extensive one of the fœtus, and though there is no direct communication between the arteries and veins, we must suppose that nourishment is imbibed from the vessels of the mother by those of the fœtus through the fine intervening membranes by which they are separated. In man the relation between the maternal and fœtal systems is not so clearly understood as in the preceding instance. In the human subject the placenta is a spongy vascular mass like a cake, from six to eight inches in diameter, about an inch thick in the middle, and two or three lines at the circumference. It adheres by one surface to the uterus, and by the other is connected with the fœtus by means of the umbilical cord. The uterine surface is lobulated, and is connected with the uterus by blood-vessels. The fœtal surface is covered by the chorion and amnios, and presents the ramifications of the umbilical vessels, which consist of two arteries and a vein. The radicles of these vessels communicate with each other, but no communication has ever been shown to exist between them and the utero-placentine vessels; for if we inject from the umbilical arteries we find that the placenta is rendered turgid, and that vessels are found filled in every part of it, but between their ramifications there will remain an uninjected substance, and the uterine surface will not be injected, for the fœtal vessels do not pass all the way to that surface. In like manner, if we inject from the uterine vessels, the placenta will be rendered turgid, but nothing passes into the fœtal vessels. From this circumstance it is concluded that the placenta consists uniformly of two portions: the one is furnished by the deciduous coat of the uterus, the other by the vessels of the chorion, and these two portions may, during the first three months, be separated from each other by maceration. The structure of the fœtal portion, so far as can be made out, appears to be similar to that of the pulmonary vessels, the artery terminating in the vein. But the maternal portion is somewhat different; there is not a direct communication, but the arteries, as Mr. Hunter thought, seem to terminate in irregular cells, and the veins appear to commence with open mouths from these cells, for by throwing wax in the uterine arteries we fill the cells, and frequently inject the uterine veins also.

It has always been considered doubtful whether the placental cells of Hunter were real or artificial, being, in the latter case, produced by extravasation of the injection; and recent researches have confirmed this doubt, but without throwing any satisfactory light on this very obscure subject. With regard to the use of the placenta we may infer that it is very similar in man to what it is in ruminating and other animals; it most probably serves to produce a change in the blood of the fœtus analogous to that which the blood of the adult undergoes in the lungs; and, from considering that the fœtus itself cannot create materials for its own growth and support, we may further infer that the placenta is the source of nutrition also.

The navel-string, or umbilical cord, which connects the child to the mother, is composed of the umbilical vein and two umbilical arteries twisted together, and surrounded by a gelatinous substance and the reflections of the chorion and amnios; it also contains the urachus, and the remains of the duct of the vesicula alba and omphalo-mesenteric vessels. It is visible in the human embryo in the sixth week as a short and straight cord; at birth the length of it is, on an average, about two feet. The outer tunic of the cord, the amnios, is continuous with the epidermis, or cuticle of the fœtus at the umbilicus; and in the same way the chorion, which is also reflected on the navel-string, is continued into the dermis, or true skin of the fœtus.

The following is Valentin's account of the development of the principal organs of the human embryo.

"The primitive streak or groove is the first indication of the future embryo. It consists of a very small longitudinal groove in the middle of the upper surface of the serous lamina. It soon after enlarges, while its two margins are raised to form the laminæ dorsales. They grow over towards each other, meet in a longitudinal suture, and thus inclose a cavity, the primitive tube. Anteriorly this tube dilates into several vesicles, which lie behind each other, and in which is deposited the cerebral substance. The spinal cord is laid down in its remaining cylindrical portion. The several parts of the brain of

the human embryo gradually pass through numerous transitional forms, which correspond with their permanent conditions in various of the lower animals.

"A dense cord, the chorda dorsalis, is early deposited beneath almost the whole length of this primitive tube. At the same time, square spots are observed on either side, symmetrically arranged in pairs. Each two corresponding squares subsequently grow towards each other, to construct the body of a vertebra. In doing this, they include between them a corresponding segment of the chorda dorsalis, and gradually altogether displace it. In *Mammalia* and birds, the remaining portions of this structure subsequently disappear.

"The vertebral arches commence as dense curved pairs of streaks; each of which unites on the one hand with the body of the vertebræ, and on the other with its opposite fellow. The various processes of the vertebræ are only added subsequently.

"The first rudiment of the skull is formed by a membranous capsule, which gradually merges into a special cartilaginous covering, called the primordial skull. Some portions of the latter are ossified immediately afterwards, while others disappear after new pieces of bone have been opposed to them.

"The blastema adjoining the inferior surface of the skull produces a series of pairs of processes, which finally give rise to the chief structures of the face and neck. Those which lie between the future mouth and the chest are called the branchial or visceral processes; and the fissures which remain between them, the branchial fissures. Their form and relations to the vascular trunks which supply them somewhat resemble the type met with in the gills or branchial respiratory organs of the fish.

"The margins of the central portion of the serous lamina are gradually involuted, so as to form the walls of the thoracic and abdominal cavities. But as they only subsequently meet in the inferior median line of the embryo (which we are supposing to be horizontal), there remains at first a long fissure, through which are protruded the heart, a large portion of the intestinal canal, and the allantois. This aperture afterwards closes in the region of the thorax, and the posterior part of the abdomen; and finally disappears, leaving no relic save the navel. The ribs commence as dense striæ, which first become cartilaginous, and are then ossified. The several pieces of the sternum are developed by a similar process.

"The extremities are at first altogether absent. They subsequently sprout in the form of small stumps. Each of these is first divided into an internal segment which pertains to the trunk, and corresponds to the thigh or upper arm, and a free terminal plate which is developed into the hand or foot. The fore arm and leg are only formed subsequently. The fingers and toes are at first united by a kind of web, so as to resemble fins. This membrane begins to disappear from without inwards.

"The eye at first forms a hollow vesicle, which is connected with the brain by a tubular handle, the future optic nerve. The retina is produced from a deposit which resembles that of the cerebral substance in the vesicles of the brain. The crystalline lens, the vitreous humour, and the iris, are only developed subsequently. A special vascular tunic, the capsulo-papillary sac, surrounds the lens of the early embryo. Its anterior segment then forms the papillary membrane, a vascular coat which is stretched immediately in front of the papillary aperture. By the gradual loss of its blood-vessels, this is converted into a simple transparent membrane, which disappears a few days after birth.

"The labyrinth of the ear also begins as a hollow vesicle, having a handle which is continuous with the brain. The vestibule, the cochlea, and the semicircular canals are then developed, at what is comparatively a very early date. The formation of the auditory ossicles is ultimately connected with the development of the most anterior visceral arches. At this period the long process of the malleus extends on the first maxillary process, or the future lower jaw, as far as to the median line; in the *Mammalia*, however, it afterwards gradually disappears, so as to leave scarcely a trace. The tympanic cavity is chiefly developed from the gap situated at the first visceral arch. The external ear is produced last of all.

"The organs of smell are also first indicated by vesicles which are connected with the brain. The nose is developed afterwards, during the evolution of the face. The palate, which is subsequently laid down, ends by separating the cavities of the nose and mouth. The tongue grows out of the first maxillary arch. The external integument is only separated into corium and epidermis towards the end of the second month, or the beginning of the third. It afterwards acquires its nails, together with its various glands and hairs. In the advanced embryo, almost all the surface of the body is covered by a very fine down. The copious desquamation and fatty secretion of the skin result in a caseous substance which covers many portions of the fœtal body, and is capable of protecting it like an ointment from the injurious action of the liquor amnii.

"Those primary changes by which many of the embryonal organs commence, are effected without the aid of the vascular system. The heart subsequently begins as a tube, which, anteriorly, is continuous with centrifugal vessels or arteries; posteriorly, with centripetal tubes or veins. It afterwards undergoes a peculiar involution, divides into segments, produces the auricular appendages, and finally, presents two auricles and a single ventricle. The latter gradually acquires a septum, which is at first an incomplete, and finally a perfect one. These embryonal vessels gradually undergo numerous changes, which are due, not only to the formation or metamorphosis of those organs of the body that are rich in vessels, but also to a variety of causes which belong to the vascular system itself.

"The contrast of a systemic and a separative circulation obtains at a very early date. A great part of the surface of the yolk is at first covered by a vascular distribution, the aurea vasculosa, in which the blood of the embryo is changed by a process, the details of which are at present unknown. This vitelline circulation begins soon after the heart of the embryo has commenced to beat. In the *Mammalia* it subsequently disappears, to make way for the placental circulation. The blood then runs through the umbilical arteries into the fœtal placenta, where it undergoes a diffusion with the blood of the maternal placenta, returning to the fœtus through the umbilical vein. The renovation thus produced corresponds, not only to the respiration of the more developed being, but also to the most pressing requirements of its nutrition.

"The connection between the state of development of the heart and that of the great vessels, produces a peculiar movement of the blood, which has been designated the fœtal circulation, or the circulation of Sabatier. It is most distinct shortly after the middle of pregnancy. The blood of the right ventricle then passes chiefly into the lower half of the body and the placenta; while that which returns from this organ goes chiefly to the left heart, in order to flow thence to the head and neck, from which it finally returns to gain the right auricle and ventricle. So that there is a partial contrast between the circulations of the upper and lower halves of the body. After birth it is replaced by the systemic and pulmonic circulations.

"The placental circulation ceases soon after birth, being replaced by the pulmonic on the respiration of air. But in the normal course of development the preparations necessary for this change are made some months before the end of pregnancy. Hence, under favourable circumstances, a child which comes into the world seven or eight months after conception may nevertheless continue to live.

"The foramen ovale is due to the fact, that the inferior vena cava originally opens into the left auricle, and not into the right, being only gradually pushed over into the latter. This explains why the greater part of the blood that returns from the umbilical vein and the lower parts of the body passes into the left auricle during the fœtal circulation. The groove which conducts it in this course is the relic of a special adaptation, which dwindles and disappears in proportion as the left auricle is claimed by the advancing development of the pulmonary veins. Immediately after birth, the foramen ovale is at first closed mechanically by the action of the auricle; but it finally becomes organically occluded. The superior and inferior vena cava then belong exclusively to the right auricle.

"The pulmonary artery and aorta of the new-born infant are connected with each other by means of the ductus arteriosus, or duct of Botalli. This structure—which is a necessary result of the development of the embryonal vessels—prevents the two divisions of the fœtal circulation being completely separated from each other, and also hinders the perfect separation of the scarlet and dark-red blood in the new-born infant whose lungs have begun to work. But in the first few weeks after birth, the ductus arteriosus is closed by a process which somewhat resembles that seen in a deligated artery. It is thus converted into a ligamentous band, in which form it remains during the remainder of life.

"After a certain period of embryonal life, the umbilical vein which returns the renovated blood from the fœtal placenta, sends branches to the liver. Besides this, it unites with the portal vein, which also ramifies in this gland. And it has also a certain communication with the inferior vena cava, by means of a vessel—the nervous duct of Arantius—which passes between the two. Hence, part of the purified blood which is returning from the fœtal placenta can avoid the liver, and flow immediately into the auricle.

"The umbilical cord of the infant is usually tied and cut through in some part of its course. The brute mammals gnaw it asunder as soon as their young have breathed. After some time that portion which remains attached to the belly dries up, and falls spontaneously from the navel. Those portions of the unbilical arteries which first run along the bladder, and then ascend on the abdominal walls to the umbilicus, become converted into ligamentous tissue. The duct of Arantius and a large part of the umbilical vein also experience the same fate.

"The development of the intestinal canal commences by the centre of the mucous lamina being raised and folded inwards. In this way it produces an intestinal groove, which is open towards the yolk. This groove is soon afterwards shut off anteriorly and posteriorly, so that there only remains a median gap, the intestinal navel. The circumference of the mucous lamina furnishes a covering for the umbilical vesicle. The portion which intervenes between this and the intestinal navel is drawn out into a cylindrical duct, the pedicle or stalk of the umbilical vesicle." (Valentin, 'Text-Book of Physiology.')

The fœtus has many peculiarities which distinguish it from the child after birth, most of which are peculiar to its mode of life, and are lost immediately after being separated from the mother or are

gradually removed during gestation. The most characteristic difference is that it lives in a medium of water, and not of air, and consequently does not breathe by lungs, but has the blood which is deteriorated by circulating through the system purified in some manner in passing through the placenta. The umbilical vein carries the blood from the placenta to the fœtus: it enters the liver by the longitudinal fissure, and in the tranverse fissure communicates with the vena portæ, sending the greater part of the blood to be circulated in the liver. This organ is of great size, and seems to perform some important office in the fœtal economy. It is conjectured by Dr. R. Lee to secrete albuminous matter, which nourishes the fœtus. The rest of the blood is transmitted directly to the vena cava inferior by the ductus venosus, which seems to be a continuation of the umbilical vein in man, though in most animals it is merely a branch arising from the sinus of the vena portæ. The blood conveyed by the vena cava inferior to the right auricle of the heart, does not all pass, as in the adult, into the right ventricle, but a great portion goes immediately into the left auricle through an opening in the septum of the auricles called the foramen ovale, which closes up immediately after birth. The blood that still goes into the right ventricle through the auriculo-ventricular orifice is propelled into the pulmonary artery, but, as there is no use for it at present in the lungs, it nearly all passes through a vessel named the ductus arteriosus into the aorta. This duct also becomes obliterated after birth, its functions having ceased when once the child has breathed.

By the aorta the blood is sent from the left side of the heart and ductus arteriosus to the different parts of the body, from which it is returned by the veins, but a great part of it passes out of the body of the fœtus by the umbilical arteries, which are continued from the internal iliacs, and pass out at the navel to go to the placenta. The blood of the fœtus differs in its physical and chemical qualities from that of the adult. There is before birth no distinction between arterial and venous blood; it is of a dark colour in both systems of vessels. The purified blood is brought from the placenta by the umbilical vein, and is mixed before arriving at the heart with that which has been circulating through the fœtus: the mixed blood is then transmitted by the aorta to various parts of the body; some of it only going again to the placenta by the umbilical arteries to be again purified.

The position of the child in the uterus is that which takes up the least room; it lies with the head downwards, the chin being bent on the breast; the knees are doubled up close to the belly, and the arms are folded in the space between the head and legs. This is the most general position, and the child thus forms an oval figure, of which the head forms one end and the breech the other. The long axis of this ellipse measures in the ninth month fully ten inches, and the short one five or six inches. The quantity of fluid which surrounds the child at the full time is, on an average, about two pints.

The ordinary period of utero-gestation in man is forty weeks, though labour often takes place before this period, or is delayed a little beyond it. The embryo having now arrived at a sufficient degree of maturity to exist separately, the fibres of the uterus contract, accompanied by contraction of the abdominal muscles and diaphragm. In consequence of this pressure the membranes gradually dilate the mouth of the womb; they then burst and evacuate the liquor amnii, when the pressure acts upon the child itself, which is gradually forced into the world, and commences a new existence. In man, and other *Mammalia*, the young being for a considerable time depends upon its mother for the whole of its nourishment, and very generally requires a supply of warmth and a degree of protection till it is able to provide for itself.

REPTILIA, a class of Animals belonging to the sub-kingdom *Vertebrata*, and embracing the creatures usually known as Crocodiles, Lizards, Turtles, Tortoises, Frogs, Toads, and Serpents. In the articles AMPHIBIA, CROCODILIDÆ, CHELONIA, OPHIDIA, and SAURIA, will be found an account of the principal forms and organisation of these creatures. We here propose to give a slight sketch of their history, and the attempts made at their general classification.

The ancient monuments of the Egyptians prove that the great groups of the tortoises, the lizards, the serpents, and the frogs, as well as their habits, were well known to that people; and the Sacred Scriptures abound in passages (the Old Testament especially) showing that a similar knowledge obtained when they were written. Indeed from the earliest times these forms must have attracted the attention of man; and a natural desire on his part to ascertain which of them were dangerous, and which were innocuous, must have led him to particular inquiry in order to solve the doubt.

In Herodotus and Athenæus there are not wanting passages indicative of precise notions respecting many species of reptiles.

That this class of animals had employed no small portion of the acute observation of Aristotle, and that he was well acquainted with their form, structure, and habit, appears from the great work which has justly immortalised him as a zoologist. We need only refer to the following passages in his 'History of Animals' to be well satisfied of the fact (lib. i., c. 1.; lib. ii., c. 10, 17; lib. v., c. 3, 4; lib. viii., c. 2, 17). We find noticed the oviparous quadrupeds, namely, the land and marine *Testudinata*, the crocodiles, the lizards, &c.; the serpents, with an observation that they may be placed at the side of the lizards, as resembling them closely, if we suppose the lizards to be lengthened and deprived of their feet. The frogs are also often mentioned. Aristotle was quite aware of the generation of most of this class; he knew that the viper was ovoviviparous, and states that it brings forth its young alive, having produced an egg internally (ὁ μὲν ἔχις ἔξω ζωοτοκεῖ, ἐν αὐτῷ πρῶτον ὠοτόκησας); and he indicates what animals should be designated as *Amphibia*.

Pliny writes much and elegantly concerning this class; but the best of his observations are borrowed from Aristotle, and his far from well-digested compilation is mixed up with so great a portion of error and so large a measure of credulity, as justly to merit the censure passed by Cuvier on this voluminous and pleasant author, but too often fabulous natural historian.

Darkness settles on the period from the fourth to the ninth century as far as the history of the sciences is concerned; but at that epoch the best Greek works were translated by the Arabs, who thus handed on the most curious known facts, especially those which had any reference to the art of medicine. Again there is a great void till the early part of the sixteenth century, when France produced Belon and Rondeletius, Italy Salviani, and Switzerland that prodigy of erudition, as he is designated by Boerhaave, Conrad Gesner. Two of Gesner's books are devoted to the natural history of reptiles—lib. ii., 'De Quadrupedibus Oviparis;' and lib. v., 'De Serpentium Naturâ.'

Towards the end of the same century Aldrovandi appeared. The results of fifty years' research in collecting objects of natural history, the drawings which he caused to be made of them, and his diligent studies relative to every point bearing on their history, appeared after his death, which happened in 1605, in fourteen volumes folio. The two books upon serpents and lizards do not appear to have been published till 1640, when they were given to the world by Professor Ambrosini of Bologna: twenty-two chapters are occupied by the serpents, and six only are dedicated to basiliaks, dragons, and other lizards, the greater part of which however are fabulous.

Jonston's 'Historia Naturalis,' edited by Henry Ruysch, son of the celebrated anatomist, under the title of 'Theatrium Universale Omnium Animalium,' is principally a selection of the remarks of those who preceded him, and he has but few observations which can be called his own; still fewer indeed than Aldrovandus, who does not abound in originality.

But it is to our countryman John Ray that we owe the first arrangement which can be truly called systematic: in his 'Synopsis Methodica Animalium Quadrupedum et Serpentini Generis,' which first appeared in 1693, we have a classification based on the mode of respiration, the volume of the eggs, their colour, &c. This basis is not indeed strengthened by any description of the habits or organisation of the reptiles on which he treats, and cannot but be considered as insufficient; still it is valuable, and has the merit of leading the way to more accurate methods.

The *Amphibia* form, in the last edition of the 'Systema Naturæ,' published by Linnæus himself, the third class of the animal kingdom. This class consists of three orders:—

1. *Reptiles*, which are described as 'pedati, spirantes ore.'
2. *Serpentes*, which are characterised as 'apodes, spirantes ore.'
3. *Nantes*, which are characterised as 'pinnati: spirantes etiam branchiis lateralibus.'

The last order, which consists of cartilaginous and other fishes, forms no part of our present inquiry, which is confined to animals included in the two first.

The Reptiles are thus designated:—'Os respirans pulmonibus. Pedes quatuor:'—and they consist of the genera *Testudo* (Land, Marine, and Fresh-Water Tortoises); *Rana* (Frogs and Toads); *Draco* [DRACONINA]; and *Lacerta*, which includes the Crocodiles and the rest of the Saurians.

The *Serpentes* have the following general character:—'Os respirans tantum pulmonibus. Pedes nulli, pinnæve natatoriæ nullæ. Aures nullæ;' and they comprise the following genera:—*Crotalus* (the Rattle-Snakes); *Boa* (Boas and Pythons); *Coluber*, including all serpents which have abdominal scuta and subcaudal scales, whether poisonous or not; *Anguis*, including the Slow-Worms, *Bipes* and other serpents, the poisonous *Cerastes*, &c.; *Amphisbæna*; and *Cæcilia*.

The work on Oviparous Quadrupeds, published by Klein in 1751—'Quadrupedum Dispositio Brevisque Historia Naturalis'—requires hardly any notice, and another which made its appearance in 1755—'Tentamen Herpetologiæ'—deserves as little. The latter, notwithstanding its extensive title, treats only of serpents; and the value of the criticisms of this opponent—he cannot be called rival—of Linnæus may be appreciated by his arranging in the same category the Earth-Worms, Tape-Worms, and Leeches.

But it is to the 'Specimen Medicum' presented by Laurenti at Vienna, in order to obtain the degree of Doctor, that we must look for the first well-digested history of reptiles. This remarkable work, which omits the Tortoises, but, in other respects may be said to have formed an era in the science of Herpetology, is divided into two parts: the first relates entirely to the natural history and characters of the genera; the second is devoted to specific descriptions, and the record of experiments made to detect the existence of poison in some species, and the effect of remedies in certain cases. But though this most able treatise is always quoted as that of Laurenti, it has been

attributed to Winterl, a distinguished chemist of Vienna, whose name appears oddly in the last page of the work as having been the assistant of Laurenti — or rather his 'collaborateur' — in his therapeutic experiments.

Though Scopoli devoted but a few pages to the Reptiles, his observations must not be passed by. The pupil of Linnæus, he showed himself worthy of his master: but at the same time he appears in his arrangement to have been fettered by the principles adopted by the great Swede, though he varied the application of them.

The Count Lacépède (1788-90) divided the Reptiles into three great groups:—

1. Oviparous Quadrupeds, subdivided into (1) those which possess a tail, and (2) those which are tailless.
2. Biped Reptiles.
3. Serpents.

In 1799 the method of M. Alexandre Brongniart was read to the French Academy of Sciences, and it seems to have been first published in the 'Bulletin des Sciences,' in 1800; it was afterwards printed among the other Memoirs of the National Institute. His classification may be regarded as a considerable step in advance of those who had preceded him, and had principally confined themselves to external characters, well defined doubtless, but of little moment when compared with those based on organisation and habits. Whilst they carefully attended to the presence or absence of tail or feet, they neglected those essential points which spring from generation and development. Brongniart pointed out the approximation of the Tortoises to the Lizards, and even to the Serpents, and was the first to show that the Toads, Frogs, and Salamanders, ought to constitute a separate order.

M. Brongniart recognised the following orders:—

1. Chelonians (Tortoises).
2. Saurians (Lizards).
3. Ophidians (Serpents).
4. Batrachians.

The method of Lacépède seems to have found more favour in the eyes of M. Latreille than that of M. Alex. Brongniart, which last must have been known to the former when he published his 'Natural History of Reptiles,' in 1801. He places in his first division the Oviparous Quadrupeds, whose body is provided with feet, dividing them into two sections, according as they have unguiculated or clawless toes, and a scaleless skin. His second division is formed by the Serpents; and in his third, designated by the name of Pneumobranchians, he places the genera *Proteus* and *Siren*, as well as another, which he names *Ichthyosaurus*, which last is only a Tadpole.

In 1825, when the science had very much advanced, M. Latreille, in his 'Families of the Animal Kingdom,' published another arrangement, which Messrs. Duméril and Bibron have digested into the following table:—

HEMACRYMES PULMONÉES.

Classes.	Sections.	Orders.	Families.
Reptiles	Cuirassed	Chelonians	Cryptopods (*Testudo*, &c.). Gymnopods (*Sauroshelys*, *Trionyx*, &c.).
		Emydosaurians	Crocodilians (Crocodiles, &c.).
	Scaly. Saurians	Lacertiform	Lacertians (*Monitor*, &c.). Iguanians (*Iguana*, &c.). Geckotians (*Gecko*, &c.). Chameleonians (*Chamæleo*, &c.)
		Anguiform	Tetrapods (*Scincus*, *Seps*, *Chalcides*). Dipods (*Bipes*, *Bimanus*). Apods (*Anguis*, *Ophisaurus*, &c.).
	Ophidians	Idiophids	Amphisbænians (*Amphisbæna*, &c.). Cylindrical (*Tortrix*). Coluberians (*Acrochordus*, *Boa*, *Python*, &c.). Anguivipers (*Bongarus*, *Hydrophis*, *Pelamys*, &c.). Vipers (*Crotalus*, *Berus*, *Naja*, &c.).
		Batrachophids	Gymnophids (*Cæcilia*).
Amphibia		Caducibranchians	Anurous (*Pipa*, *Bufo*, *Rana*, &c.). Urodeles (*Salamandra*, *Triton*, *Axolotl*).
		Perennibranchians	Ichthyoids (*Proteus*, *Siren*).

In 1802 and 1803 appeared the 'Traité Général' of Daudin. In this distinguished work the method of M. Alexandre Brongniart is followed, in so far as the division of the Reptiles into four orders. In the three sections of Chelonians 57 species are named and described. In the order Saurians, Daudin first places *Crocodilus*, with its three sub-genera [Crocodilidæ], and then the genera *Draco*, *Tupinambis* (in which he describes several new species), *Lacerta* (subdivided into the Ameivas, the Collared, Ribanded, Spotted, Gray, Dracenoid, and Striated Lizards)—31 species in all, and including the genera *Trachydromus*, *Draco*, *Basiliscus*, and *Agama* (which last is subdivided into five sections), *Seps*, and *Chalcides*. The third order, Ophidians, contains numerous and natural genera, some of them rather overloaded, *Coluber* for instance, under which 172 species are arranged; and others with only one or two. The fourth order, Batrachians, appears to have employed his particular attention. [Amphibia.] He includes *Salamandra* and *Triton* in one genus, and assigns a single species to the genera *Proteus* and *Siren*. Such is a mere sketch of the great work of Daudin, founded, as he himself declares, upon his personal examination and study of 517 species.

In the short notice published by George Cuvier, in his 'Tableau Elémentaire de l'Histoire Naturelle' (1798), he divided the Reptiles, like Lacépède, into Oviparous Quadrupeds, Serpents, and Biped Reptiles.

Oppel (who had been a diligent attendant at M. Duméril's course of lectures in 1807 and 1808, and in whose works much of the lessons of the latter are to be traced, as Oppel himself acknowledges), after publishing in the 19th volume of the 'Annales du Muséum,' a Memoir on the Ophidians, and another on the Batrachians, produced, in 1811 at Munich, his treatise 'Die Ordnungen, Familien, und Gattungen der Reptilien, als Prodrom einer Naturgeschichte derselben' (thin 4to.).

The following synoptical table exhibits Oppel's method:—

Reptilia	Testudinata		Chelonii. Emydæ.
	Squammata	Sauril	Crocodilini. Geckoides. Iguanoides. Lacertini. Scincoides. Chalcidici.
		Ophidii	Anguiformes. Hydri. Crotalini. Viperini. Constrictores. Pseudovipera. Colubrini.
	Nuda		Apoda. Caudata. Ecaudata.

In 1790 Merrem published a paper in German, with the title of 'Materials for a Natural History of Amphibia,' and in 1820 and 1821 two other papers followed. These papers treat of serpents and several genera of Saurians, and are illustrated with coloured plates. But his system appears to have been published (in 1800) at the suggestion of Bechstein, who had translated Lacépède's 'History of Reptiles' into German; and in 1820 a second edition of this system, which is shown in the following table, made its appearance:—

Classes.	Orders.	Tribes.	Subdivisions.
Pholidota	*Testudinata*	with feet	Pinniform. Digitated.
	Loricata (Crocodiles)		
	Squammata	*Gradientia*	*Ascalabota*. *Sauræ*. *Chalcidici*.
		Repentia (Anguis, Ophisaurus, Acontias).	
		Serpentia	Gulones: *Innocui*. *Venenati*. *Typhlini*.
		Incedentia (Chirotes).	
		Prendentia (Chamæleon).	
Batrachia	*Apoda* (*Cæcilia*).		
	Salientia (*Rana*, &c.).		
	Gradientia	with eyelids	*Mutabilia* (*Salamandra*, &c.).
		without eyelids	*Amphipneusta* (Hypochthon, or Proteus).

M. De Blainville, in 1816, published in the 'Nouveau Bulletin des Sciences de la Société Philomatique,' the prodromus of his systematic distribution of the animal kingdom, which he produced, in 1822, in his 'Principes d'Anatomie Comparée.' Under the type *Osteozoaria*, and the sub-type *Ovipara* or *Anastozoaria*, he places the Reptiles, which he divides into two classes, namely—1, Reptiles or Ornithoid Squammifers; 2, Amphibians or Nudipellifers, Naked Ichthyodians.

The First Class is separated into three orders:—

I. Chelonians, consisting of the genera *Testudo*, *Emys*, *Chelys*, *Trionyx*, *Chelonia*, and *Dermochelys* (Sphargis).

II. Emydosaurians, or Crocodiles, divided into three sub-genera.

III. Saurophians, or Bipennians, which are separated into two sub-orders:—

A. Saurians, consisting of the families of Geckoidians, Agamoidians (the Normal, as *Agama* and *Basiliscus*, and the Anormal, as *Chamæleo* and *Draco*), the Iguanoidians, *Tupinambis*, and the Lacertoidians (divided into Tetrapods, Dipods, and Apods).

B. Ophidians, which are divided into—

1. The Dipods (Chirotes).
2. Apods:—α (with numerous teeth), *Pelamys*, *Hydrophis*, the Vipers, and the Lethifers; β (without venomous teeth), the Amphisbænas, the Climbers or Boas, and the Colubers.

The Second Class, Ichthyoid or Nudipelliferous Amphibians, is composed of four orders:—

1. The Batrachians, divided into two sub-orders—α (Aquiparous), *Rana*, &c.; β (Dorsigerous), *Pipa*.
2. The Pseudosaurians or Salamanders.
3. The Subichthyans, or True Amphibians (*Proteus*, *Sirens*).
4. The Pseudophidians (*Cæcilia*).

Dr. John Edward Gray published in 1825 his 'Synopsis of the Genera of Reptiles and Amphibia,' in the 'Annals of Philosophy.' He considers the Reptiles, or scaly-skinned group, and the *Amphibia*, naked-skinned group, as distinct classes.

The class *Reptilia* are thus divided:—

§ I. Body covered with imbedded hard plates; legs distinct, fit for walking. *Loricata*, Gray, not Merrem.

Order I. *Emydosauri*, De Blainville.

Families.—1, *Crocodilidæ*; 2, *Ichthyosauridæ*; 3, *Plesiosauridæ*.

Dr. Gray thinks that *Megalosaurus* of Buckland is perhaps allied to this order.

Order II. *Sauri*, De Blainville.

Section 1. Tongue not extensile. *Ascalabota*, Merrem.

Families.—1, *Stellionidæ*; 2, *Geckotidæ*.

Section 2. Tongue extensile. *Saurœ*, Merrem.

Families.—3, *Tupinambidæ*; 4, *Lacertinidæ*; 5, *Chamæleonidæ*.

Order III. *Sauropkidii*, Gray.

Section 1. Body covered with imbricate scales; anus transverse, not terminal; tongue extensile.

Families: 1, *Scincidæ*, Gray; 2, *Anguidæ*.

Section 2. Body covered with intricate (imbricate?) scales; anus terminal.

Family: 3, *Typhlopidæ*, Gray.

Section 3. Body covered with rings of square scales.

Families: 4, *Amphisbænidæ*, Gray; 5, *Chalcididæ*.

Order IV. *Ophidii*, Brongn. (*Serpentes*, Linn.)

Section 1. Upper jaws with fangs only. *Venati*. (*Venenati* must be meant.)

Families: 1, *Crotalidæ*; 2, *Viperidæ*.

Section 2. Upper jaw with teeth, and with or without fangs; oviparous.

Families: 3, *Hydridæ*; 4, *Colubridæ*; 5, *Boidæ*.

Order V. *Chelonii*. (*Testudinata*, Oppel.)

Section 1. Feet and head retractile into the carapace; carapace solid, covered with horny scales. *Cryptopodi*.

Families: 1, *Testudinidæ*; 2, *Emydidæ*, Bell.

Section 2. Feet and head not or only partly retractile into the carapace; carapace mostly soft. *Gymnopodi*.

Families: 3, *Trionycidæ*; 4, *Sphargidæ*; 5, *Cheloniadæ*.

The following table of the affinity of Reptiles is given by Dr. Gray:—

Normal Groups.	Annectant Groups.
Order I.—*Sauri*.	
1. *Stellionidæ*.	3. *Lacertinidæ*.
2. *Geckotidæ*.	4. *Chamæleonidæ*.
	5. *Tupinambidæ*.
Order II.—*Emydosauri*.	
1. *Crocodilidæ*.	3. *Plesiosauridæ*.
2. ———.	4. *Ichthyosauridæ*.
	5. ———.
Order III.—*Chelonii*.	
1. *Testudinidæ*.	3. *Trionycidæ*.
2. *Emydidæ*.	4. *Sphargidæ*.
	5. *Carettidæ* (*Cheloniadæ*?)
Order IV.—*Ophidii*.	
1. *Crotalidæ*.	3. *Hydridæ*.
2. *Viperidæ*.	4. *Colubridæ*.
	5. *Boidæ*.
Order V.—*Sauropkidii*.	
1. *Scincidæ*.	3. *Typhlopsidæ*.
2. *Anguidæ*.	4. *Amphisbænidæ*.
	5. *Chalcidæ*.

The 'Neue Classification der Reptilien' of Fitzinger was published at Vienna in 1826. This work, the result of much anatomical and physiological study, has always held a prominent place in the history of Herpetology, and its leading principles will be seen in the following table:—

Class.	Orders.	Tribes.	Families.
Reptilia.	*Monopnoa*	I. *Testudinata*	1. Carettoides. 2. Testudinoides. 3. Emydoides. 4. Chelydoides. 5. Trionychoides.
		II. *Loricata*	6. Ichthyosauroides. 7. Crocodiloides.
		III. *Squamata*	8. Ascalabotoides. 9. Chamæleonides. 10. Pneustoides. 11. Draconoides. 12. Agamoides. 13. Cordyloides. 14. Tachydromoides. 15. Ophisauroides. 16. Chalcidoides. 17. Ameivoides. 18. Lacertoides. 19. Scincoides. 20. Anguinoides. 21. Amphisbænoides. 22. Typhlopoides. 23. Gymnophthalmoides. 24. Ilysioides. 25. Pythonoides. 26. Colubroides. 27. Bungaroides. 28. Viperoides. 29. Crotaloides. (Saurians and Ophidians.)
		IV. *Nuda*	30. Cæcilioides.
	Dipnoa	V. *Mutabilia*	31. Ranoides. 32. Bufonoides. 33. Bombinatoroides. 34. Pipoides. 35. Salamandroides.
		VI. *Immutabilia*	36. Cryptobranchoides. 37. Phanerobranchoides.

The following is a synoptical table from the second edition of Cuvier's 'Règne Animal.'

			Orders.			Families.
Heart with an Auricle.	Double	Limbs: Jaws	Horny, without teeth			Chelonians.
			Toothed	Saurians	Feet: Ordinary: toes to the number of: Five before, four behind	Crocodilians.
					Feet: Five to four: Tongue: Bifurcated, extensible	Lacertians.
					Feet: Five to four: Tongue: Not extensible: Body: Ordinary	Iguanians.
					Feet: Five to four: Tongue: Not extensible: Body: Flattened	Geckotians.
					Feet: Five to four: Tongue: Vermiform, very extensible	Chameleonians.
					Feet: Very short, or to the number of four at least	Scincoidians.
		No Limbs		Ophidians	Skin: Scaly: Eye: With three eyelids	Anguis.
					Skin: Scaly: Eye: Without a third eyelid	True Serpents.
					Skin: Naked	Naked Serpents.
	Single			Batrachians		Batrachians.

Messrs. Carus and Ficinus have, in their zoological arrangement, adopted very nearly the classification of Merrem and the principles of Oken for the Reptiles.

In the method proposed by Dr. Harlan, in the 'Journal of the Academy of Natural Sciences of Philadelphia,' he adopts the four orders of Batrachians, Ophidians, Saurians, and Chelonians.

In 1828 Ritgen's classification of Reptiles appeared in the 'Nova Acta Nat. Cur.,' to which we refer those of our readers who may wish to consult it. This classification is not much attended to.

Wagler published his 'Naturalisches System der Amphibien,' founded upon the organisation of the animals, at Munich in 1830.

In this system the *Amphibia* consist of eight orders:—1, the Tortoises; 2, the Crocodiles; 3, the Lizards; 4, the Serpents; 5, the Orvets; 6, the *Cæciliæ;* 7, the Frogs; and 8, the Ichthyodes.

In 1832 Professor Müller of Bonn published his 'Beiträge für Anatomie und Naturgeschichte der Amphibien.' ('Zeitschrift für Physiologie von Tiedemann und Treviranus,' Heidelberg.) Much interesting detail relating to the history of reptiles is here entered into, but the Professor treats more especially of the Batrachians and Serpents. He divides the *Amphibia* into two great orders, consisting of the scaly and the naked.

Scaly *Amphibia.*	Naked *Amphibia.*
Occipital condyle simple	Occipital condyle double.
True ribs	None or rudimental.
Auricle of the heart double	Single.
Internal ear with round and oval fenestræ	Oval only.
With a distinct cochlea	None.
Penis of the males simple or double	None.
No metamorphosis	Most frequently a distinct metamorphosis.
No branchiæ	Distinct branchiæ, or with persistent or not permanent holes.
Skin scaly, scutcheoned, or cuirassed	Naked.

Professor Müller divides the Serpents in accordance with their anatomical structure.

The Microstomes, or those which have a not dilatable mouth, correspond very nearly to the Homoderms of M. Duméril. They are separated into four families:—1, the Amphisbænoids; 2, the Typhlopins; 3, the Uropeltaceans; 4, the Tortricins.

The second sub-order (Macrostomes) corresponds with the Heteroderms of M. Duméril. These are divided into seven families:—1, the Oligodonts; 2, the Holodonts (*Python*, &c.); 3, the Isodonts (*Boa, Pseudoboa*, &c.); 4, the Heterodonts (*Dendrophis, Coronella*, &c.); 5, Amphiboles (*Dryophis, Dipsas*, &c.); 6, the Antiochalinans (*Bongarus, Naja*, &c.); and 7, the Serpents with three sorts of teeth, and in which all the mandibular teeth are perforated and venomous (*Elaps, Scytale, Crotalus*, &c.).

In 1833 the first part of Schinz's 'Naturgeschichte und Abbildungen der Reptilien' was published at Leipsic; in 1834 it was concluded. It brings down the information to the time of its publication, is well digested and well illustrated with coloured figures of the true reptiles and amphibians, mostly from good originals, but some from nature, and will be found very useful, especially as a book of reference.

Mr. Swainson ('Natural History of Fishes, Amphibians, and Reptiles,' in Lardner's 'Cyclopædia') places the *Amphibia* and the *Reptilia* in different classes.

He gives the following as "a natural arrangement of the class of *Amphibia*, according to Professor Bell:"—

Order 1. *Amphipneura* (*Amphipneusta?*) (*Proteus, Siredon, Menobranchus, Siren, Pseudobranchus*). Order 2. *Anoura* (Frogs and Toads). Order 3. *Urodela* (*Salamandrina, Salamandra, Tritonella, Molge*). Order 4. *Abranchia* (*Menopoma, Amphiuma*). Order 5. *Apoda* (*Cæcilia*).

The same author gives the following as a 'Synopsis and Natural Arrangement of the Class of Reptilia:'—

Order 1. *Emydosaures*—Crocodiles (*Crocodilus, Champsa, Stenosaurus.*) Order 2. *Chelonides*—Tortoises (Families: *Chelidridæ*, Crocodile Tortoises; *Testudinidæ*, Land Tortoises; *Emydæ*, River Tortoises; *Trionycidæ*, Soft Tortoises; and *Chelonidæ*, Sea Turtles). Order 3. *Elanosaures* (Enaliosaurs?)—Fish Lizards (*Plesiosaures, Ichthyosaures, Saurocephalus, Pterodactylus*). Order 4. *Ophides*—the Serpents (Families: *Hydrophidæ*, Water Serpents; *Crotalidæ*, Poisonous Serpents; *Coluberidæ*, Snakes not poisonous; *Anguidæ*, Slow-Worms; and *Amphisbænidæ*, Blind-Worms.) Order 5. *Saures*—the Lizards (Families: *Chamæleonidæ; Iguanidæ*, Thick-Tonged Lizards; *Lacertidæ*, Slender-Tongued Lizards; *Agamidæ;* and *Scincoidæ*.

In the same year Professor Bell published his interesting 'History of British Reptiles.' He considers the *Reptilia* and *Amphibia* as distinct classes, and justifies his opinion by a reference to their characters, which appear to him to be sufficiently marked and important to warrant their separation.

Dr. J. E. Gray has more recently developed his classification in the very valuable British Museum Catalogues. Those devoted to the *Reptilia* are not yet completed.

With the exception of the Paris collection, that of the British Museum is more rich in *Reptilia* than any other public or private museum.

RESEDA'CEÆ, a natural order of Plants belonging to the class of Exogens. It has a many-parted calyx; the petals unequal, of broad fleshy plates having lacerated appendages at the back; an hypogynous one-sided glandular disc; definite stamens inserted into the disc, the filaments erect, the anthers 2-celled, opening longitudinally; a 3-lobed 1-celled many-seeded sessile ovary, scarcely closed, usually with 3-6-parietal placentæ, sometimes surrounding a free central ovule-bearing body; 3 glandular sessile stigmas; campulitropal or amphitropal ovules; the fruit dry and membranous or succulent, opening at the apex, or apocarpous, with empty carpels surrounding a central placenta, or even hooded and 1-seeded; the seeds several, reniform, with a taper arcuate embryo without albumen, and a radicle next the hilum. The species of this order are soft herbaceous plants, or in a few instances small shrubs with alternate entire or pinnately-divided leaves, and minute gland-like stipules. The flowers in racemes or spikes. They are natives of Europe, the adjoining parts of Asia, the basin of the Mediterranean, and the adjacent islands. A few species occur in the north of India, the Cape of Good Hope, and California.

This order embraces the genera *Reseda, Ochradenus, Oligomeris, Holopetalum, Astrocarpus*, and *Caylusea*.

R. odorata is the Common Mignionette. It has lanceolate bluntish entire or trifid leaves; a 6-parted calyx equal in length to the petals, which are finely cleft into many club-shaped divisions, the two lowest simple, the capsules 3-toothed. It is a native of the North of Africa and Egypt, but its delicious fragrance has caused it to be cultivated all over the world. It is naturally an herb, but when trained in the greenhouse it becomes shrubby. The arborescent form of this plant is called Tree-Mignionette. [MIGNIONETTE, in ARTS AND SC. DIV.]

R. luteola, Weld, Woold, or Woad, is a British species. It is known by its elongate-lanceolate undivided leaves.

R. lutea has 3-cleft or pinnatifid leaves.

R. suffruticulosa is a rare British plant with the leaves all pinnatifid. It grows near the sea.

RESINS. [SECRETIONS OF PLANTS.]

RESPIRATION is that function in the animal kingdom by means of which the various tissues of the body are exposed to the chemical influence of the gases of the atmosphere, and the products thus formed expelled from the body. The advance of chemical knowledge has demonstrated that this function is one essentially of oxidation, and hence it has been proposed to consider all cases of oxidation in organic bodies as instances of respiration. Such an extension of the use of the term has led to its application to plants as well as animals. It should however be remembered that the older physiologists applied the term Respiration to that function of plants by which they take up carbonic acid and give out oxygen, and which was regarded as an equivalent process to the taking up of oxygen and disengaging carbonic acid in animals. It was subsequently found that plants, during certain processes, gave off carbonic acid and absorbed oxygen gas; and it was hence inferred that plants performed a function essentially the same as that effected in animals by the oxidation of carbon in respiration.

The cases in which plants have been observed to consume oxygen and throw off carbonic acid are as follows:—1. During the growth of the order *Fungi*. 2. During the growth of the leafless parasites. 3. During night by most plants. 4. During the active growth of the *Coniferæ*. 5. During the flowering of most plants. 6. During the germination of plants.

This process has been observed to be attended with the same results in certain of these cases, as in the respiration of the higher animals, that is, with the disengagement of heat. [HEAT, VEGETABLE.] When the process of oxidation takes place rapidly, disengagement of heat is the necessary result. That these phenomena take place cannot be doubted, but the propriety of classing them with those of the respiration of animals must be questioned, and on these grounds:—

1. The oxidation that takes place in the vegetable kingdom is not a constant phenomenon, but only occurs occasionally in the life of the plant. It is during the latter stages of the growth of *Fungi* that it is observed, when it may be supposed that these plants are entering upon a stage of decay. The oxidation in the *Coniferæ* arises from their secreting resinous matters, which unite readily with oxygen. Again, in the flowering of plants it is only an occasional and exceptional phenomenon in the life of plants. The carbonic acid given out by plants at night can be quite as readily accounted for on the supposition that a certain quantity of the carbonic acid taken up in the day has been undecomposed, and is given out at night, as on the theory of its being the result of oxidation. So likewise in germination, the carbonic acid given off is not the result of a process of life in the young embryo, but of a process of decomposition going on in the starch of the albumen by which it is surrounded. [GERMINATION.]

2. If the term Respiration is to be applied to the evolution of carbonic acid, and absorption of oxygen gas from the fluids of organic beings wherever found, then it must be used to comprehend the processes of fermentation, putrefaction, and eremacausis, which take

place either out of the structure of organic beings, or in their interior. The carbonic acid given off from food in the stomach or intestines ought not most assuredly to be regarded as the result of respiration, yet this would be the case if we accepted a mere chemical definition of respiration.

Respiration then appears to be a purely animal process, by which the fluids of the animal are brought into contact with the oxygen of the air, the final result of which is the discharge of carbonic acid gas. This process is continuous in the animal kingdom; and in the great majority of cases in the higher animals, if it be suspended for a few minutes the animal dies. When an animal dies from being deprived of oxygen gas, it is said to be suffocated.

In the higher animals special organs are provided for the performance of that portion of this function which consists in the taking up of oxygen gas directly from the atmosphere, and allowing the carbonic acid to escape. Hence these arrangements have been called Organs of Respiration. It should however be understood that the chemical changes involved in the disappearance of the oxygen, and the appearance of the carbonic acid, are carried on in the tissues themselves. The lungs, gills, or sacs, are organs where the blood receives the oxygen gas, and gets rid of its carbonic acid; whilst the capillaries of the systemic circulation are the organs by which the blood gets rid of its oxygen, and the tissues their carbonic acid. The process of respiration then is the same in the highest as in the lowest animals, with this exception, that in the lowest animals there are no organs of circulation, and no organs of ventilation, as the lungs and gills may be called, for conveying the oxygen and carbonic acid to and from the tissues.

The absorption of oxygen by the animal cell seems to effect three great objects:—1. The preparation of the materials taken up as food for the purposes of nutrition. 2. The removal of certain constituents which have been employed in nutrition, and destroyed during the performance of the function of the part. 3. The production of heat, arrangements for the accumulation of which are made in the higher animals, which are from this circumstance called warm-blooded. [Heat, Animal.]

That the performance of one or other of these functions is essential to the life of animals is seen from the fact that, should the supply of oxygen to the tissues of animals be limited or suspended, they exhibit deficient vitality or die. It is not only one function of the animal body that is affected by this deprivation, but all; so that we find the amount of oxidation performed by this process becomes the exponent of the amount of vital activity displayed by any particular animal, or class of animals. When the functional activity of an animal is great it consumes more oxygen, and gives off more carbonic acid, than when it is small. Thus, in animals which hybernate, the amount of oxygen consumed, and carbonic acid given out, is much less during their period of repose than during their period of activity. Sluggish and slow-moving animals consume less oxygen than those which are active. Thus the *Mollusca* consume less oxygen than the various tribes of active insects. It is also found that animals whose movements are slow will support the absence of oxygen gas for a very much longer time than those whose movements are quick.

Under the head of the various articles devoted to the classes and families of animals some account is given of the general character and structure of what are called the Respiratory Organs. In the lowest forms of animals, the *Infusoria*, the whole surface of the animal is exposed to the fluid in which they live, and which contains the oxygen necessary to produce the respiratory changes. When a number of cells are congregated together, as in the sponges, and cavities or tubes are formed, special provision is made by means of cilia, or molecular movements, for carrying the fluid into these cavities, or tubes, as seen in many of the polygastric animalcules and the sponges. Passing higher in the forms of radiate animals, as in the *Polypifera*, we find the arrangements for introducing water into the interior of the animal becoming more complicated, till in the *Holothuriadæ* we find a special system of vessels for supplying this fluid, which have been called an 'aquiferous,' or 'water vascular system,' and which becomes more fully developed in the *Entozoa*, the lowest tribe of the *Articulata*.

These arrangements amongst the lower animals are preparatory to the two predominant forms of respiratory apparatus which are found in the higher animals. The provision for supplying the system with oxygen is in them made by means of a fluid called blood, and which is carried by a circulating apparatus to all parts of the body. [Blood; Heart.] This circulating apparatus brings the blood in contact with the air by one of two arrangements. Either the aërating organ is a projection from the surface of the body, when it is called a Gill; or it is a depression in the surface, when it is called a Sac or Lung. The first of these arrangements is found in all animals which breathe through the agency of water, whilst the second is found in those which breathe air. [Lungs.] In the Aquatic *Mollusca*, the *Cirripedia*, the *Annelida*, the *Crustacea*, the aquatic larvæ of insects, the fishes, the tadpole condition of the *Amphibia*, and the perennibranchiate forms of that family, we meet with a vast variety of forms of gills adapting these animals to lead an aquatic existence. On the other hand, we find in the Terrestrial *Mollusca* and the Insects the simplest forms of air-breathing apparatus; whilst in the Reptiles, the Birds, and *Mammalia*, we have varied forms of lungs.

Man breathes by means of lungs. The structure and arrangement of those organs, and the nature of the movements performed by the muscles which contribute to the performance of their peculiar function, are described under the article Lungs. The lungs of man are so constructed that they are alternately expanded and contracted. During each expansion, a certain quantity of air is taken into the lungs, and this act is called Inspiration. This expansion is followed by a corresponding collapse, during which the lungs occupy a smaller space, and a certain quantity of air is expelled—this is called Expiration. The quantity of air changed in the human lungs at each respiratory effort varies. It is however easily measured by blowing into a vessel filled with water or other fluid, when the amount of fluid displaced will be the measure of the quantity of air thrown out from the lungs. Instruments of this kind, with an index attached, under the name of Spirometers, are now frequently employed as a means of diagnosis in diseases of the chest. The difficulty however of securing freedom from disturbing causes renders their results less to be depended on than could be wished. The quantity of air thrown out from the lungs has been variously estimated, but probably from 20 to 25 cubic inches is near the truth. Scharling conducted a series of experiments on the quantity of carbonic acid thrown out of the lungs by persons of different sexes and various ages. The following table gives an idea of the average relations of the excretion of carbonic acid gas during one hour:—

Subject.	Age.	Weight	Carbonic Acid expired in one hour.	Amount of Carbonic Acid expired in one hour for each 1000 grammes' weight.
	Years.	Kilogrammes.	Grammes.	Grammes.
Man . .	35	65·50	33·530	0·5119
Youth . .	16	57·75	34·280	0·5887
Soldier . .	28	82·00	36·623	0·4466
Girl . . .	17	55·75	25·342	0·4546
Boy . .	9½	22·00	20·338	0·9245
Girl . . .	10	23·00*	19·162	0·8331

The air that is habitually and almost uniformly changed in breathing is by Mr. Hutchinson called Breathing Air. "The quantity over and above this which a man can draw into the lungs in the deepest inspiration he names Complemental Air; its amount is various, as will be presently shown. After ordinary expiration, such as that which expels the breathing air, a certain quantity of air remains in the lungs, which may be expelled by a forcible and deeper expiration: this he terms Reserve Air. But even after the most violent expiratory effort the lungs are not completely emptied; a certain quantity always remains in them, over which there is no voluntary control, and which may be called Residual Air. Its amount depends in great measure on the absolute size of the chest, and has been variously estimated at from 40 to 260 cubic inches.

"The greatest respiratory capacity of the chest is indicated by the quantity of air which a person can expel from his lungs by a forcible expiration after the deepest inspiration that he can make. Mr. Hutchinson names this the Vital Capacity: it expresses the power which a person has of breathing in the emergencies of active exercise, violence, and disease; and in healthy men it varies according to stature, weight, and age.

"It is found by Mr. Hutchinson, from whom nearly all our information on this subject is derived, that at a temperature of 60° Fahr., 225 cubic inches is the average vital capacity of a healthy person 5 feet 7 inches in height. For every inch of height above this standard the capacity is increased on an average by 8 cubic inches; and for every inch below it is diminished to the same amount. This relation of capacity to height is quite independent of the absolute capacity of the cavity of the chest; for the cubic contents of the chest do not always or even generally increase with the stature of the body, and a person of small absolute capacity of chest may have a large capacity of respiration, and vice versâ. The capacity of respiration is determined only by the mobility of the walls of the chest; but why this mobility should increase in a definite ratio with the height of the body is yet unexplained, and must be difficult of solution, seeing that the height of the body is chiefly determined by that of the legs, and not by that of the trunk or the depth of the chest. But the vast number of observations made by Mr. Hutchinson leave no doubt of the fact as stated above.

"The influence of weight on the capacity of respiration is less manifest and considerable than that of height; and it is difficult to arrive at any definite conclusions on this point, because the natural average weight of a healthy man in relation to stature has not yet been determined. As a general statement however, it may be said

* The kilogramme=2·205 lbs. very nearly. The gramme=15·434 grains

that the capacity of respiration is not affected by weights under 161 lbs., or 11½ stones; but that above this point it is diminished at the rate of one cubic inch for every additional pound up to 196 lbs., or 14 stones; so that, for example, when a man of 5 feet 6 inches, and weighing less than 11½ stones, should be able to expire 217 cubic inches, one of the same height, weighing 12½ stones, might expire only 203 cubic inches.

"By age the capacity appears to be increased from about the 15th to the 35th year, at the rate of five cubic inches per year; from 35 to 65 it diminishes at the rate of about a cubic inch and a half per year, so that the capacity of respiration of a man 60 years old would be about 30 cubic inches less than that of a man 40 years old of the same height and weight.

"Mr. Hutchinson's observations were made almost exclusively on men, and his conclusions are perhaps true of them alone; for women, according to Bourgery, have only half the capacity of breathing that men of the same age have.

"The number of respirations in a healthy adult person usually ranges from 14 to 18 per minute. According to Mr. Hutchinson, the force with which the inspiratory muscles are capable of acting is greatest in individuals of the height of from 5 feet 7 inches to 5 feet 8 inches, and will elevate a column of three inches of mercury. Above this height the force decreases as the stature increases, so that the average of men of 6 feet can elevate only about 2½ inches of mercury. The force manifested in the strongest expiratory act is, on the average, one-third greater than that exercised in inspiration; but this difference is in great measure due to the power exerted by the elastic reaction of the walls of the chest, and it is also much influenced by the disproportionate strength which the expiratory muscles attain through being called into use for other purposes than that of simple expiration. The force of the inspiratory act is therefore better adapted than that of the expiratory for testing the muscular strength of the body.

"Much of the force exerted in inspiration is employed in overcoming the resistance offered by the elasticity of the walls of the chest and of the lungs. Mr. Hutchinson estimated the amount of this elastic resistance by observing the elevation of a column of mercury raised by the return of air forced, after death, into the lungs, in quantity equal to the known capacity of respiration during life; and he calculated that in a man capable of breathing 200 cubic inches of air, the muscular power expended upon the elasticity of the walls of the chest, in making the deepest inspiration, would be equal to the raising of at least 301 lbs. avoirdupois. In tranquil respiration, supposing the amount of breathing air to be 20 cubic inches, the resistance of the walls of the chest would be equal to lifting more than 200 lbs. The elastic force exerted in ordinary expiration must therefore be much greater than enough to lift this weight; because in it the elastic force of the lungs is also in action—a force which is not included in these estimates, because the lungs were in both cases burst by the air forced into them." (Kirkes and Paget, 'Handbook of Physiology.')

The changes of the air in the lungs effected by the respiratory movements are assisted by the air itself. It is a well-known fact that carbonic acid, although heavier than atmospheric air, is speedily diffused through it, according to the known laws of the diffusion of gases. There is no doubt that this law is in active operation during the respiratory changes, and that it assists the oxygen in passing into the lungs, and the carbonic acid in passing out. If it were not for this interchange the reserve and residual air would probably be injuriously charged with carbonic acid. It is also probable that the difference of temperature within and without the lungs assist in the interchange of the air.

The air which is taken into the lungs during respiration is the air of the atmosphere, which in round numbers consists of 21 of oxygen, and 79 of nitrogen in every 100 parts. A small proportion of carbonic acid exists in it, about 4 parts in 10,000. It also contains a varying quantity of watery vapour. The changes which occur in this air during respiration are—1. It contains a larger quantity of carbonic acid gas. 2. Its oxygen is diminished. 3. Its watery vapour is increased.

An easy proof of the existence of carbonic acid in the air expired from the lungs, is afforded by blowing through a tube into lime water, when the carbonic acid will unite with the lime, and carbonate of lime will be precipitated. The quantity of this gas which is calculated by Valentin and Brunner, as thrown out from the lungs in 24 hours, is 1345·3 cubic inches, or about 636 grains an hour. This would make about 173 grains of carbon in an hour, or 8 ounces in the 24 hours. Andral and Gavarret calculated the quantity at 9 ounces, and Mr. Coathupe at 5 ounces. Liebig gives 13 ounces as the quantity of carbon thrown off from both the skin and lungs.

The quantity of carbon however which is thrown out from the lungs varies under different circumstances. As is seen in the table above, sex and age make a considerable difference in the quantity of carbon expired.

Diet exercises a considerable influence on the quantity of carbon thrown out from the lungs. The following table exhibits the quantity of oxygen required by certain articles of diet to convert them into carbonic acid and water. It should always be recollected in relation to this subject, that although carbon is spoken of so frequently, that not only is carbon oxidated, but also hydrogen. Wherever hydrogen is present in the tissues, it sustains apparently the same relation to oxygen as carbon. Hence, in the calculation of the influence of diet on respiration it should never be left out:—

Substance.	Carbon.	Hydrogen.	Oxygen.	The quantity of Oxygen required for the formation of Carbonic Acid and Water in addition to the amount already present.
100 parts of Fat . .	78·13	11·74	10·13	292·14
,, Starch . .	44·45	6·17	49·38	118·52
,, Sugar (C_{12}, H_{12}, O_{12})	40·00	6·66	53·34	106·67
,, Malic Acid (C_4, H_2, O_4)	41·38	3·45	55·17	82·78
,, Albuminates	47·48	4·98	13·14	153·31
,, Collagen .	42·52	4·47	13·59	135·56
,, Muscular substance				
,, Muscular Fibrin and Collagen (Schmidt).	46·10	4·72	13·66	147·04

From this table it may be gathered that vegetable diet consumes more oxygen in the production of carbonic acid and water than animal diet. This is also found to hold good in the case of carnivorous and herbivorous animals—the latter taking up a larger quantity of oxygen than the former, as seen in the following result of an experiment by Regnault and Reiset:—

Species of Animal.	Food.	Proportion of 100 parts of absorbed oxygen which are given off to the carbonic acid.	For 1000 grammes' weight of the animal in one hour.		
			Consumed Oxygen.	Exhaled Carbonic acid.	Exhaled Nitrogen.
		Per Cent.	Grammes.	Grammes.	Grammes.
Dog . .	Meat . .	74·5	1·163	1·211	0·0078
Rabbit .	Carrots	91·9	0·883	1·116	0·0036

The same result is indicated by the following experiment on Birds:—

Animals.	Food.	Of 100 parts of absorbed oxygen there pass into the Carbonic Acid	For 1000 grammes' weight of the animal in one hour.		
			Consumed Oxygen.	Exhaled Carbonic Acid.	Exhaled Nitrogen.
	Oats.	Per Cent.	Grammes.	Grammes.	Grammes.
Hens . .	Abundantly	80·7	1·053	1·320	0·0079
Small Birds	Sparingly	75·3	11·473	11·879	0·1296

It has been found that the carbon and hydrogen of nitrogenous foods become oxidised, and are given out during respiration, but they do not supply sufficient for the wants of the system, and when animals are fed on nitrogenised foods, the fat is oxidised and converted into carbonic acid and water.

It appears to be now an established fact, that the imbibition of spirituous drinks of all kinds is attended by a diminished excretion of carbonic acid. This was indicated by Prout, and has since been confirmed by Vierordt and others. This shows the importance of such drinks in cases where the oxidating processes are proceeding too rapidly, and of their injurious tendency where these processes need to be stimulated. Dr. Prout observed that strong tea exercises the same influence on the system.

Sleep produces a very considerable diminution of the excretion of carbonic acid. Scharling found that the ratio of carbonic acid exhaled during sleep in one hour in the night, to that eliminated in one hour in the day after dinner, was as 31·39 to 40·74. A much greater difference is found between animals during their waking and hybernating states.

Bodily exercise increases the exhalation of carbonic acid, whilst rest diminishes it. Seguin, Prout, Vierordt, and Hoffman, have all proved this by experiment.

With regard to the quantity of oxygen consumed during respiration, it was at one time supposed to be exactly equal to the quantity found in the carbonic acid expired. This however is not the case, for accurate experiments show that, after all allowance made for oxygen present in the tissues, there is constantly a small quantity more taken into the lungs than is thrown out. The destination of this oxygen is undoubtedly to be found in the carbonic acid gas thrown out from the lungs, in the formation of the substances found in the bile and urine, and in the formation of phosphoric and sulphuric acids. The quantity of oxygen consumed is nevertheless measured by the carbonic acid thrown off from the lungs, so that, where there is an increase of excretion of carbonic acid, there is an increase of absorption of oxygen. It is an interesting fact that small animals consume a relatively much greater proportion of oxygen gas than larger ones. It is also a fact of practical importance, that the quantity of carbonic acid gas exhaled is not increased by increasing the quantity of oxygen in the atmosphere. As a proof of the necessity of the changes involved in the absorption of oxygen gas, it has been found that the eggs of birds, and undoubtedly this applies to the eggs of all animals, absorb oxygen and give out carbonic acid. The following table gives the result of some experiments of Valenciennes on this subject:—

In 1000 grammes' weight of Eggs.	From the 9th to the 12th day of Incubation.	From the 16th to the 19th day of Incubation.
	Grammes.	Grammes.
The loss of weight amounted to .	26·26	41·72
The absorbed oxygen . . .	5·74	10·70
The exhaled carbonic acid . .	4·33	11·92
The exhaled water . . .	2·88	3·66
The ratio of absorbed O to the O in CO_2	100 : 54·9	100 : 81·0

The nitrogen of the atmosphere appears to act as a diluent, and to temper the activity of the oxygen gas. Although when animals are placed in atmospheres of pure oxygen, or hydrogen, a certain quantity of nitrogen is thrown out from their lungs, it still requires proof that this has been taken up from the atmosphere. It is not improbable that a certain quantity of nitrogen may be thrown off by the decomposition of the nitrogenous tissues in the blood, or excretions.

With regard to the watery vapour which passes off from the lungs, it may be stated as a general rule that it is sufficient to saturate the expired air. Its absolute amount is therefore influenced by the following circumstances:—1, By the volume of air expired; 2, by the quantity of watery vapour contained in the air previous to its inspiration; 3, by the temperature of the expired air; 4, by the length of time which each volume of inspired air is allowed to remain in the lungs.

We have thus considered the principal physical and chemical phenomena presented during the respiration of animals. It should however be recollected that these phenomena are dependent for their existence on the influence of the nervous system. All the respiratory movements effected by the muscular tissues, as far as they are independent of the consciousness of the individual, are under the absolute governance of that part of the brain which is called the medulla oblongata. It is this portion of the nervous system which acts as the centre of all the impressions which convey the necessity of breathing, and which initiates all the motions which result in respiratory action. [Nervous System; Brain.]

(Kirkes and Paget, *Handbook of Physiology;* Lehmann, *Physiological Chemistry*, translated for the Cavendish Society by Dr. Day; Valentin, *Text-Book of Physiology*, translated by Dr. Brinton.)

REST-HARROW. [Ononis.]

RESTIA'CEÆ, *Cordleafs*, a natural order of Plants, principally inhabiting the southern hemisphere, and nearly related to *Cyperaceæ*. They abound at the Cape of Good Hope and in Australia, where they form a hard wiry rush-like herbage. They have not been found in America. They have in general a scaly creeping rhizoma, or rootstock; simple stems clothed with the sheaths of abortive leaves; and glumaceous flowers with a tolerably regular structure. The floral envelopes generally consist of 4 or 6 glumes in two rows. The stamens are 2 or 3; the ovary for the most part 2-3-celled, with a single ovule in each cell. The fruit is either a nut or a 3-celled seed-vessel; the seeds are pendulous, and the embryo is a small lenticular body lying within albumen at the end of the seed most remote from the hilum. In almost all cases the sexes are separate. The hard texture of some species renders them suited for thatch for houses, but they are of no other use. There are 23 genera and 171 species of this natural order.

RETE'PORA. [Polyzoa.]

RETI'FERA, a family of *Mollusca*.

RETINA. [Eye.]

RETINALITE, a Mineral, having a resinous appearance, found with and allied to Serpentine. It is found at Granville in Upper Canada. (Dana.)

RETINASPHALTUM. [Retinite.]

Restia tetraphylius. [Restiaceæ.]

1, the male: *a*, the stamens and abortive ovary; *b*, the same inclosed within the floral envelopes.

2, the female: *c*, the flower; *d*, the ovary with abortive stamens; *e*, a section of the ripe seed, showing the embryo.

RETINITE, a Mineral Resin. It occurs in roundish masses. Its colour is light yellowish brown, green, or red; lustre earthy or slightly resinous in the fracture. It is sub-transparent to opaque. Often flexible and elastic when first dug up, but loses these qualities on exposure. Its hardness is 1-2·5, and its specific gravity 1·135. It takes fire, and burns with a bright flame and fragrant odour. It is soluble in alcohol. It is found in the Bovey coal of Devonshire, and also in the brown coal of Wolchow in Moravia, and near Halle. (Dana, 'Mineralogy.')

REUSSITE, a Mineral, called also Soda Sulphate of Magnesia. It occurs in flat six-sided prisms, acicular crystals, and mealy efflorescences. Its colour is snow-white. Fracture conchoidal. Taste saline and bitter. It is found in the vicinity of Seidlitz and of Saidschutz in Bohemia. According to Reuss, it contains Sulphate of Soda, Sulphate of Magnesia, Muriate of Magnesia, and Sulphate of Lime.

RHAMNA'CEÆ, a natural order of Exogenous Plants, remarkable for having a valvate calyx, hooded petals, opposite to which their

Rhamnus Alaternus.

1, a flower about to expand; 2, a flower cut open to show the position of the stamens and petals; 3, a transverse section of a fruit, and seeds.

stamens are inserted into the tube of the calyx, and a superior or half inferior fruit which is either dry or fleshy. The species are found nearly all over the world, except in the arctic zone. The chief number of species is said to be dispersed through the hottest parts of the United States, south of Europe, north of Africa, Cape of Good Hope, and Australia. They are all shrubs, with small greenish or inconspicuous flowers.

The species which are best known in this country are the *Rhamnus frangula*, Alder; *R. catharticus*, Buckthorn; *Paliurus Australis*, Christ's Thorn; and Buckthorn, the evergeeen *Rhamnus Alaternus*. The useful species are of some importance:—*R. catharticus* and several others have purgative berries; *R. infectorius* yields the French berries of the shops employed for dyeing yellow; the fruit of the Jujube, *Zizyphus Jujube* and *Z. vulgaris*, is sub-acid and eatable, and the species are cultivated for it in the south of Europe and the temperate parts of Asia; *Z. Lotus* gave its name to the Lotophagi, or Lote-Eaters, of Africa; and *Rhamnus frangula* is extensively cultivated for the manufacture of charcoal. *Ceanothus Americanus* yields the New Jersey Tea. [Ceanothus; Hovinia; Paliurus; Rhamnus.]

RHAMNUS (the word is Greek, 'Ράμνος), a widely diffused genus of Plants, the type of the natural family *Rhamnaceæ*. It is chiefly found in the temperate parts of Europe, in Siberia, and in the Himalayas at elevations of 6500 feet; also in the New World, and at the Cape of Good Hope.

The genus is characterised by having an urceolate 4-5-cleft calyx; petals wanting, or emarginate; anthers ovate, 2-celled; disc thin, overspreading the tube of the calyx; ovary superior, 3-4-celled; styles 3 or 4, distinct or united; fruit fleshy, with 3 or 4, or in consequence of abortion, 2 fibrous indehiscent stones.

R. catharticus (called also *Spina cervina*, hence Buckthorn), an indigenous shrub, with opposite branches, spreading, straight, round, smooth, hard, and rigid, each terminating in a strong spine after the first year. Leaves deciduous, bright green, smooth, ribbed, the young ones downy. Flowers yellowish green, on the last year's branches numerous; the fertile ones with narrow petals, rudiments of stamens, and a deeply 4-cleft style; barren ones with an abortive ovary, and broader petals. It flowers in May, ripening its berries in September, at which time they are collected. The berries are about the size of a peppercorn, black externally, but within of a deep violet, the pulp inclosing three or four seeds. The taste is nauseous and repulsive at last, though at first sweetish and only bitter. They contain a peculiar extractive, a colouring principle, acetic acid, and gum. The fresh and dried berries, the expressed juice, or a syrup prepared from them, all possess purgative properties, exemplified in that form which has led to the designation 'hydragogue.' Its action is attended with much sickness, griping, and thirst. It should be restricted to the arts, in which it is serviceable, being the source of the pigment called Sap-Green or Bladder-Green. [Buckthorn, in Arts and Sc. Div.]

R. frangula, Alder Buckthorn, has alternate branches and elliptical acuminate leaves. It is a native of the British Islands.

R. infectorius is a dwarf shrub found in wild places in the south of Europe among rocks. The fruit is purgative, and contains also a colouring principle, for which it is sold under the name of French Berries. *R. saxatilis*, *R. amygdalinus*, and *R. oleoides* have similar properties.

RHÆTIZITE, a Mineral, a form of *Kyanite*. [Kyanite.]

RHAMPHASTIDÆ. [Ramphastidæ.]

RHATANY. [Krameria.]

RHEA. [Struthionidæ.]

RHEE BOC. [Antilopes.]

RHENITE, a Mineral, a Hydrous Phosphate of Copper. It occurs crystallised and massive. Its primary form is an oblique rhombic prism. Cleavage indistinct, parallel to the horizontal diagonal. Colour blackish green, and green of various shades; streak light green. Its fracture is uneven. Hardness 5·0. Lustre vitreous. Translucent, opaque. Specific gravity 4·2 to 4·3. It is found at Rheinbreitenbach, near Bonn, on the Rhine.

Its analysis by Lynn gives—

Phosphoric Acid	21·687
Oxide of Copper	62·847
Water	15·454
	99·988

RHESUS MONKEY. [Macacus.]

RHEUM, a genus of Plants belonging to the natural order *Polygonaceæ*, of which the name is taken from the 'Ρέον of Dioscorides, and which includes the different species of plants which yield the stalks and root so well known by the name of Rhubarb. It is doubted by some whether the root to which the name 'rha' and 'rheon' was applied by the Greeks was the same as that to which we now apply the name of rhubarb, because the descriptions of the former given by Dioscorides and Pliny do not apply to the latter. It is admitted however that our rhubarb was known to the later Greek physicians, as Alexander of Tralles and Paulus of Ægina, and there is no doubt that the Arabs were well acquainted with it; and it is remarkable that they quote 'rheon' as the Greek synonyme of their 'rawund,' which is rhubarb, and which they describe as being of various kinds, as Indian, Turkish, Chinese, and from Khorassan. From this it is probable that one kind may have become substituted for another as the communication with the east increased.

Long as the Rhubarb root has been known, it is remarkable that the species of *Rheum* yielding it is yet unknown; this is in consequence of the best rhubarb, Turkey rhubarb, being only obtained by the Russians at Kiachta from the Chinese. That called Chinese may be the produce of the same, or of a different species, from the northern boundaries of that country. Dr. Royle, after reviewing the different accounts of the commerce of rhubarb, states:—"This would bring the rhubarb country within 95° of E. long., in 35° of N. lat., that is, into the heart of Tibet. As no naturalist has visited this part, and neither seeds nor plants have been obtained thence, it is as yet unknown what species yields this rhubarb." Sievers had previously said that his travels had satisfied him that as yet nobody, that is, no scientific person, has seen the true rhubarb plant. The Himalayan and Persian rhubarbs have alone been ascertained.

The different species of rhubarb are important plants, not only on account of the roots being so extensively employed, and so valuable for their medicinal qualities, but also on account of the stalks of the leaves being now so much employed, from their agreeable acidity, in making tarts, &c. As the species are all indigenous in cold parts of the world, that is, from the southern parts of Russia, Siberia, Tibet, the north of China, and the Himalayas, so they may all be grown in the open air of this country, and several are cultivated on account of their stalks. Some also, both in England and France, are cultivated on account of their roots, often for the purpose of adulteration.

The genus *Rheum* is characterised by having an inferior petaloid sexpartite calyx, into the bottom of which the stamens, about nine in number, are inserted; anthers opening lengthwise; ovary superior, with a single erect ovule; styles three, reflexed; stigmas peltate, entire; fruit (achenium) 3-cornered, winged, with the withered calyx at the base.

The species which are known and cultivated are the following:—

R. Emodi, Wallich, *R. australe* of Don, is found in Kumaon. The root is a valuable medicine, though bearing hardly any resemblance to that of the shops. Stems much branched, six to ten feet high, very thick below, gradually diminishing, and spreading into large panicles, and there rough, with minute warts. Leaves very large, cordate, acute, dull-green, but little wavy, very rough, covered with little hairs. Petioles very rough, furrowed, and very much narrower at the upper than the lower end. Panicles terminal, very long. Flowers blood-red, very small.

R. Webbianum, Royle, 'Illust.,' t. 99; *R. Emodi* of Meisner, found by Mr. Moorcroft at the height of 12,000 feet above the level of the sea, and by Dr. Royle on the Choor Mountain. Root-leaves large, long-stalked, rather downy above, veiny beneath, margin hairy. Axillary racemes clustered, terminal, panicled; pedicels in threes, twice as short as the ripe fruit.

R. spiciforme, Royle, 'Illust.,' t. 78, found on the northern face of the Himalayas. Leaves thick, leathery, cordate, blunt, red and netted beneath, and covered with stellate down on each side. Pedicels numerous, clustered, as long as the ripe fruit. The roots are lighter coloured and more compact than those of *R. Emodi*.

R. Moorcroftianum (Royle), Small-Stalked Rhubarb. Leaves and stems covered with short pubescence; petioles deeply furrowed; the stipules as long as the petioles, and very membranous; scales at the base yet longer, extremely thin, and towards the summits much torn. This species was found by Messrs. Moorcroft and Hearsay near the Niti Pass in the Himalayas, at an elevation of 12,000 feet.

R. leucorhizum, Pall. (*R. nanum*, Sievers; *R. tataricum*, Linn.). A small plant for the genus; the root is white and branched, though said to be equally efficacious with the best sorts. Radicle leaves about three, short stalked, from four to six inches long, and from five to nine inches broad; smooth on both sides, toothletted at the edge. Flowering stem about two inches high when in flower, afterwards becoming ten to twelve inches high.

R. rhaponticum, Linn.; north of the Caspian. According to Guibour, cultivated largely near Lorient, in the department of Morbihan in France, at a place called from that circumstance Rheumpole. Leaves roundish, ovate, cordate, obtuse, but little wavy, very concave, even, very slightly downy on the under side. Panicles very compact and short, always rounded at the ends, and never lax. *R. rhaponticum*, *R. hybridum*, *R. compactum*, and hybrid varieties of them, are the common garden rhubarbs.

R. undulatum, Linn. (*R. rhubarbarum*, Linn.); China and Siberia. Leaves oval, obtuse, deep-green, with veins purple at the base, often shorter than the petiole, downy on each side when young, looking as if frosted. Petiole downy, blood-red, semi-cylindrical.

R. Caspicum, Fischer (*R. rhaponticum*, Ledbour); In the Altai Mountains. Leaves ovate, acuminate, obtuse, cordate, inflexed at the base, thick, very wavy, glossy on the upper but slightly downy on the under side. Petiole pale green, minutely downy.

R. compactum, Linn.; Tartary and China. Leaves heart-shaped, obtuse, very wavy, deep-green, thick, quite smooth on both sides, glossy on the upper. Sinus nearly closed with parenchyma. Petiole green.

R. crassivernium, Fischer. Leaves heart-shaped, acuminate, obtuse, wavy, bullate, deep-green, quite smooth, rather glossy above; ribs

slightly coloured red. the centre ones above half an inch deep at the base. Petiole dull red. rounded, rather angular.

R. palmatum, Linn., generally thought to be the source of the true officinal rhubarb; near the great wall of China. Leaves roundish, cordate, half palmate; the lobes pinnatifid, acuminate, deep dull-green, not wavy, but uneven and very much wrinkled on the upper side, hardly scabrous at the edge, downy on the under side. The flowering stems are taller than those of any other species.

R. Ribes seems to be so named from the Persian name Ribas, which is as frequently written Rewash, and which Elphinstone, Burnes, and other travellers notice as being highly esteemed by the Persians, and of which the stalks are prepared in a variety of ways, and considered a great delicacy.

(Royle, *Illustr. Himal. Bot.*; Lindley, *Flora Medica*; Pereira, *Elements of Materia Medica.*)

RHEXIA. [MELASTOMACEÆ.]

RHINACANTHUS (from ῥίν, a snout, and ἄκανθα, a thorn), a genus of Plants belonging to the natural order *Acanthaceæ*. It has a regularly 5-parted calyx with small subulate bracts and bractlets; a hypocrateriform 2-lipped corolla, with a long slender tube, the upper lip narrow, the lower trifid, with equal segments; 2 stamens inserted in the throat of the corolla, the anthers 2-celled, awnless, with one cell placed above the other almost in a line; a clavate capsule much compressed at the base, with the commissure of the valves in contact and seedless; the upper part 4-seeded, or by abortion 2-seeded; the dissepiment complete, adnate; the seeds ovate, bi-convex, augmented with hooks which are concave and obtuse.

R. communis is a native of the continent of India, with opposite stalked broad-lanceolate obtuse leaves, above smooth, below a little downy, entire, from two to four inches long and from one to two inches broad, and a fleshy ring surrounding the base of the ovary. The roots of this plant are boiled in milk, and are reckoned by the natives of India an aphrodisiac. In conjunction with lime-juice and pepper they are used as an external application for ringworm.

(Lindley, *Flora Medica.*)

RHINANTHUS (from ῥίν, a snout, and ἄνθος, a flower). a genus of Plants belonging to the natural order *Scrophulariaceæ* of Jussieu, and the type of the order *Rhinanthaceæ* of De Candolle. It has a compressed membranous inflated 4-toothed calyx; the superior lip of the corolla galeate, compressed, bidentate at the apex, the lower one spreading, 3-lobed; the anthers bipartite, mutic, villous; the capsule 2-celled, obtuse, compressed; the seeds compressed, marginate, or girded by a membranous wing. The species are annual plants, inhabiting marshes and confined in their geographical distribution to Europe.

R. Crista Galli, Cockscomb, or Common Yellow Rattle, has oblong-lanceolate serrate leaves; the flowers in lax spikes, the calyx glabrous, the lobes of the upper lip of the corolla short, roundish, the bracts ovate inciso-serrate, the seeds with a broad membranous border. This plant has the name of Yellow Rattle from the colour of its flowers, and the rattling noise made by the seeds in the capsule when ripe. On this account the fruits are called rattle-boxes in Ireland. In some parts of England this plant is known by the name of Penny-Grass, and in Yorkshire it is called Henpenny, from the seed-vessels resembling in shape and size a silver penny. The term Cockscomb has been applied to this plant from the fringed appearance of the bracts which surround the flowers. The seeds of a species of *Rhinanthus* were at one time used in infusion for destroying vermin in bedsteads and furniture.

R. major has linear-lanceolate serrate leaves; the flowers in crowded spikes, the calyx glabrous, the lobes of the upper lip of the corolla oblong, the bracts inciso-serrate, with an attenuated point, the seeds with a very narrow membranous border. This is the plant of British botanists, but the *R. major* of Koch and Reichenbach has a broad membranous margin to the seed, and the central part of the upper lip of the corolla as prominent as the lateral lobes. This plant is found in meadows and corn-fields in the North of England, and also in Scotland.

Several other species of this genus have been described. Koch, in his 'Flora Germanica,' has five—*R. minor*, the *R. Crista Galli* above described, *R. major*, *R. alectorolophus*, *R. angustifolius*, and *R. alpinus.*

(Don, *Dichlamydeous Plants*; Babington, *Manual of British Botany.*)

RHINOBATIDÆ. [RAIIDÆ.]

RHINOCARPOS, a genus of plants.

RHINO'CEROS (the Greek Ῥινοκέρως), the name of a genus of Pachydermatous Quadrupeds, placed by Linnæus in his order *Bruta*; and by Illiger in his order *Multungula*, family *Nasicornia*. It has been a question whether one of the species, *Rhinoceros unicornis*, Linn. (*R. Indicus*, Cuv. and Desm.) is not the ראם (Reem), or ריש (Rem), of Scripture (Numb. xxiii. 22; xxiv. 8; Deut., xxxiii. 17; Job, xxxix. 9, 10; Psalms, xxii. 21; xxix. 6; xcii. 10; Isaiah, xxxiv. 7).

In the Septuagint the word is translated Μονοκέρως, or Unicorn, except in Isaiah, where it is rendered Ἄβροι (or the mighty or powerful ones).

In the Tigurine and Vulgate versions the word is rendered (Numb., xxiii. 22; Job, xxxix. 9, 15) Rhinoceros, with a note to the former, that others read Monoceros; and in Scheuchzer's 'Physica Sacra' we have (Tab. 313) Numb., xxiii. 22, illustrated by a somewhat extravagant and exaggerated figure of a one-horned Rhinoceros, with "Reem: Rhinoceros" below the plate.

In the Bible "Imprinted at London by Robert Barker, Printer to the King's most excellent Maiestie" ('Breeches' Bible), the word used is 'Unicorne;' and 'Unicorn' is the expression in the version now in use in our churches.

Some are of opinion that the Reem, or Reïm, of Scripture were savage animals of the Bovine genus, and others that the word signified the Oryx, observing that Reem is the Arabian name for a species of wild-goat or gazelle. These allege that the Reem was two-horned. (Deut. xxxiii. 17; Psalms, xxii. 21.) The better opinion seems to be that the animal or animals intended to be designated in most of the passages quoted, if not in all, was or were the *Rhinoceros unicornis*, or Great Asiatic one-horned Rhinoceros. M. Lesson expresses a decided opinion to this effect; and indeed the description in Job (chap. xxxix.) would almost forbid the conclusion that any animal was in the writer's mind except one of surpassing bulk and indomitable strength.

It has also been doubted whether accounts of the Indian Ὄνοι ἄγριοι (Wild Asses) given by Ctesias ('Indic.,' ed Bähr) were not highly coloured and exaggerated descriptions of animals of this genus, and whether the Ὄνος Ἰνδικός (Indian Ass) of Aristotle was not a Rhinoceros.

The account of Ctesias is evidently tinged with fable; but there are parts of it which suit well with the habits of a Rhinoceros. He describes his Wild Asses as being as large as horses, and larger, with white bodies, red heads (πορφυροῖ), and blue eyes (κυανέους), having a horn on the forehead a cubit long, which for the extent of two palms (παλαιστάς) from the forehead is entirely white; above it is pointed and red (φοινικοῦν ἐρυθρὸν πάνυ), and black in the middle. Of this horn drinking-cups are formed, and those who use them are said not to be subject to spasm (σπασμῷ) nor epilepsy (ἱερᾷ νόσῳ), nor to the effects of poison, provided, either before or after taking the poison, they drink out of them wine or water or any other liquid. Other asses, whether wild or domesticated, have no astragalus, neither have the other wild solipedes (μόνυχα); but these have an astragalus and a gall-bladder (?) (χολὴ ἐπὶ τοῦ ἥπατος). "Their astragalus," adds Ctesias, "which I have seen, is very beautifully formed (κάλλιστον), in figure and size like that of an ox, heavy as lead, and red throughout like cinnabar. This animal is very swift and very strong. Neither a horse nor any other pursuer can overtake it. It begins its progress slowly, increasing in speed as it goes on, and runs quicker and faster. They are not naturally ferocious, but when they first lead forth their little young ones to grase, and are surrounded by many horsemen, they are unwilling to fly and leave their young, but fight with horns and heels (λακτίσμασι) and teeth (δήγμασι), killing many horses and men. They are also destroyed by arrows and javelins, for they are not to be taken alive. The flesh is not eatable by reason of its bitterness, but the animals are hunted for the sake of the horns and astragali."

It is not at all improbable that these parts, so much sought after on account of supposed virtues, underwent some process by which they were artificially coloured in the manner above described.

Aristotle, who (lib. viii. c. 28) speaks of Ctesias as not being worthy of credit, notices (lib. ii. c. 1) the Ἰνδικὸν ὄνον (Indian Ass). He observes that he has never seen a one-horned solidungulous animal; but there are a few which are monoceratous and solidungulous, such as the One-Horned Indian Ass (Ἰνδικὸν ὄνον μονόκερων), and that it is the only one of the solidungulous animals which has an astragalus.

Agatharchides describes the One-Horned Rhinoceros by name, and speaks of its ripping up the belly of the Elephant. ('Phot. Bibl.,' cel.) This is probably the earliest occurrence of the name Rhinoceros.

The Rhinoceros which figured in the celebrated pompa of Ptolemy Philadelphus was an Ethiopian, and seems to have marched last in the procession of wild animals, probably on account of its superior rarity, immediately after the camelopard, and before the wain carrying Bacchus fleeing to the altar of Rhea from the persecution of Juno. (Athenæus 'Deipn.,' v. c. xxxii.)

Dion Cassius (lib. li.) speaks of the rhinoceros killed in the circus with a hippopotamus in the show given by Augustus to celebrate his victory over Cleopatra; and says that the hippopotamus and this animal were then first seen and killed at Rome. If the rhinoceros was one-horned, as it appears to have been from his description, he was certainly wrong as to the sight at least; for Pliny ('Hist. Nat.,' viii. 19), alluding to the games of Pompey the Great, remarks, "Iisdem ludis et rhinoceros unius in nare cornu, qualis sæpe visus;" and probably equally wrong as to the killing, for upon great occasions few animals left the arena alive, and Pompey was not likely to have risked his popularity by baulking the Roman appetite for blood. It is not improbable that the rhinoceros slain upon the occasion of the victory of Augustus with the hippopotamus was African, and two-horned. If so, Dion would be right; for it does not appear that a two-horned rhinoceros had ever been either seen or slain previously.

The rhinoceros so clearly described by Strabo (lib. xvi. p. 774), as seen by him, was one-horned. The folds of the skin are distinctly alluded to. That noticed by Pausanias (lib. ix. c. 12) as 'the Bull of Ethiopia' was two-horned, and he describes the relative position of the horns.

Mr. Wood ('Zoography') gives an engraving of the coin of Domitian (small Roman brass), on the reverse of which is the distinct form of a two-horned rhinoceros—that coin which, with the epigram of Martial, has so puzzled antiquaries, and led some of them astray, when a very little knowledge of natural history would have kept them in the right road.

"The exhibition of the Two-Horned Rhinoceros to the Roman people, probably of the very same animal represented on the coin," says Mr. Wood, "is particularly described in one of the epigrams attributed to Martial ('De Spectaculis Libellus,' 'Ep.,' xxii.), who lived in the reigns of Titus and Domitian."

The following are the lines:—

"Sollicitant pavidi dum rhinocerota magistri,
Sæpe diu magnus colligit ira ferus.
Desperabantur promissi prælia Martis:
Sed tamen is rediit cognitus ante furor,
Namque gravem *gemino cornu* sic extulit ursum,
Jactat ut impositus taurus in astra pilas."

"By this description it appears that a combat between a rhinoceros and a bear was intended, but that it was very difficult to irritate the more unwieldy animal, so as to make him display his usual ferocity; at length however he tossed the bear from his double horn, with as much facility as a bull tosses to the sky the bundles placed for the purpose of enraging him. Thus far the coin and the epigram perfectly agree as to the existence of the double horn; but unfortunately commentators and antiquaries would not be convinced that a rhinoceros could have more than one horn, and have at once displayed their sagacity and incredulity in their explanations on the subject. Hence we find a similar coin engraved in the second volume of Cooke's 'Medallic History of Rome,' where the animal is misrepresented, and particularly the horns, which appear like tusks, bending in different directions. After quoting the lines of Martial, Mr. Cooke observes, that it is the opinion of Bochart that the disputed line should be read thus—

"Namque gravi geminum cornu sic extulit ursum."

By which alteration we should have two bears instead of one;* but Mr. Cooke proposes to omit only one letter, the *s* in the word 'ursum,' by which means he turns the bear into a wild bull; and as it is perfectly natural that the wild bull, or urus, should have two horns, he translates the line thus—

"Struck with amazement, we beheld upborne
The buffal dreadful with his double horn."

If Cooke had seen the coin himself, or had consulted that book so useful to a medallist, the 'Catalogue of Dr. Mead's Coins,' he would not have deprived the epigram of its original and curious information."

Two at least of these two-horned rhinoceroses were shown at Rome in the reign of Domitian.

The emperors Antoninus, Heliogabalus, and Gordian, also exhibited rhinoceroses, and Captain W. H. Smyth, R.N., noticing a coin of the emperor Philip (large brass), speaks of a noble lion on the reverse as representing one of the *Leones Mansueti* mentioned by Capitolinus. "It seems," says Captain Smyth, speaking of the 'Seculares Augustorum' (the legend on the reverse), "that there were provided no fewer than 32 elephants, 10 tigers, 10 elks, 60 lions, 30 leopards, 1 hippopotamus, 1 rhinoceros, 40 wild horses, 20 wild asses, and 10 cameleopards, with a vast quantity of deer, goats, antelopes, and other beasts; and, still further to increase the public hilarity, 2000 gladiators were matched in mortal affray." ('Descriptive Catalogue of a Cabinet of Roman Imperial large Brass Medals.')

Cosmas speaks expresely of the Ethiopian Rhinoceros as having two horns, and of its power of moving them.

The first rhinoceros seen by modern Europeans appears to have been a *Rhinoceros unicornis* (Linn.), sent from India to Emmanuel, king of Portugal, in 1513. Emmanuel sent it as a present to the Pope, but the animal in an excess of fury sunk the vessel on its passage. A sketch of the animal was sent from Lisbon to Nürnberg for Albert Dürer, who engraved the extravagant figure from which those of Gesner, Aldrovandi, Jonston, and Scheuchzer were taken. Among other monstrosities, the animal, which is represented as if it were clad in offensive and defensive armour, has a second small horn projecting from the top of the shoulders. A reduced copy of the same figure is given in the early edition of Petiver. In 1656 we find in the 'Catalogue of the Museum Tradescantianum' (sec. ii., 'Four-Footed Beasts, with some Hides, Hornes, Hoofs')—

"The Rhinoceros . { horn. / jaw-bone. / back-bone."

In 1685 one was brought alive to England; another was shown throughout a great part of Europe in 1739; and a fourth, a female, in 1741. The Rhinoceros of 1739 was described and figured by Parsons ('Phil. Trans.,' xlii.), and he also mentions that of 1741, which animal Cuvier believes to be the same that was shown at Paris in 1749, painted by Oudri, and afterwards engraved by Edwards ('Gleanings'), and that figured by Albinus. It was certainly that described by Daubenton, and the subject of the observations of Meckel. The Rhinoceros whose osteology is described by Cuvier was the fifth that had come to Europe. It arrived at Versailles in 1771, being then very young, and Buffon notices it in his supplement. This animal died in 1793, at the age of 25 or 26. In 1790 a rhinoceros was brought from the East Indies to this country as a present to Mr. Dundas, who gave the animal away. It was afterwards purchased by Pidcock for 700*l.*, and was exhibited at Exeter Change and about the country. A seventh, very young, destined, it is said, for the menagerie of the emperor of Germany, arrived from the East Indies in 1800, and died in London soon after its arrival. This animal was dissected by Mr. Thomas, who published his observations in the 'Philosophical Transactions.' An eighth, which afterwards went to Germany, was seen at Paris some years afterwards. All these were one-horned. Of late years several of the same species (*R. Indicus*) have arrived in London. One of these, a fine healthy animal, is now living in the Zoological Gardens in the Regent's Park.

No two-horned rhinoceros seems to have been brought alive to Europe in modern times.

The bony framework of the animal of this genus approximates to that of the *Hyrax*, the Tapirs, and the Horse among living genera. Though a general resemblance pervades the entire skeleton of the animals of this genus, there are certain differences, in the skull especially, which render it advisable to notice certain of the species separately with regard to their osseous structure. All the species have seven molar teeth on each side, both in the upper and under jaw, but the species differ as to the incisors. The following is the dental formula of *R. Indicus* (*R. unicornis*, Linn.):—

$$\text{Incisors, } \frac{4}{4}\text{; Canines, 0; Molars, } \frac{7-7}{7-7} = 36.$$

The pyramidal elevation of the cranium is the first point that strikes the observer on viewing the skull of the *R. Indicus*. The next remarkable parts are the ossa nasi, which are of a size and thickness without example among quadrupeds: these form an arch or vault, which overhangs what may be termed the incisive bones, and gives support to the horn, forming, with the parts of the maxillary bones which carry the incisives, the great nasal notch which distinguishes the skull of these animals. Hence three pair of bones—the nasal, the incisive, and the maxillary—contribute in the Rhinoceros to form the contour of the external apertures of the nostrils; whilst, with the exception of the Tapir, the two first only are employed for this purpose in the other quadrupeds. The form of the molar teeth varies but little from that which characterises those of other species. The upper incisors are very much compressed, and placed obliquely at a very considerable angle; the lower incisors are large, pyramidal, and pointed, and between them are two very little incisors, which are supposed never, or hardly ever, to cut the gum. There are also two little incisors on each side of the two upper great ones; but these are, on the contrary, on the outside of the large incisor teeth. The form of the lower incisor teeth reminds the observer of the instrument generally used by husbandmen for extracting docks (*Rumex*) from their pastures, and they appear to be calculated for uprooting plants, as well as tearing or stripping up branches or stems of shrubs or trees. In the case of uprooting, the nipper-like operation of the two great upper incisors, as opposed to the lower ones, would materially assist the extraction.

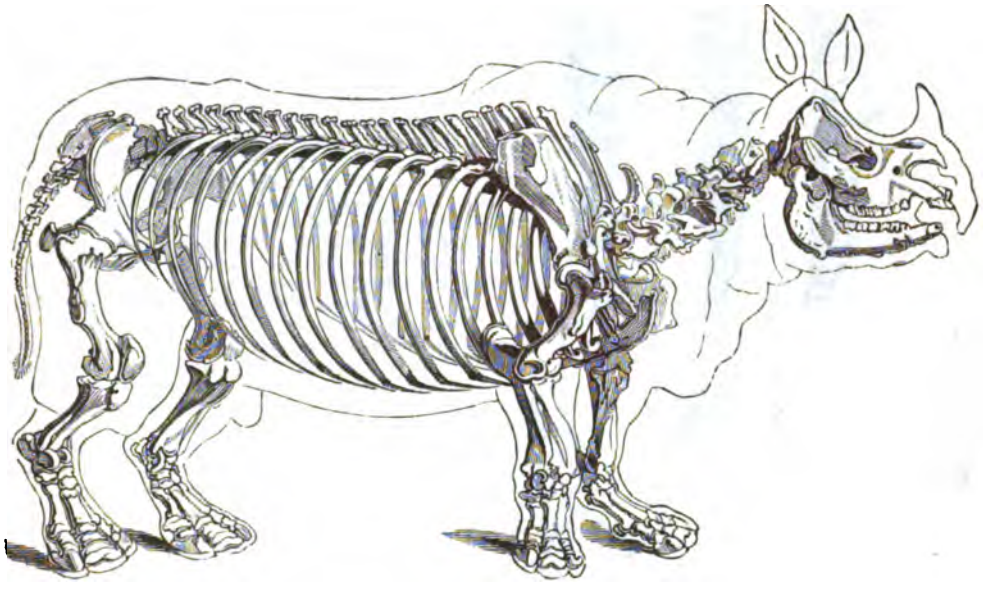
The number of molar teeth on each side often varies in different individuals, though there are never more than 28.

There are 56 vertebræ in all—7 cervical, 19 dorsal, 3 lumbar, 5 sacral, and 22 coccygian. The transverse apophyses of the atlas are very great and very wide, and without obliquity, so that their contour is nearly rectangular, which distinguishes them from those of the Hippopotamus; their extreme size distinguishes the atlas of the Rhinoceros from that of the Elephant still more clearly. The spinous process is only a large tubercle, and below the body of the vertebra is a small longitudinal crest. There are 19 pairs of ribs, 7 of which are true; they are easily recognised by their proportional thickness and the great arch formed by their curvature. The first pair are soldered together below. The sternum in the adult is composed of four bones; the first is compressed into a ploughshare-shape, and projects in a point in front of the first rib.

Of the anterior extremities the following parts are remarkable:—The scapula is oblong; its greatest width is at its upper fourth; its posterior border is elevated and thickened at this point. The crest has a very projecting apophysis at its upper third, directed a little backwards; this crest terminates at the lower fourth of the scapula, and consequently there is no acromion; a tuberosity occupies the place of a coracoid process, and the glenoid cavity is nearly round. This configuration distinguishes the scapula or blade-bone of the Rhinoceros from that of other great quadrupeds; that of the Elephant, for example, forms a nearly equilateral triangle, and the spine a great recurrent apophysis. The widely-crested humerus is very remarkable, and distinguishable from that of every other quadruped of the same size, but the carpus is formed after the same model as that of the Tapir and the Horse; though the Rhinoceros and the Tapir resemble each other more than they respectively

* And also a piece of bad Latin.

resemble the Horse in this part of the skeleton. The anterior face of the semilunar bone is square, and not pointed above, as in the Hippopotamus. None of the bones of the anterior extremities are liable to be confounded with those of animals of the same size; and though their greatest resemblance is to those of the Tapir, the smallness of those of the latter makes a sufficient distinction.

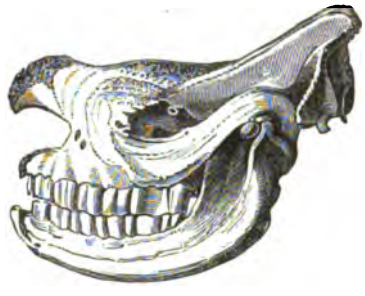


Skeleton of *Rhinoceros Indicus*.

The posterior extremities present the following remarkable parts:—The pelvis is extremely wide, and that of the elephant alone among living quadrupeds resembles it; but the pelvis of the Rhinoceros is at once distinguished by its forked spine. The angle of the os ilium, which reaches the sacrum, is besides more elevated, and its neck much longer and narrower. The external edge of this bone is nearly as great as the internal, whilst in the Elephant it is much smaller. The crest of the pubis commences from the top of the ossa ilii. The oval holes are wider than they are long. The tuberosity of the ischium is very large above, and in the form of a hook. The femur is if anything more remarkable than the humerus; its upper part is extremely flattened from before backwards; the eminence which Cuvier calls the third trochanter projects extremely, and forms a hook, which ascends to touch a hook descending from the ordinary grand trochanter, so that there is an oval hole between these two eminences. The tibia, fibula, tarsus, and the upper part of the metatarsus are constructed upon the plan of those of the Horse; but the pulley of the astragalus is wider, more oblique, less deep, and its posterior internal angle is obliquely truncated; the astragalus touches the cuboid bone by a rather wide surface; the scaphoid and the third cuneiform bones are less flattened; the second cuneiform and the cuboid larger. In these points the Rhinoceros resembles the Tapir more than the Horse, and indeed were it not for size would be hardly distinguishable from the former; but it differs from both in having a larger and stouter calcaneum. Its anterior or astragalian surface is triangular. The astragalus has two large facets; that of the inside is prolonged into a tail-like process all along the lower edge of this surface, as in the Tapir. In the Horse the third facet towards the external angle is distinct. The facet, which touches the cuboid bone, is very small. The cuboid bone has a large and long protuberance behind, which does not exist in the Horse. On the inside of the foot is a similar one, produced by a supernumerary bone attached to the scaphoid, the internal cuneiform, and the internal metatarsial bones, which represent at once the first cuneiform and the thumb in its entirety. This bone exists only in the Tapir and in the Horse; but in the latter it is promptly soldered to the second cuneiform bone. The scaphoid bone then has three articular facets on its inferior or rather metatarsial face; the third cuneiform or internal bone is much smaller than the other. The phalanges are all wider than they are long; the second phalanx of the middle toe is especially short. The last are channelled like those of the hoof of a horse. (Cuv.)

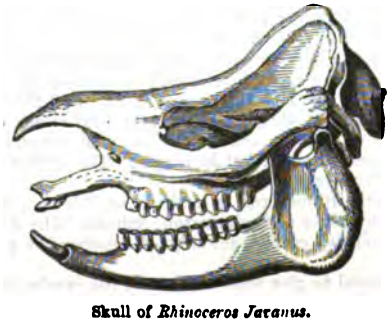
The osteology of the various species of *Rhinoceros* differs very considerably. The following differences appear on examining the skull of the two-horned species of the Cape:—1. On its upper surface the horisontal contour of the bones of the nose is rounded in the Cape species, and almost extravagantly so in *R. simus*, whilst in the one-horned species it is pointed. 2. The principal differences in the profile relate to the form of the incisive bones, which in *R. Indicus* advance as far as the bones of the nose, and have above a particular apophysis: in *R. Africanus* and *R. simus* the incisive bones are each reduced to a small oblong piece. 3. On the lower surface, besides the differences which result from the form of the zygomatic arches, the direction of the occipital crest, and that which the difference of the incisive bones produces on the front of the palate, it may be observed that the series of molars is longer in *R. Africanus* and *R. simus*, and that it converges anteriorly with that of the opposite side. 4. The posterior surface is demi-elliptical, and higher than it is wide in *R. Indicus*, and rather wider than it is high in *R. Africanus* and *R. simus*, in which last the occipital foramen is wider than it is high, whilst in *R. Indicus* those proportions are reversed.

The principal differences of the lower jaws are (besides the length which precedes the molars, which is much less in *R. Africanus* and *R. simus* than in *R. Indicus*), 1st, that the series of molars is longer in the African species; 2nd, that the rising branches are much less high; 3rd, that the coronoid apophyses are much shorter, less pointed, and less directed forwards; 4th, that the dental branches are much more convex externally.

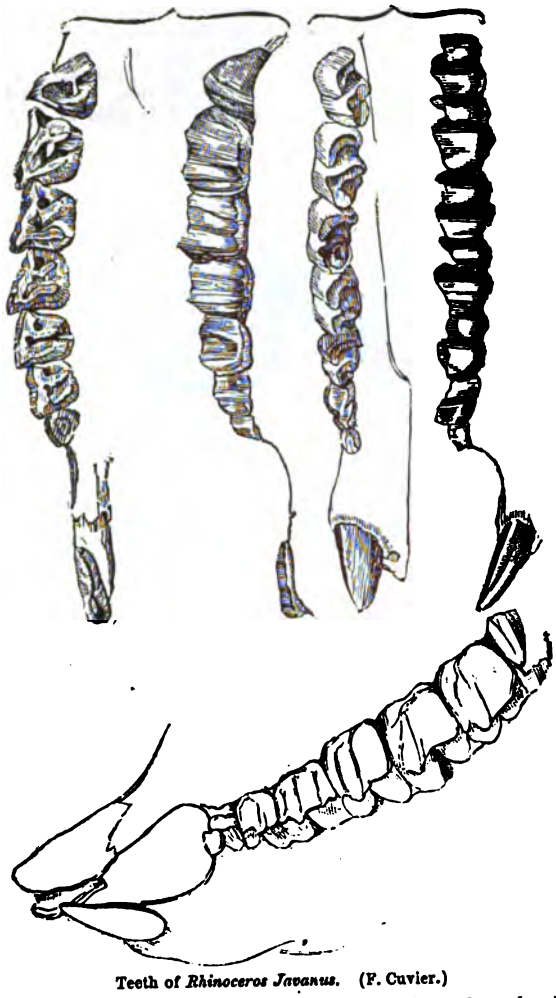


Skull of *Rhinoceros bicornis*.

The One-Horned Rhinoceros of Java (*R. Javanus*) resembles less, in the bones of the extremities, the *R. Indicus*, than does the *R. Africanus*; which, as Cuvier observes, is remarkable. But in the skull the resemblance to that of *R. Indicus* is striking, though there are still remarkable differences. The whole cranium, for instance, is less, and the zygomatic arches, the orbits, and the nasal bones, which terminate in a sharp point, are less developed. The post-orbital



Skull of *Rhinoceros Javanus*.



Teeth of *Rhinoceros Javanus*. (F. Cuvier.)

apophysis can hardly be traced. The occipital crest is less elevated; there is no apophysis on the superior edge of the incisive bones; the orbit has a more forward position; the posterior base of the zygomatic arch is less approximated to the occiput; the region of the external opening of the ear is wider; the descending part of the occipital arch, which is trenchant in *R. Indicus*, is here stout and obtuse. The posterior surface of the skull of *R. Javanus* is wider than it is high: in *R. Indicus* it is just the reverse; and the same difference exists in the dimensions of the occipital hole.

The osteology of this genus can be well studied in the museum of the Royal College of Surgeons of England, where there is a skeleton of the Sumatran two-horned species, and a fine collection of separate portions of the osseous system of the teeth and the horns of these animals.

The stomach of these animals is simple; their intestines are very long, and the cæcum is very large. Sparrman, who dissected a Cape Two-Horned Rhinoceros as well as his position and his Hottentot assistants would permit, remarks that the viscera most resemble those of a horse; though the stomach did not in the least resemble that of a horse, but rather that of a man or a hog. It was 4 feet in length and two feet in diameter; and to this viscus was annexed an intestinal tube 28 feet in length and 6 inches in diameter: at 3½ feet from the bottom was a large cæcum. The liver was 3½ feet in breadth, but in depth (taken as if the animal were in a standing position) 2½ feet. There was no gall-bladder nor any trace of it. The spleen was hardly a foot broad, but full 4 feet long.

The heart was a foot and a half in length, and the breadth was not much less. The right lobe of the lungs had an incision in it (probably made by the Hottentots who exenterated the animal, or by the shot, which passed through the great blood-vessels of the lungs, and mortally wounded the animal), but was in other respects undivided and entire: it was 2 feet in length. The kidneys were a foot and a half in diameter.

The hide of the Rhinoceros is perhaps as thick as, if not thicker than, that of any other pachydermatous animal. The horns, solid as they are apparently, consist actually of congregated parallel horny fibres.

We now proceed to give some account of the species of *Rhinoceros*:

R. Indicus (*R. unicornis*, Linn.) has a single horn on the nose.

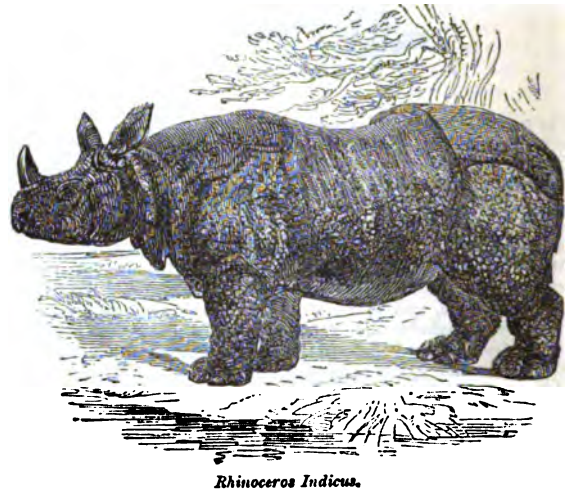
Skin naked, very thick, of a dull deep purplish-gray, marked with sub-elevated, rounded, and other inequalities, and remarkable for the deep folds which it forms behind and across the shoulders, and before and across the thighs, &c. There are a few stout, stiff, horny, and smooth hairs on the tail and on the ears.

The best early figure of *R. Indicus* known to us is that of Bontius, which, though somewhat exaggerated by the draughtsman about the lip, and furnished with little claws instead of broad nails, gives in general a correct idea of the animal.

Pennant, who is decidedly of opinion that this species is the Unicorn of holy writ, and the Indian Ass of Aristotle (p. 463), says that it loves shady forests, the neighbourhood of rivers, and marshy places; that it brings forth one young at a time, and is very solicitous about it; that it is quiet and inoffensive, but when provoked, furious, very swift, and very dangerous. "I know a gentleman," he continues, "who had his belly ripped up by one, but survived the wound."

The Rhinoceros described by Dr. Parsons came to London in 1739 from Bengal. It is stated that though but two years old, the expenses of his food and his voyage amounted to near 1000*l.* sterling.

The rhinoceros brought to this country in 1790 is the subject of an interesting account by Mr. Bingley, in his 'Animal Biography.' When it arrived it was about five years old, was tolerably tractable, would walk about at its keeper's command, and allowed the visitors to pat his back and sides. He was allowed twenty-eight pounds of clover, about the same quantity of ship-biscuit, and a great quantity of greens daily. Twice or thrice a-day five pails of water were given to him. The vessel out of which he drank contained about three pails, and each time as the animal drank the vessel was filled up. He never ceased his draught till the vessel was exhausted. He was fond of sweet wines, and it is stated that he would drink three or four bottles in a few hours.



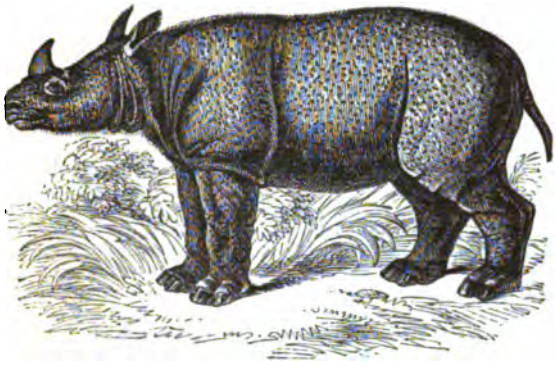
Rhinoceros Indicus.

Rhinoceros Indicus.

The species inhabits the East Indies, especially beyond the Ganges. It is recorded as having been found in Bengal, Siam, and Cochin-China. Shady forests, the neighbourhood of rivers, and marshy places are favourite localities. Their ordinary food consists of herbage and the branches of trees. The flesh is said to be not unpalatable. our figure was taken from an animal which was living in the garden of the Zoological Society, but the horn was taken from a perfect specimen; for the animal, though a fine one, and in excellent general

health, from the time of its arrival and from the first growth of the horn constantly employed itself in rubbing it down, so as to prevent its proper increase.

R. Javanus (Cuvier) has one horn; folds of the neck obsolete; scutules of the skin angled at the margin, concave in the middle, and furnished with a few short bristles; margin of the ears and under side of the tail hairy.



Rhinoceros Javanus. (F. Cuvier.)

Dr. Horsfield, who had an opportunity during his residence at Surakarta, the capital of the Javanese empire, of examining an individual taken during infancy and kept in confinement, or rather in a state of domestication, gives a good figure of it, observing that the drawing from which the plate is taken, though deficient in some points that the skilful pencil of Mr. Daniell would have supplied from the living animal, exhibits, with scrupulous accuracy, its form and proportions. In 1817 this individual measured nine feet in length, and was four feet three inches high at the rump; and Dr. Horsfield remarks that the Rhinoceros figured by F. Cuvier (of which a reduced copy is given above), which was brought to Europe from the British possessions in India, was higher in proportion to its length, and its form was more unwieldy, the entire length being seven feet, and the height four feet ten inches. The head of the animal seen by Dr. Horsfield was strongly attenuated to the muzzle, and had a triangular form; the flexible lip was considerably lengthened, and the sides of the head were marked with protuberances or scutula, resembling those on the body, but no great roughnesses or folds were apparent. The marks of distinction afforded by the folds of the external covering were less evident than those afforded by the form of the body and the attenuated head; but the folds on the whole appeared less rough or prominent than in *R. Indicus*.

This animal is gregarious in many parts. Dr. Horsfield states that it is not limited to a particular region or climate, but that its range extends from the level of the ocean to the summit of mountains of considerable elevation. Dr. Horsfield noticed it at Tangung, near the confines of the Southern Ocean, in the districts of the native princes, and on the summit of the high peaks of the Priangan regencies. It prefers high situations.

The domesticated individual above alluded to by Dr. Horsfield was taken while very young, in the forests of the province of Keddu, and was conveyed to the residency at Magellan, in the year 1815 or 1816. By kind treatment it soon became domesticated to such a degree, that it permitted itself to be carried, in a large vehicle resembling a cart, to the capital of Surakarta. "I saw it," says the Doctor, "during its conveyance, and found it perfectly mild and tractable. At Surakarta it was confined in the large area or square which bounds the entrance to the royal residence. A deep ditch, about three feet wide, limited its range, and for several years it never attempted to pass it. It was perfectly reconciled to its confinement, and never exhibited any symptoms of uneasiness or rage, although on its first arrival harassed in various ways by a large proportion of the inhabitants of a populous capital, whose curiosity induced them to inspect the stranger of the forest. Branches of trees, shrubs, and various twining plants were abundantly provided for its food; of these the species of *Cissus* and the small twigs of a native fig-tree were preferred. But plantains were the most favourite food, and the abundant manner in which it was supplied with these by the numerous visitors tended greatly to make the animal mild and sociable. It allowed itself to be examined and handled freely, and the more daring of the visitors sometimes mounted on its back. It required copious supplies of water, and, when not taking food, or intentionally roused by the natives, it generally placed itself in the large excavations which its movements soon caused in the soft earth that covered the allotted space. Having considerably increased in size, the ditch of three feet in breadth was insufficient for confining it, but, leaving the inclosure, it frequently passed to the dwellings of the natives, destroying the plantations of fruit-trees and culinary vegetables which always surround them. It likewise terrified those natives that accidently met with it, and who were unacquaintec with its appearance and habits. But it showed no ill-natured disposition, and readily allowed itself to be driven back to the inclosure, like a Buffalo. The excessive excavations which it made by continually wallowing in the mire, and the accumulation of putrefying vegetable matter, in process of time became offensive at the entrance of the palace, and its removal was ordered by the emperor to a small village near the confines of the capital, where, in the year 1821, it was accidentally drowned in a rivulet." ('Zoological Researches in Java.')

This species is the Warak of the Javanese, the Badak of the Malays and of the inhabitants of the western parts of Java. (Horsfield, 'Zoological Researches in Java.')

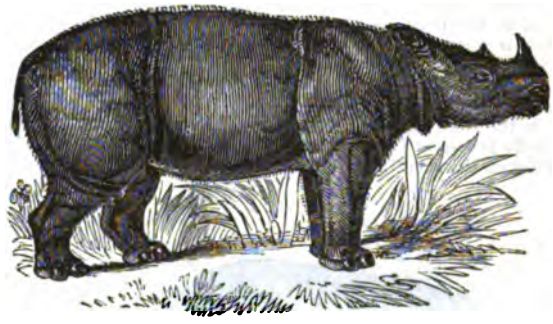
Marsden, in his 'History of Sumatra,' states that the Rhinoceros, Badak, both that with a single horn and that with a double horn, are natives of the woods. He adds that he does "not know anything to warrant the stories told of the mutual antipathy and the desperate encounters of these two enormous beasts." The horn, he adds, is esteemed an antidote against poison, and on that account formed into drinking-cups.

R. Sumatrensis, Cuv. (*R. Sumatranus*, Raffles), has four great incisors, as in the two preceding species, but hardly any folds on the skin, which is hairy; a second horn behind the ordinary one.

The first satisfactory indication of the existence of this species occurs in Pennant, who imagined that the two-horned species of Sumatra was identical with *R. bicornis*, the only African species then known. He quotes the following remark of Mr. Charles Miller, who was long resident in Sumatra:—"I never saw but two of the two-horned Rhinoceros; but I believe they are not uncommon in the island, but are very shy, which is the reason they are but seldom seen. I was once within twenty yards of one. It had not any appearance of folds or plaits on the skin; and had a similar horn resembling the greater, and, like that, a little turned inward. The figure given by Dr. Sparrman is a faithful resemblance of that I saw."

The hide is rugose, covered with scattered stiff brown hairs; folds on the shoulders and croup but slightly marked; the skin generally rather delicate, and nearly without folds; head rather elongated; eyes small and brown; upper lip pointed and curved downwards; ears small and pointed, fringed with black short hairs; first horn bent backwards, second smooth and pyramidal, placed a little in front of the eyes.

It is a native of Sumatra.



Rhinoceros Sumatrensis. (F. Cuvier.)

R. Africanus, Cuv. (*R. bicornis*, Linn.), is of a pale yellow brown; horns unequal in length; neck surrounded with a furrow at the setting on of the head; eyes brown. Length 10 feet 11 inches. (Smith.)

The hide is pale yellowish-brown, with tints of purple upon the sides of the head and muzzle; the groins flesh-coloured; eyes dark brown; the horns livid-brown clouded with green; the hairs on the tip of the tail and the margins of the ears deep black.

Sparrman, in his description, exposes the errors of Buffon regarding both this species and *R. Indicus*; especially the opinion that the copulation of the latter takes place croupe à croupe. His poetical fancies too touching the impenetrable nature of the skin are freely and justly dealt with by the same learned Swede, who ordered one of his Hottentots to make a trial of this with his hassagai on one of those which had been shot. Though this weapon was far from being in good order, and had no other sharpness than that it had received from the forge, the Hottentot, at the distance of five or six paces, not only pierced with it the thick hide of the animal, but buried it half a foot deep in its body.

Dr. Smith remarks that the present species, under the name of Rhinoster, has been familiarly known to the colonists of the Cape of Good Hope ever since 1652. In that year, when the Dutch first formed their settlement on the shores of Table Bay, this animal, he observes, was a regular inhabitant of the thickets which clothed the lower slopes of Table Mountain. He states that, like the Keitloa, this species feeds upon brushwood and the smaller branches of dwarf trees, from which circumstance it is invariably found frequenting wooded districts, and in those situations its course may often be traced by the mutilations of the bushes. "As it feeds but slowly," says Dr. Smith, "and besides passes much of its time in idleness, it

must be regarded as a very moderate eater, and considering that it appears to be fastidious in the choice of its food, it is fortunate for its comfort that it does not require more nourishment. Of the many shrubs which exist in the locality in which it resides, few comparatively appear formed for its choice, as it is to be seen approaching many and leaving them again without either injuring a branch or plucking a leaf."

Rhinoceros bicornis, female and young. (Smith.)

R. Keitloa (Smith) is of a pale brownish-yellow colour; the two horns subequal in length, the anterior one cylindrical, the posterior one compressed; anterior part of the upper lip produced and acuminate. Length, body and head, 11 feet and 1½ inches. Height 5 feet. Its figure nearly that of *R. bicornis*.

Dr. Smith remarks that the only species yet known with which the present could be confounded is the *R. bicornis* of authors. There are however, he observes, many and marked differences between them, of which the following are a few of the external and more palpable ones. In *R. Keitloa* the two horns are of equal or nearly equal length; in *R. Africanus* the posterior in neither sex is ever much beyond a third of the length of the anterior horn; the length of the head in proportion to the depth is very different in the two. The neck of *R. Keitloa* is much longer than that of the other, and the position and character of the cuticular furrows destined to facilitate the lateral motions of the head are very different. Besides these, Dr. Smith states that many other diagnostic characters might be instanced; such as the black mark on the inside of the thigh of the Keitloa, the distinctly produced tip of the upper lip, and the comparatively few wrinkles on the snout and parts around the eyes.

Rhinoceros Keitloa, male. (Smith.)

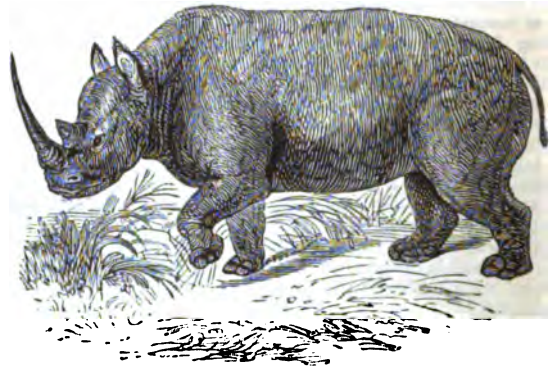
Dr. Smith thinks that it may with propriety be inferred that the Keitloa has not, for many years at least, been in the habit of generally extending its range higher than about 25° S. lat. He remarks that we have sufficient evidence that individuals of this species have approached Latakoo, or rather the country some 60 miles to the north of it, in the fact that Mr. Burchell, "whose merits as a traveller can be best appreciated by those who follow him in the same field, is at present in possession of the horns of an individual which was killed by his hunters." Dr. Smith further states that the natives at and around Latakoo are only acquainted with two species, namely, Borili (*R. bicornis* of authors), and Mohoohoo (*R. simus*, Burch.); and those who were in the employ of the expedition declared, when they first saw the Keitloa, that it was not an animal of their country; and at once enlarged upon the points in which it differed from Borili.

The food of this species consists of small shrubs, or the more delicate branches of brushwood, in collecting which, Dr. Smith observes, the prolongation of the anterior extremity of the upper lip proves a useful assistant.

R. simus (Burch.) is of a pale gray-brown colour, tinged with yellow-brown; margins of the ears towards the tips, and tail both above and below at the extremity, clothed with stiff black hairs; mouth ox-like; two horns, the anterior one much the longest; eyes yellowish-brown. Length, body and head, 12 feet 1 inch. Height, at the shoulder, 5 feet 7 inches.

"Mohoohoo, the name of this species among the Bechuanas," says Dr. Smith, "is considered by them to be one of the original animals of their country, and to have issued from the same cave out of which their own forefathers proceeded: in this respect they make a difference between it and Keitloa, with whose origin they do not profess to be acquainted."

Mr. Burchell, who added so much to our knowledge of the zoology of Africa, found, when he was in Latakoo, this species common there; and the natives told Dr. Smith that it was not unfrequently found even farther to the southward. The last-named author however tells us that it has almost ceased to exist, even in the situations where its discoverer met it; and the Doctor observes that this is accounted for by the danger to which it is exposed being now much increased from the general introduction of fire-arms among the Bechuanas. He also remarks that the form of the mouth at once suggests the kind of food upon which the animal probably subsists; and an examination of the contents of the stomach, principally grass, confirmed the inference. "Localities abounding in grass are therefore the haunts of the Mohoohoo, and to enjoy them throughout the year, he is necessitated to lead a more wandering life than the two species already figured."



Rhinoceros simus. (Smith.)

The above species are those which are best known, although it is not improbable that others exist, and this is the impression of Dr. Smith. The following species are given in the 'Catalogue of the Specimens of Mammalia' in the British Museum:—

Family *Elephantidæ*.

Tribe *Rhinocerina*.

1. *Rhinoceros unicornis*, Linn., the Rhinoceros; *R. Indicus*, Cuv.; *R. Asiaticus*, Blum.; *R. inermis*, Lesson.
2. *R. bicornis*, the Gargatan, or Rhinaster; *R. Africanus*, Desm.; *R. Brucei* and *R. Gordonii*, De Blainv.
3. *R. Keitloa*, A. Smith; Sloan's Rhinoceros.
4. *R. simus*, Burchell's Rhinoceros; *R. Burchelii*, Desm.; *R. Canus*, Griffith.

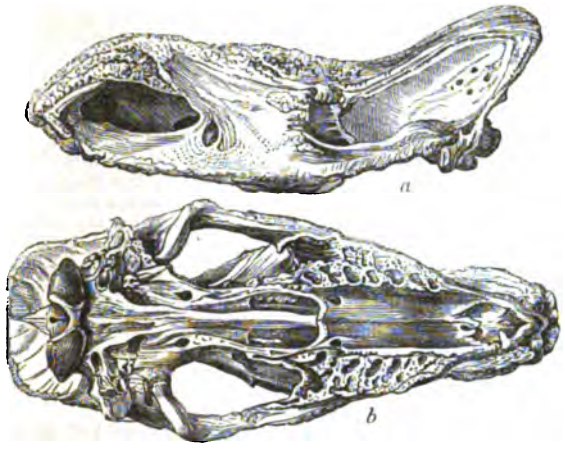
Fossil Rhinoceroses.

The Fossil Rhinoceroses hitherto discovered may be divided into three groups—1, those with a true or bony septum narium; 2, those without a bony septum; and 3, those with incisor teeth.

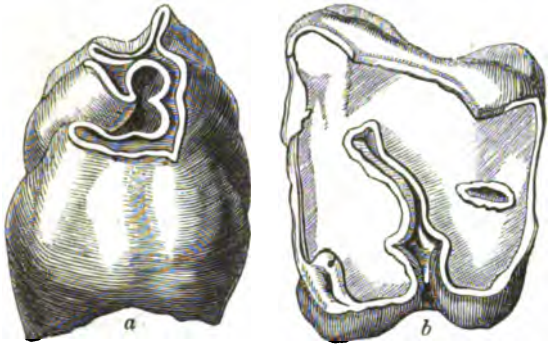
The greater portion of remains found in Northern and Central Europe and Asia belong to the first group; those found in Italy belong to the second.

The skulls of the Rhinoceroses belonging to the first group exhibit an essential difference when compared with those of the living species. Those of the former are longer and narrower in proportion; the width between the orbits is less; the bones of the nose are more elongated; the disc on which the anterior horn was seated is an oblong ellipse, whilst in *R. bicornis* it is a hemisphere. An analogous elongation exists in the place where the second horn was situated, whence Cuvier concludes that the horns of the Rhinoceros with a bony septum narium were very much compressed laterally. The same great zoologist remarks that in *R. bicornis* or *R. Africanus* (Cape Rhinoceros) the occipital crest is nearly over the occipital condyles, and the posterior surface of the occiput is nearly perpendicular to the axis of the head. In *R. Javanus* this surface is inclined forwards, which renders the distance from the nose to the crest shorter than that from the nose to the condyle in a proportion of 19 to 25; and it

is much the same in *R. Sumatrensis*. In *R. Indicus* this forward inclination is still more remarkable, although the difference of the two lines is less in the proportion of 21 to 25, on account of the extreme height of this occipital surface. In all the fossil skulls, on the contrary, the occipital surface is strongly inclined backwards, and the distance from the nose to the crest much longer than that from the nose to the condyles. It would seem, says Cuvier in continuation, that in some fossil individuals the two horns did not touch each other; but in one from the neighbourhood of Rugby, which Cuvier saw in the Radcliffe Library at Oxford, and of which Mrs. Buckland made a drawing for his work, he is of opinion that the horns touched, for the discs on which they were seated are confounded in one rugose surface.



Skull of Fossil Rhinoceros. (Cuvier.)
a, profile; *b*, seen from below.



a, Crown of a sixth molar, but little worn, of a Fossil Rhinoceros; *b*, molar of a Fossil Rhinoceros, much worn, seen from above.

The skulls of the group of fossil rhinoceroses which have no bony septum narium much resemble that of *R. bicornis*. As compared with the cranium of the ordinary fossil rhinoceros, which has the bony septum, the cerebral part of the skull is less prolonged and less thrown backwards; the orbit is placed above the fifth molar; the nasal bones terminate in a free point, and are not attached to the intermaxillary bones by a vertical septum; the intermaxillaries are much less prolonged and of a different conformation, offering none of the characters which render the other fossil skulls of this genus so remarkable. But though the skulls without the bony septum approach more to that of the *R. bicornis* than of any other living species, there are notwithstanding several differences. The bones of the nose in the last-mentioned fossils are delicate, straight, and pointed; whilst those of *R. bicornis* are very thick and convex; the intermaxillaries of the fossil are much larger than those of *R. bicornis*, and the zygomatic arch is shorter and more convex towards the top; moreover there is a deeper depression between the part which supports the second horn and that which elevates itself to form the occipital crest.

The fossil rhinoceroses furnished with incisor teeth were much smaller than any known species, living or fossil.

The following fossil species have been recorded:—*R. tichorinus*, Cuv.; *R. incisivus*, Cuv.; *R. leptorhinus*, Cuv.; *R. minutus*, Cuv.; *R. elatus*, Croiz. and Job.; *R. pachyrhinus*, Cuv.; *R. hypselorhinus*, Kaup.; *R. Goldfussii*, Kaup.; *R. leptodon*, Kaup.

Two of these species are British, *R. tichorinus* and *R. leptorhinus*. In his 'British Fossil Birds and Mammals,' Professor Owen has described and distinguished these two species.

R. tichorinus, the Two-Horned Tichorine Rhinoceros, belongs to Cuvier's group with a closed septum narium. The first notice of the fossil remains of the genus *Rhinoceros* occurs in a curious old tract entitled 'Chartham News, or a brief relation of some strange bones there lately digged up in some grounds of Mr. John Somner of Canterbury. In this little work, which was printed and published in London in 1669, is an account of fossil bones found in digging a well at Chartham. These remains are now in the collection of the British Museum, and evidently belong to *R. tichorinus*. Remains of this species have been found very generally dispersed over the British Islands. "Although the remains of the great Tichorine Rhinoceros," says Professor Owen, "have not been found in such abundance in the caves, the unstratified drift, and the post-pliocene fresh-water deposits of Britain, as those of its more gigantic contemporary the Mammoth, the two-horned pachyderm seems to have been as extensively distributed over the land which now constitutes our island. The works of continental palæontologists demonstrate that this Rhinoceros was similarly associated with the Mammoth in the more recent deposits of France, Germany, and Italy."

The most remarkable specimens of this rhinoceros have been discovered in the northern latitudes of Asia. Twenty years previous to the discovery of the mammoth enveloped in ice [ELEPHANT], a Tichorine Rhinoceros had been discovered under the same circumstances. The following is Professor Owen's translation of Pallas's account of this discovery:—

"I ought here to mention an interesting discovery, which I owe to M. Le Chevalier de Bril. Certain Jakoutzki hunting this winter" (1771-2) "near Viloui, found the body of a great unknown beast. The Sieur Ivan-Argounof, inspector of Zimovia, caused to be transmitted to the Prefecture of the province of Jakoutzk, the head, a fore foot, and a hind foot of the animal, the whole of which were in an excellent state of preservation. He says in his 'Memoir,' dated the 17th of last January," (1772), "'that they found, in the month of December, the animal dead, and already much decomposed, at about forty versts above Zimovié de Vilouiskoe, on the sand of the bank, at the distance of one toise from the water and four toises from another higher and more precipitous escarpment: it was about half buried in the frozen sand. They took its dimensions on the spot: it was three and three quarters Russian ells' (aunes de Russie, about eleven and a half English feet) 'in length, and they estimated its height at three and a half ells. The body of the animal, still retaining its corpulency,' (encore dans toute sa grosseur) 'was clothed with its skin, which resembled leather; but it was so far decomposed that they were unable to bring away more than the head and the feet. These I saw at Irkoutsk; they seemed to me, at the first view, to belong to a Rhinoceros, which had been in full vigour. The head, especially, was very recogniasble, because it was covered by its skin. The skin had preserved all its exterior organisation, and one could see upon it many short hairs' (on y apercevoit plusieurs poils courts). 'The eyelids and eyelashes even had not entirely fallen into decay. I saw a substance in the cavity of the skull; and here and there, beneath the skin, were the remains of the putrified flesh. I remarked on the feet the very obvious remains of the tendons and cartilages, where the skin was wanting. The head had lost its horn, and the feet their hoofs. The situation of the horn, the fold of integument which surrounded it, and the separation' (of the toes?) 'which existed in the fore feet and hind feet are certain proofs of the animal being a Rhinoceros.' I have given an account of this singular discovery in the 'Memoirs of the Academy of St. Petersburg,' and refer my readers to that work to save repetition. They will there see the reasons in proof that a Rhinoceros has been able to penetrate near the Lena in high northern latitudes, and the circumstances that have led to the discovery in Siberia of the remains of so many strange animals."

One of the most remarkable points in this relation is the fact of this animal possessing short hairs, which probably, like those of the Mammoth, served as a protection against the cold, to which it was subject in a northern climate.

"Although the molar teeth of the *Rhinoceros tichorinus* present a specific modification of structure, it is not such as to support the inference that it could have better dispensed with succulent vegetable food than its existing congeners; and we must suppose therefore that the well-clothed individuals who might extend their wanderings northward during a brief but hot Siberian summer, would be compelled to migrate southward to obtain their subsistence during winter. Plants might then have existed with longer periods of foliation than those which now grow." (Owen.)

R. leptorhinus, Leptorhine Two-Horned Rhinoceros. Professor Owen has pointed out that the remains of this rhinoceros are frequently met with in the British Islands, though not so commonly as the last. A tooth from the upper jaw and other remains of this species have been found in the tertiary clay at Walton in Essex. Teeth have also been procured from the fresh-water beds near Cromer, on the coast of Norfolk. On the habits of this creature Professor Owen remarks:—"The habits of the less robust and less formidably armed species no doubt differed from those of the Tichorine Rhinoceros, which is more extensively distributed over England. Some naturalists have recognised different habits in the three or four species of Rhinoceros now living in Africa, and which differ from each other in form and structure much less than did the extinct Leptorhine and Tichorine Rhinoceroses of Europe."

Although the number of extinct species equals those which are now existing, no remains of this genus have ever been found in America or Australia. This peculiar form of pachydermatous creatures appears to have been confined from its first creation to the same great natural division of the world's surface to which the existing representatives of that form are still peculiar.

RHINOCEROS HORNBILL. [HORNBILLS.]

RHINOLOPHI'NA. [CHEIROPTERA.]

RHINO'LOPHUS. [CHEIROPTERA.]

RHI'NOPHIS (Wagler), a genus of Serpents.

RHINOPI'RUS. [ERPETON.]

RHINOPOMA. [CHEIROPTERA.]

RHIPIDU'RA. [MUSCICAPIDÆ.]

RHIPIPTERA, a name given by Latreille to the order previously named by Mr. Kirby *Strepsiptera*. This order embraces the genera *Xenos*, *Stylops*, *Elenchus*, and others. [STREPSIPTERA.]

RHISSOPTERA. [RHIPIPTERA.]

RHIZANTHEÆ, *Rhizanths*, *Rhizogens*, a small class of Plants, comprising the orders *Balanophoraceæ*, *Cytinaceæ*, and *Rafflesiaceæ*. They are parasitical plants, destitute of true leaves, in the place of which they are furnished with cellular scales. Their stem is either an amorphous fungous mass or a ramified mycelium, and is very imperfectly supplied with spiral vessels, which are sometimes wholly deficient. They are of a brown yellow or purple colour, never green. They produce flowers which have genuine stamens and carpels, and are surrounded by a whorl of petaloid bodies. They possess ovules, but their seed is not known.

These plants have been regarded by Lindley, Endlicher, and other botanists, as sufficiently distinct to warrant their being placed in a class by themselves. Their flowers, stamens, and ovules, indicate their relation to the phanerogamic plants, whilst their mycelial stem, parasitic habits, and cellular structure ally them with the *Fungi* and other low forms of vegetation. Mr. Brown however is of opinion that the Rhizanths are but less developed forms of Exogenous Plants. He regards them as having affinities with *Aristolochiaceæ*, and other orders of Exogens. More recently Mr. Griffiths has adopted the views of Brown, and advanced a number of arguments in favour of their being degraded forms of higher plants, and not a permanently low form of vegetation. He thinks the relations of Rhizanths various. Thus he places *Mystropetalon* near *Proteaceæ* and *Santalaceæ*; *Sarcophyte* and *Balanophora* he places near *Urticaceæ*. Finally, he places *Thismia* between *Taccaceæ* and *Burmanniaceæ*.

The following are the orders of *Rhizantheæ* as recognised by Lindley:—

Ovules solitary, pendulous; fruit one-seeded . .	*Balanophoraceæ*.
Ovules 00, parietal; fruit many-seeded; calyx 3-4-6-parted; anthers opening by slits . . .	*Cytinaceæ*.
Ovules 00, parietal; fruit many-seeded; calyx 5-parted; anthers opening by pores . . .	*Rafflesiaceæ*.

RHIZOBOLACEÆ, *Rhizobols*, a natural order of Plants, consisting of trees of very large size. The leaves are opposite, digitate, coriaceous, with a pointed stalk and no stipules; flowers large, regular, arranged in racemes, with their stalks pointed at the base and below the apex; the sepals are 5 or 6, more or less combined, imbricated in æstivation; petals 5 to 8, equal-sided, but unequal thickish, arising along with the stamens from a hypogynous disc; fruit of several combined indehiscent one-seeded nuts; seed reniform, exalbuminous, with a cord dilated into a spongy excrescence; radicle very large. The species are found in South America. They are large timber-trees, some of which yield edible fruit. It is from trees of this order that are produced the Souari (or Suwarrow) Nuts of the shops, the kernel of which is one of the most delicious fruits of the nut kind that is known. An oil is extracted from them not inferior to that of the olive. The timber of the tree is used for ship-building. (Lindley, *Vegetable Kingdom*.)

RHIZOCARPEÆ. [MARSILEACEÆ.]

RHI'ZODUS, a genus of Fossil Fish.

RHIZOMORPHA, a genus of Plants belonging to the natural order of *Fungi*, having altogether the appearance of the root of a tree. The species are found in damp cellars, old walls, mines, and other subterranean places, where they sometimes acquire a phosphorescent state, which renders them exceedingly curious objects. Nothing is at present known of their mode of reproduction or origin; but it is thought that they spring out of decaying wood buried in the ground. The genus *Rhizomorpha* is not included in Hooker's 'English Flora,' but it is mentioned by Mr. Berkeley, who wrote the mycological department of that work, as a fungous production, originating in tan-pits. Several species are mentioned by authors, of which *R. medullaris* is the most common. This is so like the root of a tree divided into numerous fibres, that it is probably often mistaken for it. Independently however of its cellular organisation, so different from that of wood, it may always be known by its musty smell.

RHIZOPHORA. [RHIZOPHORACEÆ.]

RHIZOPHORACEÆ, *Mangroves*, a natural order of Exogenous Plants, natives of the shores of the tropics, where they root in the mud, and form a close thicket down to the verge of the ocean. They are trees, or shrubs, with simple opposite leaves, having deciduous interpetiolary stipules. The calyx is adherent, with 4-12 valvate lobes; petals 4-12; stamens twice or thrice as many; ovary 2-4-celled, with two pendulous ovules in each cell. The fruit is monospermal, indehiscent, crowned by the calyx. Seed exalbuminous, embryo germinating in the pericarp. There are 21 species and 5 genera. The bark of the trees is usually astringent, and is employed in tanning and as a febrifuge. The wood of several is described as being hard and durable. The following species of *Rhizophora* are the best known forms of the order:—

R. Mangle, the Common or Black Mangrove, is found abundant on the shores of the ocean, and within the delta of the Ganges, where it grows to a considerable size. The seed of this species, which is from one to two feet long, very quickly gives rise to a young tree, and, as mentioned by Browne in his 'History of Jamaica,' if the apex from whence the root issues be stuck only a little way in the mud, the leaves quickly unfold at the opposite end. The wood is dark-red, hard, and durable, and the bark is used for tanning leather.

R. Candel, Red Mangrove, or Paletuvier. The branches of this species, though they bend downwards, do not take root in the ground. The wood is heavy, of a deep-red, and takes a fine polish. The bark is used in dyeing red, is astringent, and used in the West Indies for the cure of fevers, as well as of the bites of venomous insects.

R. gymnorhiza grows to a considerable size where the spring-tides rise over it, as in the delta of the Ganges. The wood is yellow, hard, and durable; has a sulphurous smell, and burns with a vivid light; is chiefly used by the natives for fire-wood and for making posts for constructing their houses. The pith of the wood, boiled in palm wine or with fish, is used as food.

RHIZOPHY'SA. [ACALEPHÆ.]

RHIZO'STOMA. [ACALEPHÆ.]

RHIZOSTO'MIDÆ. [ACALEPHÆ.]

RHIZOTROGUS. [MELOLONTHIDÆ.]

RHODALITE, a Mineral which appears to consist of small rectangular prisms with square bases. Hardness about 2. Colour between rose-red and flesh-red. Specific gravity 2. Before the blow-pipe per se not altered. With carbonate of soda fuses into a greenish-blue transparent bead in the exterior flame, becoming yellow in the interior flame: with borax gives a transparent colourless bead; with phosphate of soda does not fuse. It is found in Ireland, occurring probably in an amygdaloidal rock. An analysis by Mr. Richardson gives—

Silica	55·9
Alumina	8·3
Peroxide of Iron, and trace of Oxide of Manganese	11·4
Lime	1·1
Magnesia	0·6
Water	22·0
	99·3

RHODEA. [COAL PLANTS.]

RHODIOLA. [SEDUM.]

RHODIUM. [PLATINUM.]

RHODIZITE, a Mineral resembling *Boracite* [BORON] in its crystals, but it tinges the blow-pipe flame deep red. It occurs with the Red Tourmaline of Siberia. (Dana.)

RHODOCRINI'TES. [ENCRINITES.]

RHODODENDRON, a genus of Plants belonging to the natural order *Ericaceæ*. The species are evergreen shrubs, very commonly cultivated in our gardens and shrubberies, and differing from *Azalea* principally in the stamens, being 10 instead of 5, in the corolla being campanulate, not tubular, and in the foliage being hard and evergreen. The species are nearly related to each other, and occur both in the New and Old Worlds.

R. Ponticum is the species to which most of the varieties of our gardens belong. The leaves are oblong-lanceolate, glabrous on both surfaces, attenuated towards the thick petioles, with a streak on the upper surface and of a wide lanceolate form, racemes short and corymbose. It is a native of Asia Minor in Pontus, and of Gibraltar, Spain, and the Caucasus, in wet places, in beech and alder coppices. The corolla is large, purplish, with ovate, acute, or lanceolate segments. The calyx minute, 5-toothed, somewhat cartilaginous. At one time it was supposed that it was this plant which rendered the honey of Asia Minor poisonous, but it has been ascertained that the effect is really produced by *Azalea Pontica*.

R. arboreum, True Rhododendron, has lanceolate leaves, acute, silvery beneath, tapering to the base; peduncles and calyxes woolly; segments of corolla 2-lobed, with crenulating curled margins, capsule 10-celled, tomentose. It is a native of the warmer parts of India, and is one of the most beautiful of all trees, but too delicate to bear the open air in England.

R. chrysanthum has acute leaves attenuated at the base, oblong, glabrous, reticulately veined, and of a rusty colour beneath; flowers and buds clothed with rusty tomentum; pedicels hairy; calyx hardly any; segments of the corolla rounded; ovarium tomentose. It is a native of Siberia on the highest mountains, and of the Caucasus. The plant and its effects were first described by Gmelin and Steller, who mention it as used in Siberia for the cure of rheumatism; with us it is used in decoction as a substitute for colchicum.

Within the last few years a number of species of these beautiful plants has been found in the Himalayan Mountains by Dr. Joseph Hooker, who has described them in his 'Monograph of the Rhododendrons of the Sikkim Himalaya.' The most beautiful of these forms are the following:—

R. Falconeri, a white flowered species, never occurring below 10,000 feet above the level of the sea, is one of the most striking and distinct of the genus.

R. Dalhousiæ is parasitical on the trunks of large trees, especially oaks and magnolias. It has large flowers, three to seven, in a terminal umbellate head, the spread of which is greater than than of the leaves. The calyx large, deeply-divided almost to the base into five ovate-elliptical very obtuse spreading foliaceous lobes; corolla very large, 3½ inches to 4½ inches long, and as broad at the mouth, campanulate, white, with an occasional tint of rose; in size and colour and general shape almost resembling that of the white Bourbon Lily, very frequently having the odour of the lemon.

R. barbatum, a tree from 40 to 60 feet high, branched from the base. Flowers of a moderate size, of a deep puce or blood-colour, collected into a compact globose head, from 4 to 5 inches in diameter. It is one of the most beautiful of the Himalayan species, and is readily distinguished by its having bristly petioles and numerous branches floriferous at their apices.

R. lancifolium is a shrub 6 or 8 feet high; the bark reddish, papery, easily separating and falling off. Branches spreading, tortuous, wrinkled, and knotted; flowers of a moderate size, collected into a rather dense head at the ends of the branches; corolla of a rich purple colour.

R. Wallichi is a very distinct and handsome species, with lilac-coloured flowers. Its leaves are quite unlike any Indian species, and the flowers in colour and size resemble those of the much-cultivated *R. Ponticum*.

R. argentum is a tree 30 feet high, having leaves very beautiful in the leaf-buds, erect and silky, at first enveloped in large scales, so closely imbricated and so large as to resemble the cones of some species of pine, the outer or lower scales broad and coriaceous, glabrous, coloured (reddish-brown), the innermost ones oblong spathulate, pubescent. The flowers are 2 to 3 inches long, 2 to 2½ inches in diameter, always white.

Thirty-two species of the genus *Rhododendron* have been distinguished by De Candolle in the seventh volume of his 'Prodromus,' in 1839; the maximum of known species at the present time exists in Asia; for, commencing with Borneo and other Malayan islands in the tropics of the southern hemisphere, and proceeding north, we find them recorded in the mountain regions of all intervening countries that have been botanically investigated, even to northern and extreme arctic Siberia. As we proceed westward into Europe they gradually disappear, one only inhabiting Sweden and Norway, *R. lapponicum*, and that seems not to extend to the western coasts. No species grows in Mexico or near the coasts of Oregon or California, and none in the isthmus of Panama. Throughout the whole of Africa and Australia the genus is unknown, and it will be observed that it only enters the southern hemisphere through the medium of the Indian Archipelago.

Mr. Griffith in an excursion to one mountain in Bootan detected eight species, and Dr. Hooker, during a very limited sojourn in Sikkim, and notwithstanding great difficulties, was able to collect and describe a far larger number. These facts would lead to the conclusion that if the maximum of Rhododendrons be in Asia, their headquarters are on the lofty ranges of the Eastern Himalayas, where the mild and moist atmosphere is eminently suited to their habits.

(Lindley, *Vegetable Kingdom;* Dr. Hooker, *Rhododendrons of the Sikkim Himalaya.*)

RHODONITE. [MANGANESE.]

RHODOPHY'SA. [ACALEPHÆ.]

RHODOSPERMEÆ. [ALGÆ.]

RHODYMENIACEÆ, an order of *Algæ*, consisting of purplish or blood-red Sea-Weeds, with an expanded or filiform inarticulate frond, composed of polygonal cells, occasionally traversed by a fibrous axis; superficial cells minute, irregularly parted, or rarely disposed in filamentous series; fructification double; conceptacles external or half-immersed, globose or hemispherical, imperforate, containing beneath a thick pericarp a mass of spores affixed to a central placenta. The root is disc-like or branched, sometimes much matted; frond very variable in habit and colour, either leafy or filiform, and much branched, never articulate; in some an intense scarlet, in some crimson, in others brown-red or purple, usually growing somewhat darker in dyeing. The species are widely dispersed; all our genera having representatives in very distant countries, with very various climates.

Rhodymenia is an ill-defined genus, and will probably be divided into several distinct genera; many of the species, especially of the section *Calophyllis*, are among the most splendidly coloured of crimson and carmine *Algæ*. Others, as *R. Hombroniana*, are clothed in royal purple; while others, like the sober dulse of our coasts, *R. palmata*, have often as much of brown as of purple in their attire.

Many of the *Rhodymeniaceæ* are valuable in an economic sense.

R. palmata, the Dulse of our coasts, is collected largely in Scotland and Ireland, and forms an important article of diet. Many of the *Gracilariæ* are largely used in the East as ingredients in soups and jellies, and also as substitutes for glue. One of them *G. spinosa*, is the Agar Agar of the Chinese, and is largely collected both for culinary purposes, and as a component part of some of the strongest Chinese glues. It has recently been imported into England, and is occasionally used instead of carrageen moss in making jellies and blancmanges.

(Harvey, *British Algæ.*)

RHOMB SPAR, a Mineral, a variety of Magnesian Carbonate of Lime containing from 5 to 10 per cent. of oxide of iron or manganese.

RHOMBOI'DES, a genus of *Mollusca*. [PYLORIDIA.]

RHOMBUS. [CONUS; PLEURONECTIDÆ.]

RHUBARB. [RHEUM.]

RHUS, the name of a genus of Plants belonging to the natural order *Anacardiaceæ*, and to the tribe *Sumachineæ*. One of the species, *R. cotinus*, appears to have been known to Pliny, who refers to its dyeing properties, and its place of growth, the Apennines, under the name of Cotinus. This genus has an extensive geographical range, from the south of Europe to the Cape of Good Hope. It is also found in Asia and North and South America. Most of the species are poisonous, but they are much cultivated as ornamental shrubs, especially on account of the beautiful red colour of their leaves in autumn. Many of them are used also for the purposes of dyeing and tanning; as an astringent principle, to which is frequently added an acid, is common to the whole genus.

The genus *Rhus* has the following characters:—Flowers bisexual, or polygamous; calyx small, persistent, 5-partite; petals 5, inserted under the margin of the disc, imbricate in æstivation; stamens 5, hypogynous; ovary 1-celled, sessile; fruit, a dry drupe; seeds solitary, exalbuminous; radicle opposite the hilum, and bent downwards along the edge of the cotyledons. Leaves alternate, simple, or compound; panicles axillary or terminal.

De Candolle enumerates about 90 species, to which other writers have made additions, but there is reason to believe that many of the new species are merely varieties. We shall here enumerate only a few of those which have interest on account of being cultivated, or their uses in medicine and the arts.

R. cotinus, Venus-Sumach, or Wild Olive. Flowers hermaphrodite, arranged in loose panicles of a greenish-yellow colour; leaves simple, entire. This is a very ornamental shrub, and is one of the European species, growing wild in various districts of the south of Europe. It is made use of, like many other of the species, for tanning, in Italy, and is called Scotino. The wood is used by the modern Greeks for dyeing wool, which is said to be of a beautiful rich yellow. It is frequently cultivated on account of its beauty.

R. typhina, Fever-Rhus, or Stag's-Horn Sumach. Leaves with 8-10 pair of leaflets and an odd one, lanceolate-acuminate, serrated, pilose beneath. There are two forms of this plant: the one *R. t. arborescens*, in the form of a tree, from 10 to 25 feet in height; the other *R. t. frutescens*, shrubby, and only from 2 to 10 feet high. The young shoots are covered with down, which, with their somewhat crooked and stunted branches, give them the appearance of young stags'-horns; hence their name. The flowers are in dense spikes, at the ends of the branches, the pistilliferous ones developing themselves into woolly drupes, which are very conspicuous when ripe. It is found in every part of North America, and its dark-red leaves add much to the beauties of an American autumn. The fruit of this plant is exceedingly sour, and on this account it is frequently called vinegar plant, and is even used in some parts as a substitute for vinegar.

R. glabra, Smooth-Leaved Sumach. Leaf like the last, but broader and glabrous. Branches also glabrous. Fruit red, covered with silky hairs. This species, as well as another named *R. viridifolia* is considered by some botanists as only a variety of *R. typhina*. Like the last, this species is abundant in North America, over-running sometimes a whole district, and forming a troublesome weed. Its fruit is very sour, but may be eaten with impunity. Bees are very fond of the blossoms.

R. vernicifera, Varnish-Bearing Sumach, or Japan Varnish-Tree. Leaf with 5-6 pairs of leaflets, all ovate, long, acuminate, entire, glabrous above, velvety beneath. It is a native of Japan and Nepaul. Its leaves are very large and beautiful, rendering it one of the handsomest of shrubs. According to Thunberg, this is the plant which yields the celebrated Japan Varnish.

R. venenata, Poison Sumach, or Swamp-Sumach. Leaf 6-7 pair of leaflets, almost glabrous, entire, lanceolate-acuminate, reticulated beneath. Fruit white. It is a native of North America from Canada to Carolina, and also in swampy districts in Japan. This plant is exceedingly poisonous, so virulent that it is said to affect some persons by merely smelling it. A touch will sometimes produce violent inflammation. It is a beautiful shrub, and well worthy of cultivation, but great care should be taken to prevent its being carelessly handled.

R. coriaria, Hide, or Elm-Leaved Sumach. Leaf 5-7 pairs of villous leaflets, elliptical, bluntly and coarsely toothed, petioles naked. Flowers in large loose panicles of a whitish-green. Drupes villous. This plant is a native of the south of Europe. It is extensively used for the purpose of tanning, and it is said that all the leather made in Turkey is tanned with the bark of this species of *Rhus*. The fruit is acid and astringent, and the seeds are often used as tonics for exciting the appetite.

R. Copallina, Gum-Copal or Mastich-Leaved Rhus.—Leaf glabrous above, slightly pilose beneath, 5-7 pairs of leaflets and an odd one, lanceolate and entire; petiole winged and jointed; root creeping; flowers yellowish-green, dicœcious. It is a native of North America from New Jersey to Carolina.

R. radicans, Rooting Poison-Oak, or Sumach.—Leaf one pair of leaflets and an odd one, odd one petiolated, glabrous, entire. A native of America from Canada to Georgia. Its climbing habit, combined with the beautiful red colour of the leaf during the decline of the year, renders it one of the most picturesque of American plants. It frequently abounds in the forests, where it may be seen covering the tops of the highest trees. It climbs up walls and rocks, and runs upon the ground with equal facility, thus covering everything within the reach of its stems. De Candolle distinguishes three varieties: *R. vulgaris*, with a stem climbing by means of roots; *R. volubilis*, climbing without roots; and *R. microcarpa*, with fruit much smaller than the other two. Like the following species, it emits a juice which indelibly stains linen. It is equally poisonous with *R. venenata*. A detailed account of the effects of the poison of the genus *Rhus* may be seen in Professor Kalm's 'Travels in North America.'

R. toxicodendron, Common Poison-Tree, or Poison-Oak.—Leaf of one pair of leaflets and an odd one, with a petiole, inciso-angulate, pubescent; flowers greenish. It is found in woods, fields, and fences, in common with the last-named species, in North America, where they are both known by the same name. Many botanists consider the two only varieties of the same plant. This species is the type of the genus *Toxicodendron* of Tournefort. It was introduced into England in 1640, and first grown in the Bishop of London's garden at Fulham. This species is that which is most frequently used in medicine. [SUMACH, in ARTS AND SC. DIV.]

The less common species of this genus cultivated in Britain are—*R. pumila* (Dwarf Sumach), *R. viridiflora* (Green-Flowered Sumach), *R. pentaphylla* (Five-Leaved Sumach), *R. suaveolens* (Sweet-Scented Sumach), and *R. aromatica* (Aromatic Sumach).

RHYACOPHILA. [NEUROPTERA.]

RHYNCHÆA. [SCOLOPACIDÆ.]

RHYNCHASPIS. [DUCKS.]

RHYNCHITES. [CURCULIO.]

RHYNCHOCINETES. [PALÆMONIDÆ.]

RHYNCHOLITES. [NAUTILIDÆ.]

RHYNCHOSAU'RUS, a genus of Fossil Reptiles. It was found in the New Red-Sandstone of Grinsill in Warwickshire. (Owen.)

RHYNCO'SPORA, a genus of Plants belonging to the natural order *Cyperaceæ*. It has few-flowered spikelets, 6 or 7 glumes, the lower ones empty or smaller; about 6 bristles; the nut compressed, convex on both sides, crowned with the dilated base of the style. There are two British species; *R. alba*, not uncommon on turfy bogs, and *R. fusca*, a rare species found in the south-west of England and in Ireland. (Babington, *Manual of British Botany.*)

RHYPHIDÆ, a family of Dipterous Insects called False Crane-Flies.

RHYZOPHYSA. [ACALEPHÆ.]

RIBAND-FISH. [GYMNETRUS.]

RIBES (a name formerly given to a species of *Rheum*), a genus of Plants forming the natural order *Grossulariaceæ*. As this genus is the only one in the order, its characters, geographical range, and affinities are described with the order. It is well-known as producing the Currant and Gooseberry, and also for affording many of the ornamental shrubs of our gardens.

De Candolle divides the genus *Ribes* into four sections, of which the following is an analysis:—

Shrubs with prickles:—
- Peduncles 1-2-3-flowered. . *Grossularia.*
- Peduncles many-flowered . . *Botrycarpum.*

Shrubs without prickles:—
- Calyx campanulate . . *Ribesia.*
- Calyx tubular . . . . *Symphocalyx.*

* *Grossularia.*

This section includes some handsome shrubs, as well as the species which produces the common Gooseberry. Of these we shall notice a few that are most commonly found cultivated in this country.

R. Oxycanthoides, Hawthorn-Leaved Gooseberry. Prickles infra-axillary, solitary; leaves glabrous, lobes dentate; peduncles short, bearing 1-2 greenish white flowers. It is a native of rocky districts in Canada, and bears a fruit very much resembling that of the common gooseberry both in appearance and taste. Like many other described species of large genera, it has been supposed to be referrible to a more common form, the *R. glossularia*.

R. niveum, Snowy-Flowered Gooseberry. Prickles solitary, in pairs or threes; leaves glabrous, roundish, entire at the base: flowers two together in peduncles; sepals reflexed; stamens longer than the style. It grows to the height of 4 or 5 feet. It was found on the north-west coast of America by Mr. Douglas, who sent the seeds to England in 1826. The fruit is about the size of a black currant, of a deep red-purple colour. It is said to be of a superior flavour to the common gooseberry.

R. Cynosbati, Dog-Bramble Gooseberry. Infra-axillary prickles 1-2; leaves 3-4, lobed, pubescent; calyx campanulate, cylindrical; petals shorter than stigma and stamens; berry prickly. This plant is found in Canada, according to Pursh, and was discovered in India by Royle, and in Japan by Thunberg. It differs little from another well-known species, *R. divaricatum*, which has the tube of the corolla somewhat narrower and the stamens longer. Two varieties of this plant are recorded: one with smooth fruit, a native of Hudson's Bay; the other with prickly branches and fruit, shorter peduncles, pubescent purplish flowers, from Lake Huron.

R. grossularia, Common Gooseberry. This plant is too well known to require any description here, and is probably the parent of many of the other recorded species of *Ribes*. It is found wild in almost every part of England and Scotland, growing on old walls, in hedges and woods, although a question might be raised as to its being aboriginal in this island. It seems to be truly indigenous in France, Germany, and Switzerland; and according to Dr. Royle, is found in the Himalayas and on the banks of the Ganges. It has also been seen growing in North America, on rocks near the Falls of Niagara.

This plant does not appear to have been known to the ancients; and the earliest author who mentions it is Matthiolus, an Italian botanist. It was recorded as existing in England by Turner, Parkinson, and Gerard; but Ray is the earliest writer who mentions it as a cultivated species. The Dutch were the first to cultivate the gooseberry successfully, but even up to the time of Miller it seems to have gained very little repute in England as a fruit for the table. From its extensive cultivation, it has received a great variety of names. In Cheshire and the north of England it is called Feaberry, in Norfolk Feabes, both of which names are corruptions of Fever-berry, as, according to Gerard, it was at one time considered a specific against fevers. Grozzer is a common name for it in Scotland, which seems to be derived from the French name Groseille à Macquereau, which is again derived from the Latin *Grossularia*, and the use of the fruit as a sauce with mackerel. Its common name, 'gooseberry,' is derived from gorse-berry, because its prickles resembled those of the furze or gorse. Some derive this name from its berries being used as sauce for geese. [GOOSEBERRY, in ARTS AND SC. DIV.]

There are numerous varieties of this plant recorded, which chiefly vary in extent, size, and number of their prickles, and in the shape and size of their fruit and flowers.

** *Botrycarpum.*

This section includes four species intermediate between gooseberries and currants: they are however called by the former name. *R. orientale*, Eastern Gooseberry, with yellow green flowers, blowing in April and May. It is a native of Syria. *R. saxatile*, Rock Gooseberry, a native of Siberia, with greenish-purple flowers.

R. diacantha, Twin-Prickled Gooseberry. It flowers in May and June, having yellowish flowers and cuneated leaves. It grows wild in Dauria and other parts of Siberia. *R. lacustris*, Lake-Gooseberry, a native of moist places in Canada and Virginia, with flowers like a currant and prickles like a gooseberry.

*** *Ribesia.*

This section includes the greater number of the Currants, of which there are about 40 species.

R. rubrum, the Common Red Currant. The name Currant seems to be derived from the similarity of the fruit to the Corinth Raisin, or small grape of Zante, which are commonly called Corinth's, or Currants. This last is too well known to need a description. It is a native of Europe and Siberia, and the northern parts of North America, to the mouth of the M'Kenzie, and is found in mountainous districts in the north of England and Scotland. Like most plants that are easily disseminated and occupy varied elevation, latitude, and soil, this species is subject to many varieties. Of these seven have been recorded by De Candolle, which vary in the shape, size, and covering of their leaves, as well as the size and colour of their fruit. The writer of the article 'Ribes,' in Loudon's 'Arboretum et Fruticetum Britannicum,' observes, "The Common Red Currant is commonly treated by botanists as a distinct species, but we have no doubt whatever that *R. petræum*, *R. spicatum*, *R. alpinum*, *R. prostratum*, and several other botanical species are essentially one and the same thing. We have arrived at this conclusion from the study of the plants in the very excellent collections of this genus which are in the garden of the Horticultural Society of London, and in the arboretum of the Messrs. Loddiges."

The Currant is not mentioned by Greek and Roman writers, but it is scarcely possible that its beautiful red and sweet berries should have been neglected by the people amongst whom they grew. In France they were cultivated long before the Gooseberry, but were first produced in perfection by the Dutch. Gerard mentions that they were cultivated in gardens in his time. [CURRANTS, in ARTS AND SC. DIV.]

R. nigrum, the Black Currant. Flowers whitish or yellowish-green. Calyx a rich brownish-red or pink colour. The stamens and petals frequently present a remarkable peculiarity: the usual number of each is 5, but should either the petals or stamens be increased in number the other is diminished; thus, if there are 7 stamens there will be but 3 petals, and if there are 10 stamens there will be no petals, and vice versâ. The peculiar strong smell of the leaves of this

plant is very characteristic. The Black Currant has the same geographical range as the Red Currant, but is found more abundantly in the north than in the south of Europe. It is now common in Great Britain, but is probably not indigenous. It is found in Siberia, on the Caucasus, and in Sweden. It is indigenous in the woods of Russia as far as St. Petersburg, and in this district the fruit is found green, yellow, or even white. Species of *Ribes* are also found in India and South America with black fruit. There are three wild varieties—*R. bacca flavida*, with a dingy greenish-yellow fruit, supposed to be a hybrid between black and white currant; *R. bacca virida*, with green fruit; and *R. foliis variegatis*, with leaves streaked with yellow.

R. sanguineum, the Bloody or Red-Flowered Currant. Leaves cordate, serrated, villous beneath; racemes drooping, twice the length of the leaves; calyx with spreading segments. This is the most ornamental species of the genus, bearing large racemes of deep rose-coloured flowers, which are followed by berries of a bluish-black. It is a native of the north-west coast of America.

R. atropurpureum, the Dark Purple-Flowered Currant, is a native of the Altaï and mountainous districts on the river Ural.

**** *Symphocalyx.*

The species of this section are cultivated entirely as ornamental shrubs. Of these, *R. aureum*, the Golden-Flowered Currant, is best known. It is a native of America. Of this plant there are three varieties—*R. præcox*, *R. villosum*, and *R. serotinum*. They are all beautiful shrubs, and deserve a place in every collection.

RIBGRASS. [PLANTAGINACEÆ.]

RIBWORT PLANTAIN, the common name of the *Plantago lanceolata*. [PLANTAGO.]

RICCIACEÆ, *Crystal-Worts*, a natural order of moss-like Plants or Herbs, inhabiting mud or water, swimming or floating, usually annual; their leaves and stems blended into a frond of a cellular structure, creeping, green or purple underneath, with a distinct epidermis, and a cavity of air-passages beneath it in some species.

These plants form a plain transition from *Thallogens* to *Acrogens*. Their spores are collected in large numbers within organs resembling the pistils of Phænogamous Plants. They have a distinct axis of growth, and an epidermis is distinctly formed with stomates for breathing with. The genus *Duriæa* is regarded as forming the nearest transition to Liverworts. It fructifies under water, which is very seldom the case with the other Crystal-Worts.

Of the species hitherto known two-thirds have been observed in Europe, and the remainder in various parts of the world. Several species in North America, the Cape of Good Hope, and Brazil, appear to be very similar to those of Europe. There are 8 genera and 29 species.

(Lindley, *Vegetable Kingdom.*)

RICE. [ORYZA.]

RICE-BIRD, one of the names of the Paddy Bird, Paddee Bird, or Java Sparrow. It is the *Loxia oryzivora* of Linnæus.

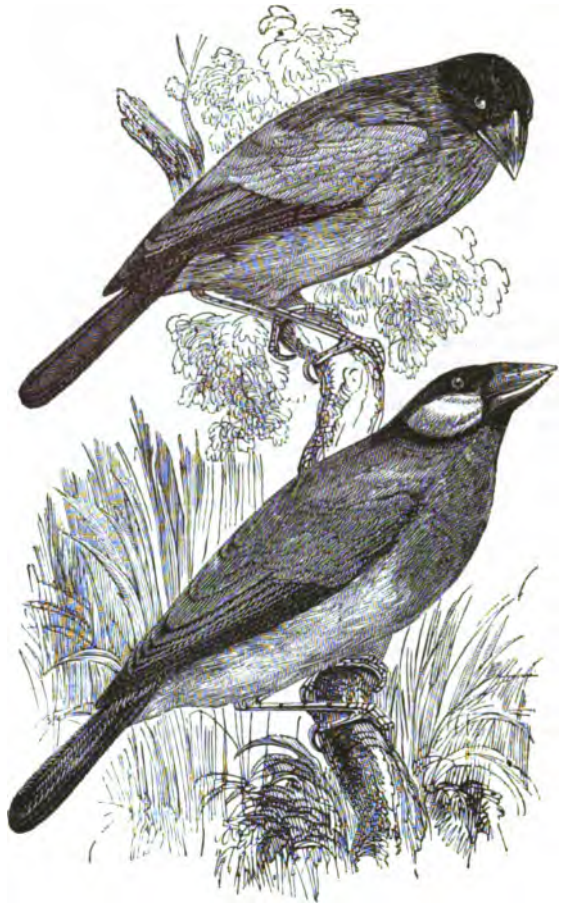
This well-known bird, whose plumage is well described by Buffon as being so well arranged that no one feather passes another, whilst all appear covered with that kind of bloom which is visible on plums, giving them a beautiful tint, has the bill very much developed; indeed, with the exception of *Pyrenestes* and perhaps *Coccothraustes*, this finch is the most remarkable of the race for the size and power of that organ.

The colour of this bird is bloomy lead-coloured; head and tail black; bill red; belly obscurely rosy; cheeks in the male snowy; legs flesh-coloured.

In Java, where it is called Glate, and the other parts of Asia where it is found, it has a very bad reputation on account of the ravages which it commits in the rice-fields with its powerful and sharp bill. In Sumatra the name of the bird is Boorong Peepee. It is often brought alive to this country, and confined in aviaries for the sake of its elegant shape and graceful colouring: its song, which is short and monotonous, does not much recommend it. This species must not be confounded with the Rice-Bird of America, *Emberiza oryzivora*, Linn. [BOB-O-LINK.] (See figures in next column.)

RICHA'RDIA, a genus of Plants belonging to the natural order *Araceæ*, of which only one species is known, the *R. Æthiopica*. It was introduced into this country from the Cape, under the name of *Calla Ethiopica*, in 1731. It is also found wild at St. Helena. It is one of the most beautiful of Aroideous plants. Its large spathe is pure white, surrounding a spadix which is coloured deeply yellow by its antheriferous flowers. *Richardia* is a hardy plant, bearing well our mildest winters, and growing in great vigour and beauty in the ordinary apartments of a house. It may be made to blossom all the year round.

RICHARDSO'NIA, a genus of Plants belonging to the natural order *Cinchonaceæ*, named by Houston in honour of Richardson, an English botanist of the sixteenth century. This genus was called *Richardia* by Linnæus, but that name has been given to another plant. Most of the species of *Richardsonia* are natives of South America. They possess emetic properties, and under the name of White Ipecacuanha, &c., are used extensively as a substitute for the true Ipecacuanha (*Cephaëlis Ipecacuanha*).



Rice-Bird (*Loxia oryzivora*, Linn., *Fringilla oryzivora* of Swainson and authors). Upper figure, female; lower figure, male. (Swainson.)

RICINULA. [ENTOMOSTOMATA.]

RI'CINUS, an apetalous genus of Plants belonging to the natural order *Euphorbiaceæ*. This word is derived from 'ricinus,' the Latin name for a species of insect which the fruit of this plant was supposed to resemble. (Pliny, 'Nat. Hist.,' xv. 7.) The common name of *Ricinus* is Palma Christi, a name applied to these plants by Brunfels, Matthiolus, and other older botanists, on account of the form of its elegant lobate leaves. It was originally a native of Asia, but is now naturalised in Africa, America, and the south of Europe. The characters of this genus are:—Flowers monœcious; calyx 3-5-parted, valvate; no petals; filaments numerous, polyadelphous; style short; stigmas 3, bipartite, feathery; ovary globose, 3-celled, with an ovule in each cell; fruit capsular, tricoccous; leaves alternate, stipulate, palmate, glands at apex of petiole; flowers in terminal panicles; trees, shrubs, or herbs, becoming arborescent.

R. communis, Common Palma Christi, is best known as producing castor-oil. It has peltate palmate leaves, with lanceolated serrated lobes; an herbaceous glaucous stem, of a purplish red-colour upwards, and flowers in long green and glaucous spikes springing from the divisions of the branches, the males from the lower part of the spike, the females from the upper; the capsules are prickly. It varies in size; in Britain it is seen seldom more than three or four feet in height, but in India it is a tree; and Clusius mentions it as measuring from two to four feet round its stem in Spain. Lindley refers several species distinguished by Willdenow to this form, namely, *R. viridis*, *R. Africanus*, *R. lividus*, and *R. inermis*. ('Flora Medica.')

R. communis will grow freely in this country, and when sown in pots or hot-beds early in the season, and transplanted in spring, it forms a very handsome border annual.

RIET-BOC. [ANTILOPEÆ.]

RIGGLE, a name for the Sand Eel. [AMMODYTES.]

RING-BIRD. [EMBERIZIDÆ.]

RING-DOVE. [COLUMBIDÆ.]

RING-THRUSH. [MERULIDÆ.]

RING-TAIL. [FALCONIDÆ.]

RING-TAILED EAGLE. [FALCONIDÆ.]

RINGENT, a form of the corolla of plants. [FLOWER.]

RINGS, FAIRY, is a name given to certain spots which are observed amongst grass in fields, and which are characterised by being more

luxuriant than the surrounding herbage. They are of two kinds: either an entire knot of grass is more luxuriant than the rest, or the luxuriant grass grows in a circle or the segment of a circle around a comparatively barren spot. The name of fairy rings was originally given to these spots because they were supposed to be the places where the little fairies held their nightly revels. Recently a better cause has been assigned for their origin. They are now known to be those portions of the surface on which a species of fungus has grown, which by dying has afforded nutriment for the grass on the spot; and as the fungus grows in this particular place on account of something favourable to its development, it continues year after year to extend itself beyond the small circular space to which it was originally confined; but as the grass in the centre loses the stimulating influence of the decayed fungus, this part becomes comparatively barren, and thus the ring of luxuriant grass keeps on extending for many years, till the earth, no longer affording the circumstances necessary to the development of the fungus, it dies. There are several species of fungus that produce this effect. It was first noticed by Dr. Withering as occurring with the *Agaricus oreades;* but the Common Mushroom (*A. campestris*), the Gigantic Puff-Ball (*Bovista gigantea*), and many others may be seen in the act of forming these circles. It is very probable that most of the large *Fungi* would form these rings during their growth, provided the entire surface of the earth by which they were surrounded afforded the circumstances necessary to their growth.

RIOLITE. [Zinc.]

RIPIDOLITE, a variety of Chlorite. [Chlorite.]

RIPPLE-MARK. In geology, the undulations on the surface of many rocks, which resemble the ridges and hollows left on mud and sand by the small waves of water, are thus termed.

The progress of geological induction has given an unexpected importance to the study of these undulations; for it is now certain that the right understanding of their origin is a very necessary element in reasoning on the deposition of stratified rocks and the displacements of the ancient bed of the sea.

The formation of small ridges and furrows, under the influence of water which ripples or undulates in small waves, may be conveniently witnessed and studied on the shores of comparatively quiet seas, on the margins of lakes, or along the sides and shallow beds of rivers. The ripple-mark thus produced is more or less permanent, according to the nature of the sediments on which it is impressed, and the circumstances which accompany and succeed the withdrawal of the water which formed it.

Loose coarse sand easily receives impressions from the superfluctuating water, which momentarily change under the varying influences of the waves: muddy sediments are less easily moulded, but the forms are less fleeting. It happens often that on the gradual retreat of the tide from broad muddy surfaces like those in the Bay of Morecambe, or along the shores of the Thames, the small rippling waves of the ebbing tide leave marks sufficiently durable to allow of being indefinitely preserved, if by any gradual operation some new sediments were gently overlaid.

A very small ripple leaves its mark on the subjacent sand or mud at only very small depths: larger waves are felt to a greater depth; and apparently the depth at which ripple-marks are formed may be judged of, within moderate limits of error, by the breadths of the ripple-marks. Wherever then we find among marine stratified rocks or sediments, of whatever date, undoubted ripple-marks such as shallow waters leave, those deposits contain clear proof of their having been formed at small depths; and when, as frequently happens, these are seen to be covered by other sediments hundreds or thousands of feet in thickness, the conclusion is just that in those situations the ancient sea-shore underwent a great subsidence, or the ocean-level experienced a great rise, after the formation of those now buried ripple-marks. There has been in those situations a change of the level of land or sea. Now, we find ripple-marked strata among the rocks of every geological age. As examples, we mention, among strata lower than the Mountain Limestone, the Fossiliferous Rocks (Grauwacke) near Kirby Lonsdale, and near Linton in North Devon; in the sandstones of the Mountain Limestone Group, under Penyghent in Yorkshire; in the sandstone of the Coal-Formation at Elland in Yorkshire; in the sandstones of the New Red-Sandstone-Formation at Storeton near Liverpool; in the sandstones of the Oolitic Rocks near Scarborough and near Stamford; in the Wealden deposits at Horsted.

In most cases ripple-mark is found on sandstones or indurated clays of fine grain and frequent lamination, and it is most distinct on surfaces where a change of deposit happens, as where sandstones alternate with thin clay partings. Rarely, as in the Storeton quarries, impressions of quadrupeds accompany the ripple-mark; and it is even thought that marks of rain are preserved thereon.

(Babbage, *Ninth Bridgewater Treatise;* Playfair, *Huttonian Theory;* Lyell, *Principles of Geology;* De la Beche, *Theoretical Researches.*)

RI'SCULUS. [Pœcilopoda.]

RI'SSOA, M. De Freminville's name for a genus of Gasteropodous *Mollusca*, founded on some small shells observed by M. Risso of Nice, and described by M. Desmarest in 1814 in the 'Nouveau Bulletin de la Société Philomathique.'

Lamarck placed the few species known to him among the *Melanias*, but without distinction. Delle Chiaje made known the animal structure of a Mediterranean species in his 'Memoirs on the Invertebrata of the Neapolitan Sea;' and Philippi recorded its generic characters in his 'Enumeratio Molluscorum Siciliæ,' from observations made upon two other Mediterranean species.

The animal has a subtriangular foot, truncated anteriorly, pointed posteriorly. Head proboscidiform, with a subulate tentacle on each side, at the external base of which the eye is placed on a little convexity; mouth prolonged into a short and truncated proboscis.

Shell elongated, turriculate, sometimes short and subglobular; aperture oval, semilunar, subcanaliculate, having the right lip thickened, and nearly always projecting forwards, and arched longitudinally; operculum horny, closing the aperture exactly.

M. De Blainville divides the genus into the following sections:—

A. Turriculated and Ribbed. Ex. *R. acuta.*

B. Subturriculated and Ribbed. Ex. *R. costata.*

C. Subturriculated; perfectly smooth. Ex. *R. hyalina.*

D. Subglobular. Ex. *R. cancellata.*

The same divisions are adopted by M. Rang.

There are about 70 recent species, which are very generally distributed, but are most abundant in the north temperate zone. They are found in North America, the West Indies, Norway, the Mediterranean, the Caspian, and in other seas. Messrs. Forbes and Hanley describe 27 species as inhabitants of the British seas. *Hydrobia Lyncera, Nematura,* and *Jeffreysia* are sub-genera.

One hundred species have been described as fossil. They are found in the Permian Rocks of Great Britain and France.

RIVER-HORSE. [Hippopotamus.]

ROACH. [Leuciscus.]

ROAN-TREE. [Pyrus.]

ROBIN, RAGGED. [Lychnis.]

ROBIN-REDBREAST. [Erythaca.]

ROBI'NIA, a genus of Plants belonging to the natural order *Leguminosæ*, named in commemoration of John Robin, a botanist in the time of Henry IV. of France. This genus is known by having an inferior perianth; teeth of calyx 5, lanceolate, two upper ones shorter and approximate; corolla papilionaceous; ovary with from 16 to 20 ovules; style bearded in front, and legume sub-sessile and many-seeded. They are North American trees, bearing nodding racemes of white or rose-coloured flowers. The genus *Robinia* formerly comprehended the plants now included under *Caragana*, from which it is distinguished by its long gibbous legume and unequally pinnate leaves.

The best known species of *Robinia* is the *R. pseudacacia*, the Bastard or False Acacia. It has stipular prickles, with loose pendulous racemes of white sweet-smelling flowers, which, as well as the legumes, are smooth. This tree, which is now so well known, was first grown in Europe by Vespasian Robin, the son of the botanist, after whom the genus was named, in the Jardin-des-Plantes at Paris.

It has always been known in America as affording an exceedingly hard and durable wood. It is there used for making posts, and occasionally trees are found large enough to be employed in ship-building; but its greatest consumption is for making trenails, by which the timbers of ships are fastened together, and for this purpose large quantities are used in the royal dockyard at Plymouth, which are imported from America.

Cattle are fond of the young shoots, and on this account it has been recommended to be cultivated as forage.

The roots and other parts of the plant, like many of its order (*Leguminosæ*), contain a saccharine principle, which accounts for the nutritive properties of the leaves. In St. Domingo the flowers are used for making a distilled liquor, which is said to be very delicious. It folds up its leaves at the approach of night.

There are two other species frequently cultivated in this country, *R. viscosa*, the Clammy Robinia, and *R. hispida*, the Hairy Robinia, or Rose-Acacia. The former is characterised by the sticky secretion with which it is covered, and which has been discovered to possess a peculiar vegetable principle. The latter, which is the smallest of the three species here mentioned, has very large flowers, and forms a very ornamental shrub when grown on an espalier rail or against a wall.

ROCAMBOLE. [Allium.]

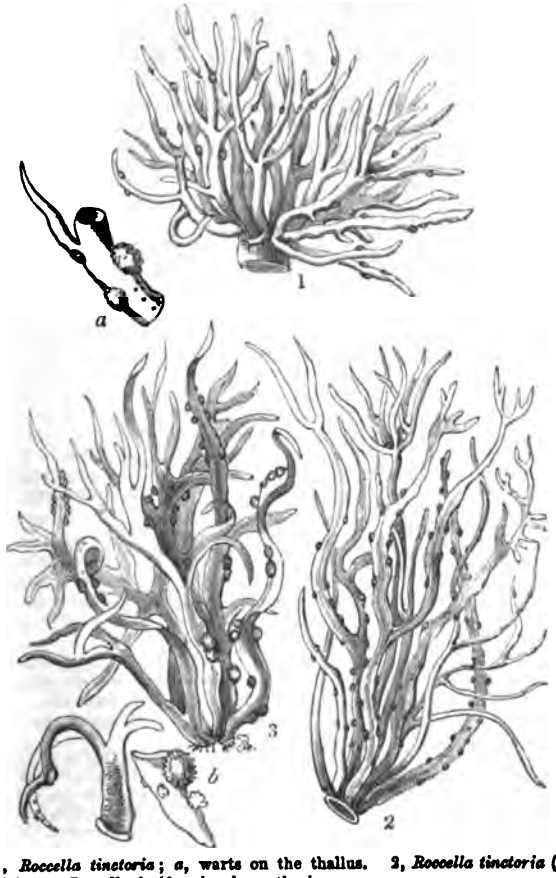
ROCCELLA, a genus of Plants belonging to the family of Lichens. The species are used in dyeing, and are popularly called Orchil, or Archil. This name is derived from the Oricello of the Italians or the Spanish Orchella. It is often corrupted in commerce into Rochilla-Weed. Several species of Lichens are employed for the same purpose, which are distinguished according to the country whence they are imported, and also by manufacturers into Weed and Moss, the former name being applied to the Filiform Lichens of botanists belonging to the genus *Roccella*, to be treated of here, whilst the terms Moss and Rock-Moss are applied to the Crustaceous Lichens belonging to the genus *Lecanora*, which include the Cudbear and Parelle of dyers. [Parella.]

The character of the genus *Roccella* is as follows:—Thallus coriaceo-cartilaginous, rounded or plane, branched or laciniated; apothecia orbicular, adnate with the thallus; the disc coloured, plano-convex, with a border at length thickened and elevated, formed of the thallus, and covering a sublentiform black compact pulverulent powder, concealed within the substance of the thallus.

R. tinctoria, Dyer's Roccella, or Orchil. Thallus suffruticose, rounded, branched, somewhat erect, grayish-brown, bearing powdery warts; apothecia flat and horny, with a scarcely prominent border. A practical writer describes "the good kind as having a nearly white powder on its surface towards the centre; the under surface is of a gray colour, and is not hairy; if wetted, it does not turn of an orange colour; its edges are flat and thin."

R. fuciformis, the Flat-Leaved Orchil. Thallus flat, branched, nearly upright, grayish-white, bearing powdery warts; apothecia horny, bordered.

Both kinds are found on maritime rocks, or on dry stone walls exposed to the influence of the sea-breeze, as well on the coast of England as on the shores of the Mediterranean and the East Indies. [ORCHIL, in ARTS AND SC. DIV.] The more arid the situation, the better is the quality of the lichens. The presence of the colouring-matter is ascertained by steeping the weed broken up in small pieces in diluted solution of ammonia, in a bottle half filled with liquid, which should be kept corked, but frequently opened in a temperature not exceeding 150° Fahr.



1, *Roccella tinctoria*; *a*, warts on the thallus. 2, *Roccella tinctoria* (East India). 3, *Roccella fuciformis*; *b*, apothecia.

ROCHEA (named after La Roche, a French botanist), a genus of Plants belonging to the natural order *Crassulaceæ*. It has a 5-lobed calyx; petals 5, united into a gamopetalous hypocrateriform corolla, with a short tube, equal in length to the spreading limb or shorter than it; stamens 5, alternating with the petals, a little exserted; glands and carpels 5. The species are fleshy simple succulent shrubs. The leaves opposite, connate at the base, thick, and white. The flowers are disposed in terminal corymbs, without any bracts. A large number of the species are cultivated in our gardens and greenhouses.

ROCINELLA. [ISOPODA.]

ROCK-CRYSTAL. [QUARTZ.]

ROCK-FISH, a name for the Black Goby. [GOBIUS.]

ROCK-MANAKIN. [RUPICOLINÆ.]

ROCK-PLANTS are those plants which are distinguished by growing on or among naked rocks, and are confined to no particular region or latitude. De Candolle ('Dictionnaire des Sciences Naturelles,' vol. xviii.) observes that they pass by insensible gradations into the plants that inhabit walls, rocky and stony places, and even gravelly places, from which they pass into those that are found particularly on sands and barren soils. Most of the plants growing on rocks have but a small development of root, as they derive their nutriment principally from the air, through the medium of their leaves and stems. A large number of the *Cryptogamia*, especially Mosses and Lichens, belong to this class. Many of these plants present a remarkable diversity, according to the nature of the rocks on which they grow. [VEGETABLE KINGDOM.]

ROCK-ROSE. [CISTUS.]

ROCK-SALT. [SODIUM.]

ROCK-SNAKE. [BOIDÆ.]

ROCKET. [ERUCA.]

ROCKET, SEA. [CAKILE.]

ROCKET, YELLOW. [BARBAREA.]

ROCKLING. [MOTELLA.]

ROCKS, in Geology, are any aggregation or collection of minerals or fragments of mineral matter, whether they are crystalline or amorphous, hard or soft, compact or loose. On this account they vary exceedingly in character, and no simple definition will give an idea of a rock as distinct from other objects around. The causes which produce them are the great agents of all geological change. They may be merely mechanical heaps, chemical crystallisations, and contain in them organic beings or not. Their exceedingly mixed character makes it difficult to classify them, independent of their age, as arranged in the various geological strata. [GEOLOGY.]

The most prevalent classification of rocks in actual use is founded on one leading feature of their origin and history. Rocks are of igneous origin (Pyrogenous Rocks), or of aqueous origin (Hydrogenous Rocks), and thus make two great classes; the former being often considered, with reference to the circumstances of their occurrence in two divisions, namely, hypogene or Plutonic rocks (as granite), and volcanic rocks (as obsidian); the latter being distinguished into fresh-water and marine deposits, the result of chemical, vital, and mechanical agencies exerted in water. Many cases are known of an alteration of these hydrogenous rocks by contact with Plutonic or volcanic masses: by this change they acquire the name of Metamorphic Rocks. Thus clays and sandstones are hardened, and have their structure altered so as to resemble clay-slate, quartz-rock, or jasper; and chalk and limestone are rendered crystalline.

Adopting as the best and most applicable the fundamental distinction of pyrogenous and hydrogenous rocks, the student will find by experience that the best if not the only good way of describing and recognising rocks, is by attending to their elementary composition. The granitic, porphyritic, amygdaloidal, or other structures of igneous rocks, are so many variable circumstances due to particular accidents in the fusion or cooling of the masses, and belong more or less to all of them, as the compact, oolitic, arenaceous, and other characteristic textures of hydrogenous rocks, mark peculiarities of their aggregation or solidification.

Mr. Scrope has successfully shown, in his 'Synopsis of Volcanic Rocks' ('Journal of Science, vol. xxi.), that these various compounds may be easily and philosophically classed by consideration of the relative abundance of two minerals seldom absent from any of them, namely, felspar and augite. (The felspar is sometimes replaced by leucite, haüyne, olivine, or mellite; the augite by hornblende or titaniferous iron.) Hence we have only three great groups:—

Felspathic	Trachyte.
Augito-Felspathic . . .	Graystone.
Augitic	Basalt.

To each of these belong many varieties, and many gradations of granitic, porphyritic, amygdaloidal, and other structures. [LAVA.] By a similar method we may class the older or Plutonic rocks of fusion, as:—Felspathic—granite, porphyry, felspar rock, claystone, eurite, pitchstone; Augito-Felspathic—sienite, euphotide; Augitic—sienite, hypersthene rock, greenstone, basalt, wacké, melaphyre.

The hydrogenous rocks of most importance may be classed according to their arenaceous, argillaceous, calcareous, or other basis, as:—

Arenaceous, uniform, as sandstones, sands; aggregated as conglomerates, pudding-stones.

Argillaceous, uniform, as clay and shale; containing fragments, as some clay conglomerates.

Argillo-Calcareous, as marls properly so called.

Calcareous, as chalk, limestone.

Calcareo-Magnesian, as dolomite.

Haloid, as gypsum, rock-salt.

Carbonaceous, as coal, lignite.

Ferruginous, as ironstone.

Cupriferous, as the kupferschiefer.

Finally, all these hydrogenous rocks are liable to local changes, by contact or proximity with the rocks of fusion. These metamorphic rocks may be classed according to the same form as those which are unaltered. We give below authentic examples of several cases of metamorphism:—

1. Arenaceous Rocks, metamorphic by induration, as along greenstone dykes in Arran, and Salisbury Crags. Similar effects happen beneath iron-furnaces, and when the effect is in extreme the result is quartz rock.

2. Argillaceous Rocks, metamorphic by induration, and a certain confluence of grains. In extreme cases the result is a kind of clay-slate, or hone-slate, or Lydian stone, with cubic pyrites, and rarely garnets, imbedded. An example of the latter occurs at Plas Newydd.

3. Calcareous Rocks, metamorphic by re-arrangement of particles,

Thus granular or saccharoid limestone is found by the side of the basaltic dykes in Antrim, on the greenstone of Teesdale, near the hypersthene of Skye, &c. The limestone among primary strata is of similar appearance, though not in contact with igneous rocks.

4. Carbonaceous Rocks. Coal becomes coke or anthracite near basaltic dykes.

Examinations of this kind have shown that ordinary sedimentary rocks altered by heat acquire aspects and structures and compositions resembling almost exactly those most common among the earliest or primary strata, as quartz rock, clay-slate, garnet mica-slate, garnet gneiss, granular marble, &c.; and it is therefore a probable inference that in all such cases of strict resemblance those ancient rocks have undergone on a great scale, and under the general influence of the intense heat of the earth, the changes which are certainly proved to have happened locally, from limited agencies, on substances of similar chemical quality. Very careful investigations on these points are however still needed to fix limits and give precision and certainty to the inferences from phenomena. [BASALT; GRANITE; GRAUWACKE; GNEISS; LAVA; MICA-SCHIST; PORPHYRY; STRATIFICATION.]

RODE'NTIA, an order of Animals belonging to the class *Mammalia*, embracing the Rats and Mice, Hares, Rabbits, Guinea-Pigs, and other well-known animals.

The following is Mr. Waterhouse's arrangement of these animals:—

		Europe and North Asia.	North America.	Africa.	India and Islands.	South America and West India Islands.
MURINA	SCIURIDÆ	5. *Sciurus.* 1. *Pteromys.* 1. *Tamias.* 3. *Spermophilus.* 2. *Arctomys.*	20. *Sciurus.* 3. *Pteromys.* 5. *Tamias.* 10. *Spermophilus.* 8. *Arctomys.* 1. *Aplodontia.*	5. *Sciurus.* 3. *Xerus.*	25. *Sciurus.* 9. *Pteromys.*	6. *Sciurus.*
	MURIDÆ	3. *Myoxus.* 8. *Dipus.* 16. *Mus.* 6. *Cricetus.*	2. *Meriones.* 6. *Mus.* *Hesperomys.* 1. *Sigmodon.* 2. *Neotoma.*	2. *Graphiurus.* 3. *Myoxus.* 4. *Dipus.* 10. *Mus.* 2. *Dendromys.* 6. *Gerbillus.* 1. *Psammomys.* 3. *Euryotis.*	12. *Mus.* 2. *Gerbillus.* 1. *Phlæomys.* 2. *Rhizomys*	30. *Mus.* *Hesperomys.* 3. *Reithrodon.*
	ARVICOLIDÆ	1. *Castor.* 20. *Arvicola.* 4. *Lemmus.* 2. *Spalax.*	1. *Castor.* 1. *Ondatra.* 8. *Arvicola.* 4. *Lemmus.* 10. *Geomys.*			
HYSTRICINA	HYSTRICIDÆ	1. *Hystrix.*	1. *Erethizon.*	1 *Hystrix.*	1. *Hystrix.* 1. *Atherura.*	3. *Cercolabes.* 2. *Synetheres.*
	OCTODONTIDÆ			1. *Aulacodus.* 1. *Orycterus.* 4. *Bathyergus.* 1. *Petromys.*		3. *Capromys.* 1. *Myopotamus.* 10. *Echimys.* 6. *Nelomys.* 1. *Cercomys.* 2. *Dasyprocta.* 1. *Œlogenys.* 2. *Ctenomys.* 1. *Poephagomys.* 1. *Octodon.* 2. *Abrocoma.*
	CHINCHILLIDÆ					1. *Chinchilla.* 2. *Lagotis.* 1. *Lagostomus.*
	CAVIIDÆ					6. *Cavia.* 2. *Kerodon.* 1. *Dolichotis.* 1. *Hydrochærus.*
LEPORINA	LEPORIDÆ	5. *Lepus.* 3. *Lagomys.*	15. *Lepus.* 1. *Lagomys.*	6. *Lepus.*	4. *Lepus.* 1. *Lagomys.*	1. *Lepus.*
		81 species. 16 genera.	99 species. 19 genera.	53 species. 16 genera.	58 species. 10 genera.	89 species. 25 genera.

These animals have two great incisor teeth in each jaw, separated from the molars by a wide space, with which they could hardly seize a living prey, or rend flesh; they could not even cut aliments, but they might serve for reducing them by continued labour into fine molecules—in a word, for gnawing them; whence the term Rodents, or Gnawers, applied to this order. With these weapons they attack the hardest vegetable productions, and frequently feed on wood and bark. The better to effect this object, these incisors have enamel in front only, so that their posterior border being worn away more than their anterior edge, they are always kept set like a chisel; their prismatic form causes them to grow from the root in proportion to the wearing down of their cutting edge; and this disposition to grow or push forward from the root is so strong, that if one of them is lost or broken, its antagonist, meeting with no opposition to keep it within bounds, develops itself so as to become monstrous. [BEAVER.] The lower jaw is articulated by a longitudinal condyle, so as to have no horizontal movement except from behind forwards, and vice versâ, convenient for the action of gnawing; the molars consequently have flat crowns, the enamelled eminences of which are always transversal, so as to be in opposition to the horizontal movements of the jaw, and to be better adapted for trituration.

The genera in which these eminences are simple lines, and which have the crown of the tooth very flat, are more exclusively frugivorous; those which have the eminences divided into blunt tubercles are omnivorous; and, finally, the small number of those which have points more willingly attack other animals, and approximate a little to the *Carnivora*.

The form of the body of the Rodents is in general such that their hinder parts exceed their anterior ones, so that they leap rather than walk; this disposition in some of them is as excessive as in the Kangaroos.

The intestines of the animals of this order are very long; their stomach simple or slightly divided; and their cæcum often very voluminous, even more so than the stomach. The *Myoxi* (Dormice) want the cæcum.

The brain of the Rodents is nearly smooth and without convolutions; the orbits are not separated from the temporal fossæ, which have but little depth; the eyes are entirely directed laterally; the zygomatic arches, delicate and curved below, announce the weakness of the jaws;

the fore arms have scarcely any rotatory motion, and their two bones are nearly united; in a word, the inferiority of these animals shows itself in the greater part of the details of their organisation. Nevertheless, the genera which have the strongest clavicles enjoy a certain dexterity, and use their fore feet for carrying their food to their mouth; others again (the Squirrels) climb trees with facility. ('Règne Animal.')

Preparations of the structure of these animals may be seen in the museum of the Royal College of Surgeons.

The following animals are arranged by Cuvier under the order *Rodentia*:—

The Squirrels (*Sciurus*, Linn.), namely, the Squirrels properly so called (*Sciurus*, Cuv.); the Flying Squirrels (*Pteromys*); and the Aye-Aye (*Cheiromys*).

The Rats (*Mus*, Linn.), namely, the Marmots (*Arctomys*, *Spermophilus*); the Dormice (*Myoxus*, Gm.); the Spiny Rats (*Echimys*, *Hydromys*, *Capromys*); the Rats properly so called (*Mus*, Cuv.); the Jerbilles (*Gerbillus*, *Meriones*); the Hamsters (*Cricetus*); the Field-Rats (*Arvicola*, Lacèp.), subdivided into the Ondatras (*Fiber*, Cuv.), the ordinary Field-Rats (*Arvicola*, Cuv., *Hypudæus*, Ill.), and the Lemmings (*Georychus*, Ill.); *Otomys*, and the Jerboas (*Dipus*, Gm.).

The Jumping Hares (*Helamys*, F. Cuv.; *Pedetes*, Ill.).

The Rat-Moles (*Spalax*, Guld.).

Bathyergus (Oryctères, F. Cuv.).

Geomys (*Pseudostoma*, Say; *Ascomys*, Licht.).

Diplostoma, Raf.

The Beavers (*Castor*).

The Coulas (*Myopotamus*, Com.).

The Porcupines (*Hystrix*, Linn.), namely, the Porcupines properly so called (*Hystrix*, Cuv.); *Atherurus*, Cuv.; *Erethizon*, F. Cuv.; and the Coendous (*Synetheres*, F. Cuv., *Cercolabes*, Brandt).

The Hares (*Lepus*, Linn.), namely, the True Hares (*Lepus*, Cuv.), and *Lagomys*, Cuv.

The Capybara (*Hydrochærus*, Erxl.).

The Guinea-Pigs (*Anœma*, F. Cuv.; *Cavia*, Ill.).

The Mocos (*Kerodon*, F. Cuv.).

The Agoutis (*Chloromys*, F. Cuv.; *Dasyprocta*, Ill.); and

The Pacas (*Cœlogenys*, F. Cuv.).

In this work the genera and species of *Rodentia* have been described under the following heads:—Chinchillidæ, Hystricidæ, Leporidæ, Muridæ, Sciuridæ, Beaver, Ondatra, Cœlogenys, Agouti, and Kerodon.

ROEBUCK. [Cervidæ.]

ROEMERIA (named after Dr. John James Römer, professor of botany at Landshut; he was author of several botanical works, and died in 1820), a genus of Plants belonging to the natural order *Papaveraceæ*. It has 4 petals, numerous stamens, 2-4 sessile stigmas, an elongated 2-4 valved 1-celled capsule with distinct placentas. The species are annual herbs yielding a yellow juice, with violet flowers.

R. hybrida, Hybrid-Roemeria, has a 3-valved erect pod with a few rigid leaves at its extremity. This plant is a native of Europe and the north of Africa, in cultivated fields and vineyards, especially on the coasts of the Mediterranean. It is also found in England in chalky corn-fields in Cambridgeshire and Norfolk. Although now having the appearance of a native, this plant has been probably introduced into this country. Two other species, *R. refracta* and *R. bivalvis*, have been described: the first a native of Tauria, the second of Syria.

(Don, *Dichlamydeous Plants;* Babington, *Manual of British Botany.*)

ROLLER. [Coracias.]

ROMANZOVITE. [Garnet.]

ROMEINE, a Mineral occuring crystalised in square octahedrons, in groups of minute crystals. Colour hyacinth, or honey-yellow. Hardness, scratches glass. It is found at St. Marcel, in Piedmont.

Its analysis by Damour gives:—

Antimonious Acid	79·17
Lime	16·65
Protoxide of Manganese	2·16
Protoxide of Iron	1·19
Silica	0·60
	99·77

RONDELETIA, a genus of Plants belonging to the natural order *Rubiaceæ*, named after Rondelet, a French botanist of the 16th century. It is characterised by having a calyx with a subglobular tube. Corolla superior, funnel-shaped, ventricose at the throat; segments 4-5, ovate-obtuse, spreading; anthers 4-5, sessile within the corolla; ovary 2-celled; style filiform; stigma bifid; capsule round, crowned with the limb of the calyx. Seeds minute, numerous, or few when abortive. The genus, as formerly constituted, included many shrubby trees which occur in India (Roxb., 'Fl. Indica'), but these have been referred by modern botanists to *Adenosacme*, *Greenia*, and *Wendlandia*. The present genus *Rondeletia* occurs chiefly in America and the West Indies.

ROOK. [Corvidæ.]

ROOT is that part of a plant which is sent downwards into the earth, at the same time that the stem is sent upwards into the air. Every part of the plant which exists underground is not root, as large portions of the stem itself may remain under the surface of the earth; and large buds, called bulbs, also exist underground. These parts have been often confounded with the root. The creeping root, and some forms of the tuberous and bulbous roots of older botanical writers, are only so many different forms of the stem. [Exogens.]

The root is distinguished by certain structural peculiarities, by which it may be easily known from the stem. First, its ramifications are irregular, not having the symmetrical form of branches, nor are they developed like branches from buds. Secondly, roots generally produce no leaf-buds. When they do appear, which occasionally occurs, they are called adventitious buds. Thirdly, roots never have leaves, scales, or other appendages developed upon their surface; and fourthly, the cuticle of roots is never found to possess stomates, which are frequently very numerous on various parts of the stem.

The smaller divisions of roots are called fibrils, which consist of a little bundle of ducts or spiral vessels, surrounded by woody fibres, lying in a mass of cellular tissue. At the apex of the fibril the cellular tissue is loose and devoid of cuticle, from which cause it absorbs more rapidly the fluid by which it is surrounded than the other parts of the root. Although the terminations of the roots cannot be considered as special organs, they have been named by De Candolle spongelets, or spongioles, in reference to their absorbing power.

The relation between the size and extent of the roots and that of the branches varies very much. In some tribes, as the *Coniferæ* and *Palmaceæ*, the roots are very insignificant compared with the size of the stem. In other plants the roots are much the longest, as in the lucern, &c. In the greater proportion of trees the roots extend wider than the branches, but do not penetrate so deep as the stem is high.

The internal structure of the root resembles that of the stem, but in Exogens the roots do not possess a central pith. The cellular tissue of many roots is exceedingly abundant, and on this account they are used as articles of diet. Many of these roots, by attention to their culture, may be increased in size; and the growth of esculent roots is an object of importance in the kitchen-garden. The principal esculent roots are: the Jerusalem Artichoke (*Helianthus tuberosus*); Turnip (*Brassica Rapa*); Carrot (*Daucus Carota*); Parsnip (*Pastinaca sativa*); Red-Beet (*Beta vulgaris*); Skirret (*Sium Sisarum*); Scorzonera, or Viper's-Grass (*Scorzonera Hispanica*); Salsafy, or Purple Goat's-Beard (*Tragopogon porripolius*); Radish (*Raphanus sativus*). Besides these, which are commonly cultivated, there are many of our native plants which possess roots yielding a nutritive matter, and are occasionally used as articles of diet. The Arrow-Head, Common Arum, Bitter Vetch, or Mouse-Peas, Earth-Nut, Meadow-Sweet, Pile-wort, Silver-Weed, Solomon's Seal, and Common Comfrey, are recorded as yielding edible roots. ('Cyclopædia of Gardening.')

During dry seasons and in dry situations the roots of many plants swell and become tuberous, which seems to be a provision for supplying nutriment to the stem and its appendages.

Roots are called annual, biennial, or perennial, according to their duration. When a root perishes after its first year's herbage and flowering, it is annual; if after the second year's herbage and first year of flowering, it is biennial. If a root endures for many years, although its herbage may perish every year, it is perennial.

There are various forms of roots distinguished by botanists. The Fibrous Root possesses a multitude of small divisions of the fibrillæ, as is seen in the *Poa annua* and many other grasses. The Nodulose Root presents occasional dilatations, as in the *Phleum nodosum*. A Præmorse Root is one in which the extremity of the primary axis has perished, or its development has been prevented by the extension of fibrillæ from its sides, as in the Devil's-Bit Scabious (*Scabiosa succisa*). The Fusiform Root is seen in the carrot and turnip; such plants are also called Tap-Rooted. The term Tubercules is applied by some to the roots of the Orchis and Dahlia; the former are palmated, or lobed, the latter are fasciculated.

Although most if not all the higher plants possess roots, amongst many of the lowest forms they are not to be distinguished. The lower plants which float about in water, as the *Oscillatoria*, *Diatoma*, &c., and which consist of little more than simple cells, possess no appendages which can be called roots. In many of the *Confervæ* a downward development of the cells of cellular tissue, attaching them to the objects on which they grow, has been observed. Some of the Lichens, as the *L. esculentus* of Pallas, and the lower forms of *Fungi*, as the Tremellas, &c., possess no roots. Many of the floating water-plants, as the *Aldrovanda vesiculosa*, do not develop roots, and derive their nourishment from the medium in which they live by the direct contact of the cellular tissue. In fact we find that the simple cells of cellular tissue in the lower plants perform all those functions which, as we ascend in the scale of organisation, are performed by particular parts of the plant. In the Charas and the *Marchantia*, the roots become more evidently developed, and the downward growth of the cells is more observable than in the *Confervæ*. On the lower surface of the *Marchantia*, prolongations of the cellular tissue are observed, which Meyen calls root-hairs or capillary fibrils. In the *Equisetaceæ* and Ferns the roots become more perfectly developed, and their surface is almost entirely covered with capillary fibrils. These fibrils are developed on almost all roots, and perform the function of absorption.

In many plants the roots, instead of being covered with the capillary fibres, present a condensed membrane, which also incloses the roots as in a sheath, and extends to the point of the root where the fibrils commence their growth. This structure occurs in most water-plants, and in the roots of those plants which are accidentally projected into water, and in some land-plants. It drops off with increasing age, in the same manner as the root-hairs. It is also seen in aërial plants, as the *Orchidaceæ*. Meyen considers this sheath a modification of the root-hairs, and hence infers that it performs the same functions. (Meyen, 'Neues System der Pflanzen-Physiologie,' Band ii.)

What the absorbent vessels are to the animal, the roots are to the plant, and a difference between plants and animals has been pointed out as dependent on the relative situation of their organs of absorption. The animal derives its nutriment, by means of its absorbents, from an internal reservoir, the stomach; whilst the plant derives its nutriment from an external reservoir, the earth. The spongioles of the roots, as we have already stated, are the active agents in the absorption of nutritious matter from the soil. By some botanists it is supposed that no other part of the root absorbs except the spongiole; but from the observations of Meyen and others it appears that the capillary fibrils and the epidermis of the root have also the power of absorbing fluid, though not in so high a degree as the delicate point of newly-developed tissue situated at the extremity of the fibrilla. [Absorption; Endosmosis.]

Roots do not absorb everything that is presented to them. It was long ago ascertained by Davy that plants did not absorb particles of charcoal and other substances that he diffused through water. Experiments also by Meyen, Link, and others, prove that the colouring matter of various infusions is not taken up by the roots, and that when this has been supposed to have taken place, it has arisen from mistaking a deposition of the colouring matter on the outside of the tissue for an absorption into it.

When the roots of plants are placed in solutions of gum, sugar, starch, &c., they thrive if the solutions are thin; but if thick solutions of these substances be prepared, the plants die in them. Experiments of this kind were performed by Sir H. Davy, who attributed the non-absorption of the thick solution, and the death of the plant, to the blocking-up of the pores of the vegetable tissue by the thick matter.

When plants are submitted to solutions of various poisonous agents, they take up very varying proportions. De Saussure instituted a series of very careful experiments for the purpose of ascertaining the quantities of earthy and alkaline salts taken up by the roots of plants. For this purpose he prepared solutions of the hydrochlorates, nitrates, sulphates, and acetates of soda, potassa, and copper, and having submitted plants of *Polygonum* and *Bidens* to them, he found that the plants constantly absorbed a larger proportion of the water than of the salt, and that the salts were taken up in different proportions. The salts were not absorbed in proportion to their innocuous qualities, as the sulphate of copper, which was the most poisonous, was absorbed in largest quantity. De Saussure concludes that it was not the properties of the salts that determined their relative absorption, but that it depended upon the relative consistence of the solutions. Plants absorb poisons much more quickly when their roots are injured by being torn or cut, and do not suffer much by exposure to weak solutions of poisonous matters. This is a point of some practical importance, and will explain how it is that vegetation does not suffer when exposed to poisonous solutions.

Another function which has been attributed to the roots is that of excretion. Du Hamel first called the attention of botanists to this subject; he found that the roots of plants grown in water gave out a brackish secretion, and looked upon it as a secretion from the fluids of the plant. Brugmans followed up this point, and, in conjunction with Coulon, came to the conclusion, from the experiments they made, that the secretion given out from the roots of plants was a process of a similar nature to the rejection of the excrements in animals, and that these secretions acted beneficially in the nutrition of some plants, and injuriously in others. At the suggestion of De Candolle, M. Macaire prosecuted some researches on this subject, which were published in 1832 ('Mémoires de la Société de Génève,' tome v., p. 287). He confirmed the views of Brugmans and Coulon, and examined more attentively the nature of the different excretions given out by plants of different orders. Thus he found that the *Leguminosæ* gave out a gum and carbonate of lime; *Graminaceæ* deposited a matter containing hydrochlorates and carbonates of alkalies and earths, and containing but little gum; *Cichoraceæ*, an abundant brown matter analogous to opium; *Euphorbiaceæ*, a gum-resinous matter. It was inferred that these excretions were matters injurious to the plant, which were thus thrown off from the system. This inference seemed to be confirmed by an experiment of Macaire's, in which, having divided the roots of a plant of *Mercurialis annua* into two parcels, he plunged the one into a glass with solution of acetate of lead, and the other into a glass of pure water; in a short time it was found that the acetate of lead had not only been taken up by the roots from the one glass, but that it had been excreted by them into the other.

These researches were considered to offer a satisfactory explanation of the practice of rotation of crops in agriculture; the rotation being required on account of the excretions of a plant being injurious to itself, but beneficial to another, as the excretion of one plant is the food of another. [Rotation of Crops, in Arts and Sc. Div.]

A far more rational explanation of the phenomena of rotation is to be found in the fact, that every plant requires certain inorganic products, as well as carbonic acid and ammonia, for its nutrition. These inorganic matters are supplied by the soil. When the same plant is grown for several years in succession in the same spot, it at last exhausts the soil of the inorganic matters necessary to its growth. By growing crops of another kind, and which do not require the same constituents in the same soil, opportunity is given for the ingredients required by the first plant to accumulate in the soil.

It is now a well-known fact that certain plants will not grow without certain inorganic constituents. Thus the plants of the sea and the sea-shore require chloride of sodium, but those which grow inland demand the salts of potash. The Grasses and Palms all require silica wherewith to form their stems, and the *Cerealia* need phosphatic salts.

Just as these facts have become known, our agriculture has assumed a more scientific character, and every farmer at the present day is aware of the necessity of adding manures containing inorganic matters to his fields. It is on this account that Guano, Coprolites, and the superphosphate of lime or materials containing it, are added so constantly to the soil. [Guano; Coprolites; Phosphatite.] That the necessity of rotation depends upon the exhaustion of these constituents of the soil, is rendered also probable by the fact that some soils grow the same crop continually for many years, which it may be supposed depends upon an abundant supply of the inorganic constituents of the soil. Again, from recent experiments it has been found, that by supplying artificially the inorganic food of plants to the soil, that the same crop may be grown any number of years in succession.

It is upon a knowledge of the nature of the food of plants that all agriculture must depend, and the principal source of this supply of this food is the soil, and the organs which take up this food are the roots. It is not however the chemical nature of the soil alone that demands notice, but also its physical properties. The great constituents of the food of plants are carbonic acid, ammonia, and water, and these are absorbed by the soil before they are supplied to the plant. According as the soil is capable of absorbing these constituents, will depend to a considerable extent its power of growing all plants. It is on this account that the absorbent nature of the soil in relation to the important elements of the food of plants, should be inquired into. The following table by Schubler of the absorbing power of different substances in relation to water, will serve as an indication of the importance of studying the physical properties of soils in general (Schleiden, 'Principles of Scientific Botany'):—

Kinds of Earth.	1000 grains of Earth distributed over a surface of 50 square inches, absorbed in			
	12 hours. Grains.	24 hours. Grains.	48 hours. Grains.	72 hours. Grains.
Quartz-Sand	0	0	0	0
Limestone-Sand	2	3	3	3
Gypsum	1	1	1	1
Loam Clay (Lettartiger Thon)	21	26	28	28
Muddy Clay (Lehmartiger Thon)	25	30	34	35
Resonant Clay. (Klangartiger Thon)	30	36	40	41
Pure Gray Clay	37	42	48	49
Fine Calcareous Earth	26	31	35	35
Fine Magnesia	69	76	80	82
Humus	80	97	110	120
Garden Mould	35	45	50	52
Field Mould	16	22	23	23
Slaty Marl	24	29	32	33

Besides the function of absorption, the roots serve other purposes in the economy of the plant. It is by means of the roots that a plant maintains its position in the earth; and if for the increasing nourishment of the plant an increase of the absorbing surface is required, it is no less necessary that, for the purpose of maintaining its stem erect and firm, an extension of its holdfasts should take place. In many instances the root appears to serve merely the purpose of holding the plant in the ground, as in the mosses and many of the plants belonging to the orders *Crassulaceæ* and *Cactaceæ*. By means of the roots the temperature of plants is kept below that of the atmosphere in summer, and above it in winter. This arises from the roots absorbing fluids from some depth below the surface of the earth, where its temperature is not much affected by the changes in the atmosphere. It is thus that the inhabitants of tropical climates are supplied with fruits whose delicious juices, pumped up from the earth, are much cooler than the atmosphere, and thus afford the most refreshing articles of diet.

ROOTSTOCK. [Exogens.]

RORQUAL. [Cetacea.]

ROSA (from the Latin *Rosa*, through the medium of the French Rose; the Latin *Rosa* and the Greek 'Ρόδον are evidently the same), the name of the most universally admired and cultivated genus of plants, forming the type of the natural order *Rosaceæ*.

The Rose was known in early times, and was as great a favourite among the nations of antiquity as it is in modern times. The Rose is found generally in almost every country of the northern hemisphere, both in the Old and New World: from Sweden to the north of Africa; from Kamtchatka to Bengal, and from Hudson's Bay to the mountains of Mexico. It is not found in South America or in Australia. All the species are included between 70° and 19° N. lat. It is found more generally on dry and free soils than on those which are wet and tenacious. In the north of Europe it occurs with single flowers, but in Italy, Greece, and Spain more frequently double.

The characters of the genus *Rosa* are—calyx 5-parted, tube fleshy, urceolate; petals five; stamens numerous, attached to the calyx and corolla; ovaries attached to the inner surface of the tube of the calyx; style long, stigma projecting beyond the mouth of the calyx; achenia numerous, hard. The species are mostly shrubs with alternate pinnate leaves and beautiful odoriferous flowers. There are few better marked genera amongst plants than this, but as of all plants it has been the greatest favourite, and thus surrounded by the greatest variety of external influences, its species and varieties are the most difficult to distinguish.

Dr. Lindley, in his 'Rosarum Monographia,' arranges the species under eleven divisions, the first of which, including but one species, has since been made into the genus *Lowea*. We shall here give the remaining divisions, and point out the species which, on account of their ornamental flowers or uses, are most frequently cultivated.

1. *Feroces*, with branches permanently tomentose and naked fruit. They are generally low shrubs, remarkable for thick hoary branches clothed with numerous prickles, and hence their name. There are only three species belonging to this division, of which *Rosa ferox*, the Hedgehog-Rose, is most common.

2. *Bracteatæ*.—The species of this division have not only their branches, but also their fruit clothed with a persistent tomentum. They have mostly bright-green leaves, and their organs of fructification are in the highest state of development of any of the genus. They belong to the class of evergreen roses. *R. bracteata*, the Macartney Rose, is a native of China, and was introduced into this country by Lord Macartney. It has upright branches, 5-9-leaflets, stout prickles, with large white terminal solitary flowers, and large globose orange-red fruit. It is a handsome plant, flowering abundantly late in the season. *R. microphylla*, Small-Leaved Rose, resembles *R. bracteata*, but differs in being smaller, and having prickly fruit and ovate-obtuse leaves.

3. *Cinnamomeæ*, distinguished by their long lanceolate leaflets, without glands, bracteated flowers, and delicate disc, but little thickened. The shoots are either with or without setæ. There are several species in this division, but comparatively few are known out of the herbarium. *R. lucida*, the Bright-Leaved Rose; *R. laxa*, Loose or Spreading Carolina Rose; and *R. Carolina*, the True Carolina Rose, belong to this division.

4. *Pimpinellifoliæ*.—Branches either crowded with nearly equal prickles or unarmed; leaflets ovate or oblong; bracts absent; sepals connivent and persistent. Although this division approaches the last in artificial characters, it is essentially different in habit. *R. spinosissima*, the Scotch Rose, is a dwarf, compact, green bush, with creeping roots; it has unequal prickles, flat, glabrous, simple serrated leaflets, and small, solitary, white, or bluish-coloured flowers. It is found native in the mountainous districts and sea-coasts of all Europe, and also in the Caucasus. It was the only rose found by Sir W. Hooker in Iceland. A great number of varieties are found in the gardens of Britain, produced from the wild plant found in the North of England and Scotland, *R. sulphurea*, the Double-Yellow Rose, and *R. alpina*, the Boursalt Rose, are also examples.

5. *Centifoliæ*, clothed with bristles and prickles; flowers bracteate; leaflets oblong or ovate, rugous, disc thickened, closing the throat; sepals compound. This division comprehends those species which have ever been most interesting to the florist, as also probably those that were earliest known. Although the garden varieties of this division would probably amount to several hundred, there are only three species.

R. centifolia, the Hundred-Leaved Cabbage, or Provence Rose, is known by its large unequal prickles, glandulous leaflets, pendulous flowers, and oblong fruit. This rose has been said to be a native of France, but this is doubtful. It has been found wild in thickets on the eastern side of the Caucasus. It is the same plant as the *R. provincialis* of Miller. A botanical variety of this species, the *R. centifolia muscosa*, is the parent of the beautiful family of moss-roses.

R. Gallica, the French Rose, has equal small prickles, erect flowers, ovate sepals, and globose fruit. It is found wild about Montalbanum, Walzenberg, and Geneva, also in Austria, Piedmont, and the Caucasus. This is supposed to be the species to which Pliny refers ('Hist. Nat.,' xxi. 18, 25, 72, 73). *R. pumila* of Jacquin is a variety of this species. Hundreds of varieties of this rose are found cultivated in gardens.

A great number of varieties of roses found in gardens are hybrids between *R. Gallica* and *R. centifolia*. They mostly combine the long graceful shoots of the last with the rich crimson hues of the first. Hybrids are also produced between *R. Gallica* and *R. Indica*, but differ from the last in not being perpetual. They have a pleasing glossy sub-evergreen foliage.

R. Damascena, the Damask Rose, has unequal prickles; the larger ones falcate, sepals reflexed, fruit elongated. This plant is supposed to have been originally brought from Damascus, and to be a native of Syria. It is much cultivated in gardens, and has not fewer varieties than the two last.

6. *Villosæ*.—Root-shoots erect; prickles nearly straight; leaflets ovate or oblong, with diverging serratures, sepals persistent, connivent; disc thickened, closing the fauces. The best known species of this division is the *R. alba*, White Rose; it has rugose glaucous leaves, with simple serratures and acicular unequal prickles, by which it may be distinguished from both *R. tomentosa* and *R. canina*, with which it is liable to be confounded. It is a native of Piedmont, Cochin-China, Denmark, France, and Saxony. Its flowers are very large, exhaling a delicious fragrance. *R. Hibernica*, the Irish Rose, belongs to this division, and is interesting to the botanist as being entirely confined to Ireland.

7. *Rubiginosæ*.—Unequal and sometimes bristly prickles, ovate or oblong leaflets, with glands and diverging serratures, persistent sepals, thickened disc, and arched root-shoots. To this division belongs the *R. rubiginosa*, Eglantine, or Sweet Briar. It is common in Britain in bushy places on a dry gravelly soil. *R. lutea*, the Austrian Briar, is nearly allied to the latter.

8. *Caninæ*.—With equal hooked prickles; oval eglandulose leaflets, with connivent serratures, deciduous sepals, and thickened disc closing the throat. To this division belong many of the varieties called Autumnal or Perpetual Roses, on account of their blooming late in the season and continuing in flower a long time. Of the roses in this group that have afforded varieties for the garden, the *R. Indica*, Chinese Rose, stands first. There is a hybrid variety between this species and the *R. odorata*, which is well known in gardens under the name of *R. Indica odorata*, Tea-Scented China Rose. This rose is the parent of a great number of sorts in gardens.

The Bourbon Rose (*R. Bourboniana*) is a natural hybrid between *R. Indica* and a variety called Red Four-Seasons. This hybrid was found amongst a number of the latter plants in a hedge in the Isle of Bourbon. It was brought to Paris, and has since produced many beautiful varieties.

The Noisette Rose was grown from seeds produced from *R. moschata* impregnated with *R. Indica*. It was first reared in America.

R. Lawranceana, the Miniature or Lawrance Rose, named after Miss Lawrance, who published a collection of drawings of roses, belongs to this division. It was first brought from China, and is probably only a dwarf variety of *R. Indica* or *R. semperflorens*, which it closely resembles in structure.

R. canina, the Dog-Rose, is one of the most common species of the division in this country, and from its varying characters has given origin to a great number of names supposed to represent species. This is the species used for making conserve of roses.

9. *Systylæ*.—Styles cohering in an elongated column; stipules adnate. The habit of the plants of this division is nearly the same as that of the last. *R. arvensis*, the Field or White Dog-Rose, belongs to this group. It is a very common plant in many parts of England, adorning the hedges with its elegant snowy blossoms. It has cord-like shoots, unequal falcated prickles, leaflets glaucous beneath; diverging stipules, and ovate crimson fruit. The varieties of this and allied species, as *R. multiflora* and *R. sempervirens*, produce the climbing roses of the garden, of which there are a great number now to be had.

R. moschata, the Musk-Rose, is one of the oldest inhabitants of our gardens. It is found native in the North of Africa, and in the temperate and warm provinces of Spain.

10. *Banksianæ*.—Nearly free subulate stipules, usually deciduous; ternate shining leaflets and climbing stems. This is the last division of the species of roses. The most remarkable species in this group is the *R. Banksiæ*, Banksian Rose, named after Lady Banks. It is a native of China, and has very numerous double sweet-scented nodding flowers, which are arranged in umbel-like corymbs.

The roses are used in the arts for obtaining their delicious perfume, which is called Attar of Roses. The petals are also used in medicine. [ROSE, in ARTS AND SC. DIV.]

(Lindley, *Monographia Rosarum*, 1820; Miss Lawrance, *A collection of Roses from Nature*, 1799; Redoute and Thory, *Les Roses*; Guilleman, *L'Histoire Naturelle de la Rose*, 1800; Thory, *Prodrome de la Monographie du Genre Rosier*, 1820; T. Rivers, of Sawbridgeworth, *Rose-Amateur's Guide, with Descriptive Catalogue of Roses*, 1836 (a very excellent account of the garden varieties and their cultivation); Sir J. B. Smith, the article 'Rosa,' in Rees's *Cyclopædia*; Don, 'Genus Rosa,' in Miller's *Gardener's Dictionary*.)

ROSA'CEA. [AGALEPHÆ.]

ROSA'CEÆ, a natural order of Polypetalous Exogenous Plants, with 4-5-lobed calyx; 4 or 5 regular petals; indefinite perigynous stamens; exalbuminous seeds; and alternate stipulate leaves. The plants of this order are allied to *Chrysobalanaceæ*, from which they may be distinguished by their styles proceeding from the side of the ovarium near the apex, and not from the base, and by their regular

petals and stamens. They are distinguished from *Fabaceæ* (*Leguminosæ*) by their regular petals and stamens, and especially by the odd segment of the calyx being posterior, and not anterior, as in that order. The genera of this order may be arranged under four groups or sub-orders, the principal distinctions of which will be seen in the following analysis :—

Carpels numerous.
Ovaries superior. *Rosaceæ* (proper).
Ovaries inferior. *Pomeæ*.
Carpels solitary.
Fruit a drupe. *Amygdaleæ*.
Fruit a nut. *Sanguisorbeæ*.

Rosaceæ proper include the true Roses (*Roseæ*), the Cinquefoils (*Potentilleæ*), the Spiræas (*Spiræeæ*), and the Neuradas (*Neuradeæ*). They are herbaceous plants or shrubs. This family includes about 570 species and 20 genera, principally inhabitants of the temperate and cold zones of the northern hemisphere of the New and Old World; a very few are found on high land within the tropics, and a small number in the southern hemisphere. None of the plants of this section of the order are unwholesome; they are characterised by the presence of an astringent principle, which has led to the use of many of them in medicine. [Rosa; Potentilla; Spiræa; Strawberry; Geum; Dryas.]

Spiræa argentea.

a, flower, showing the perigynous arrangement of the stamens; *b*, fruit, showing its apocarpous structure; *c*, one of the follicles separate from the fruit.

Pomeæ are known by the adhesion of their ovaries to the sides of the calyx, forming the fruit called a Pome. Their ovula are always in pairs. The tendency of the flowers of this family to revert to their normal state frequently affords instructive examples of morphological changes. The fruit of many of the species contains a considerable quantity of malic acid, which gives to the fruit its peculiar flavour. The Apple, Pear, Medlar, Quince, Service-Tree, and Mountain-Ash belong to this family. They are inhabitants of Europe, Northern Asia, the mountains of India, and North America. [Pyrus; Cydonia; Amelanchier; Cratægus; Cotoneaster; Mespilus.]

Amygdaleæ have but a single carpel, which when ripe is a drupe; but they are also distinguished amongst *Rosaceæ*, by their leaves containing hydrocyanic acid, and their bark yielding gum. They are natives exclusively of the northern hemisphere, where they are found in cold or temperate climates. Many of the species are poisonous, on account of the hydrocyanic acid they contain. They yield, however, some of our most valued fruits, as the Peach, Nectarine, Plum, Apricot, Cherry, and Almond, which last is the seed of the *Amygdalus communis*. [Amygdaleæ; Amygdalus; Prunus.]

Sanguisorbeæ are not only known by their solitary carpels, but they are destitute of petals and have a hard thickened calyx. They are found wild in heaths, hedges, and exposed places in Europe, North and South America beyond the tropics, and the Cape of Good Hope. Their principal property is astringency, and some of the species may be used as fodder. [Sanguisorba; Poterium; Agrimonia.]

ROSCOEA, a genus of Plants belonging to the natural order *Scitamineæ* or *Zingiberaceæ*, which was named by Sir J. E. Smith, in honour of the historian of the Medici, who elucidated the plants and remodelled the genera of the *Scitamineæ* in his beautiful work on that family. The species have been figured by Smith, Wallich, and Royle.

The genus consists of only a few species, which are confined to the Himalaya Mountains, and is characterised by having spathaceous flowers, a single-leafed tubular calyx, corolla ringent, limb double, the outer tripartite, with the upper segment erect and arched. Inner limb two-lipped, ovary inferior, style inclosed in the furrow of the anther, which is two-lobed, incurved, surrounding the style with an appendage split at the base.

The species of *Roscoea*, belonging to so tropical a family as the *Scitamineæ*, are generally accounted showy stove plants; but they are found only on the slopes of the Himalayas during the rainy season, when there is moisture with uniformity of temperature. *R. alpina* is found at as great an elevation as 9000 feet above the level of the sea, and on places whence the snow had just melted, like the snowdrop in early spring in European countries.

ROSE. [Rosa.]
ROSE-BEETLE. [Cetoniadæ.]
ROSEMARY. [Rosmarinus.]
ROSE-ROOT. [Sedum.]
ROSE-WOOD. [Triptolemea.]
ROSELITE, a rose-red Mineral related to Cobalt Bloom. [Cobalt.]
ROSIN. [Turpentine.]

ROSITE, a Mineral occurring in small grains, without crystallisation. Fracture splintery, and in the larger grains somewhat foliated. Surface of the fracture shining. Colour faint rose-red to brownish-red; the former more common. Subtransparent. Hardness 2·5 Specific gravity 2·72. It is found in Südermanland.

Its analysis by Svanberg gives—

Silica	44·901
Alumina	34·506
Peroxide of Iron	0·688
Oxide of Manganese	0·191
Potash	6·628
Lime	3·592
Magnesia	2·498
Soda	a trace
Water	6·333
	99·337

ROSMARI'NUS, a genus of Plants belonging to the natural order *Lamiaceæ*. It is one of the genera belonging to this order that are perennial and possess the character of shrubs. It is known by the following characters :—Calyx ovate, campanulate, with two lips, the upper of which is entire, and the lower two-parted; corolla not ringed in the inside; the throat slightly inflated with two lips, equal, the upper one emarginate, the lower two-parted, the middle lobe very large and hanging down; stamens two; filaments slightly toothed at the base; style with the upper lobe very short.

R. officinalis, the Common Rosemary, is an inhabitant of the southern parts of France, Spain, and Italy, the basin of the Mediterranean, and some parts of Asia Minor. It is a very leafy shrub, growing to the height of three or four feet; the leaves are sessile, linear, quite entire, revolute at the edge, and covered with white hairs beneath; the flowers are few, and in short axillary racemes; the corolla has a dull leaden blue or white colour, with the tube protruding a little beyond the calyx; the flower-leaves or bracts are shorter than the calyx. The cultivated and garden plants differ very much in the shape and number of their leaves, on which account Miller described them as two species, the *R. angustifolia* and the *R. latifolia*. The size of the leaves varies according to the soil and situation in which the plant grows. It is generally observed that the broader and longer the leaves, the more vigorous is the plant. The Rosemary abounds in the district of Narbonne in France, where it is used to form hedges for gardens, &c. It is supposed to be the aroma of this plant gathered by the bees that gives to the honey of this district its peculiarly fine flavour.

ROSSIA, a genus of Cephalopodous *Mollusca*, named by Professor Owen in honour of Sir John Ross, who found one of the first specimens in the Arctic Seas. It belongs to the family *Teuthidæ*, and has a rounded or oval body, furnished on each side with a suborbicular fin; a large head, with eyes covered by an epidermic expansion, and pierced by a very small hole; arms ten, two tentacular and retractile, eight corneous, flexible, small, and sub-spatulate. There are five species, of which two are British, *R. macrosoma* and *R. Owenii*. These have been both taken in Ireland, and the latter also near Bonchurch, in the Isle of Wight.

ROSTELLA'RIA. [Strombidæ.]

ROSTELLUM, a botanical term applied occasionally to very different parts: 1, it is most frequently used as a diminutive of rostrum, to express any small beak-shaped process; 2, it is applied to the short beak-shaped process found on the stigma of many violets, as *Viola hirta*, *V. odorata*, *V. canina*, &c.; and *Orchidaceæ*, as *Orchis*, *Spiranthes*, *Listera*, &c.; 3, some writers have also used this term to indicate the radicle or descending element of the embryo of the seed.

ROSTRUM, a botanical term applied to any rigid prolongation of remarkable length, or to any additional process at the end of any of the parts of a plant.

ROTATE, a botanical term applied to either the calyx or corolla, when the tube is very small or entirely wanting, and the petals or sepals are united and spreading.

ROTATORIA. [Rotifera.]
ROTCHE. [Auk.]
ROTELLA. [Trochidæ; Turbinidæ.]
ROTHOFFITE. [Garnet.]

ROTIFERA, Wheel-Animalcules, a class of animals placed by Ehrenberg among the *Infusoria*, under the name of *Rotatoria*. They have acquired these names on account of the apparent rotation of the disc-like organs which surround their mouths and which are covered by cilia. These creatures are very minute, and although some of the larger forms may be detected by the naked eye, their organisation can only be seen by the aid of the microscope. We are indebted to Leeuwenhoek for the discovery of their existence and the first account of their structure and habits. In the 'Philosophical Transactions' for 1702, he gave an account of the discovery of what is now called *Rotifer vulgaris*, one of the most common forms of these animals. He afterwards described another form, *Melicerta ringens*.

Subsequent observers added to the discoveries of Leeuwenhoek, so that in 1824 Bory St. Vincent described 80 species. In 1838 Ehrenberg published his great work on the *Infusoria*, and there describes 189 species of *Rotifera* in 55 genera. Although classed by Ehrenberg with the *Polygastrica*, their organisation is much higher and more complicated, and the only claim they appear to have to be classed together is the fact of their minute size. [INFUSORIA.]

The *Rotifera* are very widely diffused on the surface of the earth. They inhabit both fresh-waters and the ocean, and are found in the cold, temperate, and tropical parts of the earth. Although capable of swimming freely they are generally found near or attached to the leaves of plants. They are found constantly present in ponds and streams in which *Ceratophyllum*, *Callitriche*, *Valisneria*, and other fresh-water plants abound.

A curious point in their history, which first attracted the attention of Leeuwenhoek, is their power of retaining their vitality after having been more or less perfectly desiccated. This property is undoubtedly possessed by the ova of the lower animals, especially those which are called 'winter eggs;' but it does not appear to be very generally possessed by animals of an organisation as high as the *Rotifera*. Professor Owen states that he has observed the revivification of one of these wheel animalcules after having been kept four years in dry sand.

The *Rotifera* have usually an elongated form, although some of them are nearly as broad as they are long. In most instances they are covered with a lorica or double envelope, the outer layer of which is often of a horny consistence. Some of them build for themselves a little case, or tube, in which they live, but this must not be confounded with their proper envelope. When the lorica is soft the animal has considerable power of elongating and contracting its body, as seen in *Rotifera vulgaris*. Many of the species are furnished with an elongated tail, which is often supplied with pincer-like organs, to enable them to remain stationary whilst feeding. Those which form tubes are usually fixed.

The rotatory organs, or wheels, are fleshy retractile lobes, covered with vibratile cilia, and are capable of being contracted or expanded. These organs are moved by means of a muscular system. Muscular bands are observed attached to the tegumentary system, and also to that part of the digestive system connected with the rotatory organs. The fibres of these muscles have been observed to present the stria which are characteristic of voluntary muscles.

The digestive system consists of a mouth, jaws, frequently a dilatation which may be regarded as a stomach, and an intestinal tube which has an anal orifice. The jaws generally consist of two semicircular pieces, to which are attached one or more teeth, which act upon a central plate. The number of teeth varies, and also the form and character of the jaws in different species.

The *Rotifera* have no true circulating or respiratory organs, although Ehrenberg has described certain parts of their structure as such. In most of the species minute vessels can be seen, which terminate in blind sacs or cæca. In these cæcal branches a vibratile body exists, which keeps up a peculiar flickering movement, and it is to these bodies that Ehrenberg has given the name of 'gills.' This system of vessels is regarded by Mr. Huxley and other observers as a true aquiferous or water-vascular system. Connected with the respiratory apparatus, according to Ehrenberg, is an organ projecting from the under surface of the mouth, which he has called the 'calcar,' 'siphon,' or 'respiratory tube.' Ehrenberg describes it as a tube, and supposes currents to pass from it. It is connected with the nervous ganglion. Dujardin and Huxley have not observed either currents or an orifice in this organ.

All observers agree that the *Rotifera* possess a nervous system, which presents itself in the form of a pair of cephalic ganglia, from which proceed nervous filaments. The extent of the development of the nervous system is a subject for further inquiry. The red spots which Ehrenberg calls eyes are subject to considerable variations in appearance. Mr. Huxley says he observed them in young *Lacinulariæ*, but not in adult individuals.

The existence of sexes in a species of *Notommata* has been clearly made out by Mr. Brightwell of Norwich. The male however is much smaller and less developed than the female. All observers agree that the parts to which Ehrenberg has assigned the functions of male organs are not so. Certain caudate bodies have been described by Kölliker as *Spermatozoa*, but their nature is doubted by other observers. Mr. Huxley describes in *Lacinularia* certain "vacuolar thickenings," which he suggests have been previously mistaken for male organs, ganglia, &c. Ovarial organs are easily made out in most of the species. The ova are of two kinds. Mr. Huxley says in *Lacinularia* they consist, first, of bodies which resemble true ova in their origin and subsequent development, and which possess only a single vitellary membrane; second, of bodies half as large again as the foregoing, which resemble the ephippium of *Daphnia*: like it they have altogether three investments, and which do not resemble true ova either in their origin or subsequent development; which therefore probably do not require fecundation, and are thence to be considered as a mode of asexual reproduction. Professor Williamson has described very fully the development of the true ova in *Melicerta ringens*, from which it appears the young after they are hatched do not pass through any of those larval changes which are characteristic of animals both higher and lower in organisation. All the changes which take place occur in the ovum.

The position of the *Rotifera* in relation to the other forms of animal life has been the subject of much discussion. Dr. Grant was one of the earliest writers to take them out of the *Radiata*, and place them amongst *Articulata*. The relation of such forms as *Stephanoceros* to the Ciliobrachiate Polyps is very evident. In his 'Memoir on Lacinularia,' Mr. Huxley gives his reasons for regarding these creatures as permanent larva-forms of *Echinodermata*. After referring to the various forms of *Rotifera*, and their homologous organs, he thus concludes:—

"We may say, therefore, that the *Rotifera* are organised upon the plan of an Annelid larva, which loses its original symmetry by the unequal development of various regions, and especially by that of the principal ciliated circlet or trochal band; and it is curious to remark that, so far as the class of the *Rotifera* can be considered to be made out (approximately), the dicecious forms belong to the latter of the two modifications of the type which have been described, while the monœcious forms belong to the former.

"It is this circumstance which seems to me to throw so clear a light upon the position of the *Rotifera* in the animal series. In a Report in which I have endeavoured to harmonise the researches of Professor Müller upon the Echinoderms, 'Annals of Natural History,' 1851, I have shown that the same proposition holds good of the latter in their larval state, and hence I do not hesitate to draw the conclusion (which at first sounds somewhat startling) that the *Rotifera* are the permanent forms of Echinoderm larvæ, and hold the same relation to the Echinoderms that the Hydriform *Polypi* hold to the *Medusæ*, or that *Appendicularia* holds to the Ascidians.

"The larva of a *Sipunculus* might be taken for one of the *Rotifera*; that of *Ophiura* is essentially similar to *Stephanoceros*; that of Asterias resembles *Lacinularia* or *Melicerta*. The pre-trochal processes of the Asterid larvæ *Brachiolaria* are equivalent to those of *Brachionus*.

"Again, the larvæ of some Asterid forms and of *Comatula* are as much articulated as any *Rotifera*.

"It must, I think, have struck all who have studied the Echinoderms, that while their higher forms, such as *Echinus* and *Sipunculus*, tend clearly towards the dicecious *Annelida*, the lower extremity of the series seemed to lead no-whither.

"Now, if the view I have propounded be correct, the *Rotifera* furnish this wanting link, and connect the Echinoderms with the *Nemertidæ* and Nematoid worms.

"At the same time it helps to justify that breaking up of the class *Radiata* of Cuvier, which I have ventured to propose elsewhere, by showing that the *Rotifera* are not 'radiate' animals, but present a modification of the Annulose type—belong, in fact, to what I have called the *Annuloida*, and form the lowest step of the Echinoderm division of that sub-kingdom."

Dr. Leydig, in a paper in the 'Zeitschrift für Wissenschaftliche Zoologie,' vol. vi., on the other hand, regards the relations of *Rotifera* as much more with the *Crustacea* than with the Worms. The points of resemblance to which he draws attention are:—

1. Their external figure and hard tegument, which more nearly resembles the carapace of the *Crustacea* than the rings of the *Articulata*.
2. Their muscular structure, which resembles that of many *Crustacea*.
3. Their nervous system resembles that of many *Entomostraca*, as *Daphnia*.
4. The alimentary canal resembles that of *Daphnia*.
5. The resemblance in the character of their ova, the *Entomostraca* having two kinds of ova, as the *Rotifera*.
6. The development of *Rotifera* and Entomostracous *Crustacea* correspond.

Leydig concludes a very able paper by proposing to call the *Rotifera* Ciliated Crustaceans.

With regard to the arrangement of the *Rotifera*, we give that of Ehrenberg, which, although exceedingly defective, served to make these creatures known amongst naturalists:—

Order 1. *Rotatoria nuda.* Order 2. *Rotatoria loricata.*

Section I. *Monotrocha.*

Ciliary Circle simple and entire, and not variable.

Monotrocha nuda. *Monotrocha loricata.*

1st Fam. *Ichthydina.*

A. No eyes.

a. Body smooth.

* Tail simple, truncated, and flexible.

Gen. *Ptygura.*

Annals of Natural History, 1848; Gosse, *On the Anatomy of Notommata aurita*, in *Transactions of Microscopical Society*, 1851; Huxley, *On Lacinularia socialis*, in *Transactions of Microscopical Society*, 1851; Williamson, *On the Anatomy of Melicerta ringens*, in *Quarterly Microscopical Journal*, vol. i.; Gosse, *On the Habits of Melicerta ringens*, in *Quarterly Microscopical Journal*, vol. i.; Leydig, *On Rotifera*, translated in *Quarterly Microscopical Journal*, vol. iii.)

ROTTBOELLA, a genus of Plants belonging to the tribe *Rottboelliaceæ*, of the very natural and extensive family of Grasses, named by Mr. Brown in honour of C. F. Rottböll, a professor of botany at Copenhagen, who died in 1797, and who published several works, one in particular on exotic species of *Gramineæ* and *Cyperaceæ*. The genus is distributed throughout Asia, especially India, Australia, and the tropical islands, and extends also to Egypt. The species are usually tall, erect, and flat-leaved, with the spikes round and jointed; spikelets two in each joint, pressed close to or sunk into a hollow in the rachis; of these one is sessile, the other stalked. The species are not relished by cattle, with the exception of *R. glabra*, of which they are said to be fond in India.

ROTTEN-STONE, a Mineral, occurring massive. Fracture uneven. Colour grayish, reddish, or blackish brown. Dull, earthy, and opaque. Soft, soils the fingers, and is fetid when rubbed or scraped. It is found near Bakewell, Derbyshire; in Wales; and at Albany, in the state of New York. It is employed in polishing metals, &c. The analysis by R. Phillips gives—

Alumina	86
Silica	4
Carbonaceous matter	10
	—100

ROTTLE'RA, a genus of Plants named in honour of Dr. Rottler, belonging to the natural family *Euphorbiaceæ*. It is characterised by having male and female flowers upon different plants. Male: Calyx 3-5-partite; corolla none; stamens 30 to 40, inserted into the convex receptacle; filaments free or united at the base. Female: Ovary 2-3-4-celled, each 1-seeded; style deeply 2-3-4-partite, laciniated; capsule 2-3-4-coccous, each 1-seeded. The genus, which is found in the tropical parts of Asia and throughout India, contains handsome moderate-sized trees. *R. tetracocca* grows in Silhet, and yields a hard and valuable timber. The capsules of *R. tinctoria*, a native of the Coromandel coast, and extending to the forests of Northern India, are covered with short stiff hairs, which when rubbed off have the appearance of a powder of a fine red colour, which is employed in India in dyeing silk of a scarlet colour, and therefore forms an article of commerce in that country. Dr. Royle states that this strigose pubescence is also employed in India as an anthelmintic in the same way that cowage is, and, like it, probably acts mechanically in expelling intestinal worms.

ROUD, or RUDD. [Leuciscus.]

ROULOUL. [Tetraonidæ.]

ROUPELLIA, a genus of *Apocynaceæ*.

ROWAN-TREE. [Pyrus.]

ROXBURGHIA. [Roxburghiaceæ.]

ROXBURGHIACEÆ, *Roxburgh-Worts*, a natural order of Plants belonging to the class Dictyogens. The species are twining shrubs with tuberous roots; reticulated leaves, coriaceous, and with parallel secondary veins connecting several primary ribs; flowers large and showy, solitary, fœtid; perianth of four large petaloid divisions; stamens 4, hypogynous; anthers adnate, opening inwards, pointed, with connectives projecting far beyond the cells, which separate from the latter as far as their bases; pericarp 1-celled, 2-valved, with two clusters of seeds at the base. Seeds attached to long cords covered with loose hairs just below the seeds; embryo taper, in the axis of fleshy albumen, with the plumule lying within a slit. The plants of this small order are natives of the hot parts of India. There is but one genus—

Roxburghia, the roots of a species of which are prepared with lime water, candied with sugar, and taken with tea. The flavour is insipid.

(Lindley, *Vegetable Kingdom*.)

ROYDSIA, an Indian genus of Plants allied to the natural order *Capparidaceæ*, named by Dr. Roxburgh in compliment to Sir J. Royds. The genus consists of a single species indigenous in the forests of Silhet, where, with a stout stem and numerous branches, it climbs over the trees to a great extent, and flowers in the month of March, diffusing a strong but pleasant odour from its numerous blossoms arranged in axillary racemes or terminal panicles. The leaves are alternate, oblong, coriaceous, smooth on both sides, and without stipules. The calyx is 6-partite and of a pale-yellow colour; corolla none; stamens numerous, with the filaments inserted on the apex of a short column; ovary pedicelled, 3-celled, with two rows of ovules in each, attached to the axis; drupe berried, of the size of a large olive, orange-coloured; pulp abundant and yellow; nut oblong, single-celled and 3-valved; seed solitary, conformable to the nut. The plant is figured in Roxburgh's 'Coromandel Plants,' p. 289, and is well-suited to the hothouses of this country.

RO'YLEA, a Himalayan genus of Plants belonging to the natural order *Lamiaceæ*, and tribe *Ballotea*, named by Dr. Wallich in compliment to Dr. Royle, author of the 'Illustrations of the Botany of the Himalayan Mountains and of Cashmere, who first found it on the Sirmore Mountains. The plant forms a handsome shrub, with many branches and an abundance of pale-green glaucous leaves. It is characterised by having the calyx ovate, tubular, 10-nerved, and semi-quinquefid; corolla shorter than the calyx, 2-lipped, lips unequal; stamens 4, didynamous, ascending under the upper lip; anthers bilocular; style bifid.

R. elegans, the only species known, is called Putkuroo by the natives of the mountains where it is indigenous, and is employed by them as a febrifuge. It is suited to the shrubberies of this country.

ROYSTON CROW, the common English name for the Hooded-Crow, *Corvus Cornix*, Linn. [Corvidæ.]

The subjoined illustration is omitted in the article Corvidæ.

Royston Crow (*Corvus Cornix*).

RUBELLAN, a Mineral, which occurs in small hexagonal plates, not elastic. Colour reddish-brown. Hardness 2 to 2·5. Lustre pearly. Transparent, opaque. Specific gravity 2·8 to 3·1. Found at Schima, in the Mittelgebirge, Bohemia. The analysis by Klaproth, gives:—

Silica	45
Alumina	10
Oxide of Iron	20
Lime	10
Potash and Soda	10
Volatile Matter	5
	—100

RUBELLITE. [Tourmaline.]

RU'BIA, a genus of Plants belonging to the natural order *Galiaceæ*, containing about 40 species, found both in Europe and Asia. This genus is characterised by flowers monopetalous, superior; tube of the calyx ovate-globose, limb scarcely any; corolla sub-campanulate, rotate, 5-partite; stamens 4-5, short; styles 2, short; berries 2, 1-seeded.

R. tinctorum, Madder, has been long known, and was employed in medicine even in the time of Hippocrates, but is valued chiefly as a dye. It has a diffuse brittle-branched stem, angular, very rough, with sharp hooks; leaves 4 or 6 in a whorl, lanceolate or oblong-lanceolate, mucronate, somewhat membranous with pinnated veins; flowers small and white; lobes of the corolla ovate-lanceolate, apiculate; anthers ovate-oblong; stigmas conical. It is a native of Europe and Asia Minor, but is now extensively cultivated in Holland and France; the culture has likewise been attempted, and successfully, in this country, but the English madder could not be sold so cheap as the foreign; it is therefore still largely imported, chiefly from Holland, France, Italy, and Turkey, though since cochineal has become cheaper, it is much used for the same purposes. It is employed by dyers and calico-printers as a red and scarlet dye. It has also the singular property of turning red the bones and secretions of fowls and other animals fed on it.

R. cordifolia (*R. Munjista*), the Munjeet of India, a native of Nepaul, &c., possesses very similar properties, and is imported into England from Calcutta. The root is used as a substitute for that of *R. tinctorum*; it is known in commerce under the name of East Indian Madder, and is also employed in medicine. Like Madder, Munjeet was probably known from very early times, as Rodeen is given as the Greek name in Persian works on Materia Medica. *R. Chilensis* and *R. Relbun*, both natives of South America, are also esteemed there as dyes.

(Lindley, *Vegetable Kingdom*.)

RUBICELLE, or orange red spinels. [Spinel.]

RUBUS (the Latin *Rubus*, a Bramble), a genus of Plants belonging a the natural order *Rosaceæ*, and to the section *Potentillex* of the suborder *Rosaceæ* proper. This genus, like that of *Rosa*, has proved source of difficulty and difference amongst botanists. Some writers on the British Flora have described upwards of twenty-five species, whilst others have reduced them to four or five, or even two.

The following excellent description of this genus from Hooker's 'British Flora' has been drawn up by Mr. Borrer, who has investigated the British species with more success than any other botanist:—

"Shrub-like Plants or Herbs, with perennial Roots. The latter offer nothing very peculiar. In some species of the former the stem is upright, or merely curved at the top; but in the greater number it is either prostrate, or, as is more generally the case, assurgent, arched, and decurved; and the ends of the shoot and of the side branches, if it produce any, unless prevented by circumstances from reaching the ground, take root in the latter part of the year. In the winter the shoot is partially destroyed, the part next to the original root surviving to produce flowering branches during the ensuing summer, and usually dying after the fruit has been perfected; young shoots meanwhile springing up by its side. The rooted ends also become distinct plants at various distances from the parent root, often many yards. This mode of growth adds much to the difficulties in the discrimination of the species; since an acquaintance with both the leafy shoot and the floriferous stem, formed in the second year from its remains, is necessary. The best characters are found in the figure, the arms, and the leaves of the former. The leaves in all the British species of this division are, occasionally at least, quinate, and, with one exception, digitate, or somewhat pedate from a partial junction of the stalks of the two lateral pairs of leaflets; the margins serrated, for the most part unequally and irregularly; the prickles on the leaf-stalks more curved than those of the stem. In some species the inflorescence is remarkable, but in general the panicle varies so much as to afford no good distinction, nor can the arms of the calyx nor the form of its segment be depended on. The petals in all are delicate and crumpled, and in several species very considerable in size and width. There are some differences in the fruit, but they are rarely discriminative. In examining the figure of the leaves, the central leaflet is to be regarded; the lateral ones are always smaller and of a narrower proportion. In several species the leaves occasionally survive a mild winter, and are found the next season subtending flowering branches. The leaves of these branches are of less determinate figure; the number of their leaflets is reduced as they approach the inflorescence, and their place is supplied in the upper part of the panicle by first trifid and then simple bracteas, formed by the coalescence of the stipules. These last are usually long and narrow, entire, or sometimes toothed or jagged, and issue from the petiole, for the most part, a little above its base. They afford no distinguishing characters." This description applies equally to the foreign species as to those of Britain. The essential characters of the genus are:—calyx 5-cleft; petals 5. Fruit superior, of several single-seeded juicy drupes placed upon a protuberant spongy receptacle. The species are universally diffused over the mountainous and temperate regions of the Old and New World.

Nearly 200 species of this genus have been described. Babington, in his 'Manual of British Botany,' gives 43 species as British, Hooker and Arnott in the 'British Flora' give but 9 species, whilst Dr. Bell Salter, in the 'Supplement' to the same work, makes 22 species. This will be sufficient to show the difficulty of determining the species in this genus.

1. Species having minute leaves, and 3 to 7 leaflets.

R. Idæus, Common Raspberry, or Mount Ida Bramble. [RASPBERRY, in ARTS AND SC. DIV.] The whole plant is villose, stem round, with slender recurved prickles; leaves pinnate, with 3 or 5 ovate serrated leaflets, tomentose beneath; flowers drooping; petals obovate, wedge-shaped, entire, conniving, shorter than the calyx; carpels numerous, tomentose. It is a native of woods in Europe, from Norway and Sweden to Spain and Greece. It is found also in Asia on the Himalayas, in the north of Africa, and in America from Canada to Pennsylvania. It is found abundantly in almost every part of Great Britain and Ireland.

R. suberectus, Upright Bramble, is known by its nearly upright, not rooting, obsoletely angular stem, uniform few and small prickles, lower pair of leaflets sessile or nearly so, and panicle nearly simple. The stems are between three and four feet high. The fruit consists of a number of small dark-red aggregated carpels, which have something the flavour of the raspberry, and hence recommended for cultivation. It is a British species, and grows on boggy heaths, by the sides of streams, &c., chiefly in mountainous districts of the North.

R. micranthus, Small-Flowered Bramble, has an upright, round, branched stem, pinnate leaves, with 5-7 oblong, ovate, doubly serrate, tomentose beneath, and green above leaflets, with small reddish-purple flowers arranged in corymbs, and black fruit. It is a native of Nepaul, and one of the most gigantic of the genus, attaining a height of 8 or 9 feet. It is easily distinguished by its nearly erect, smooth, dark mahogany-coloured shoots, and very long pinnate leaves. The shoots sometimes attain a length of 20 feet. There are two other species, *R. distans* and *R. asper*, found with this in Nepaul, which have been grown in this country.

R. occidentalis, the Western Bramble, is a native of Canada and the West Indies, and was introduced into this country in 1696. It has umbellate flowers, and fruit like the raspberry, but black, and grows to the height of 4 or 6 feet.

2. Digitate leaves, with from 3 to 5 leaflets.

R. cæsius, the Gray Bramble, or Dewberry. Stem trailing, round or nearly so, glaucous: prickles straight, unequal, passing insensibly into setæ, the length of the largest rarely equalling the diameter of the stem; leaves digitate, of 3 or more rarely 5 ovate leaflets, the outermost sessile; calyx embracing the fruit. It is a native of Europe and the north-east of Asia, in woods and hedges. Many of the species described by botanists may be referred to this; the most important of these are *R. Sprengelii*, *R. dumetorum*, *R. foliolosus*, *R. flagellaris*, and *R. corylifolius*. The last, the Hazel-Leaved Bramble, is admitted as a species by most British botanists. It is known by its stem being decurved and roundish, prickles straight, passing into setæ; leaves digitate, with five ovate leaflets; fruit spreading or reflexed. It is generally a much larger and stronger plant than *R. cæsius*. Dr. Lindley refers several of the species of the German botanists, Weihe and Nees, to the *R. corylifolius*, which he admits as a genuine species.

R. spectabilis, Showy Bramble, is one of the handsomest of the genus. It has a glabrous stem, not bearing prickles; leaf of three ovate, acute, doubly and unequally serrated leaflets, downy beneath; flowers of an agreeable purplish colour, on terminal peduncles. It is a native of America.

R. fruticosus, Shrubby Bramble, or Common Blackberry, is one of the most common species of the genus. It has a 5-angled erect stem, rather tomentose, bearing recurved prickles, 3-5 leaflets, each on a secondary petiole; rose-coloured or white flowers arranged on a panicle; reflexed sepals, almost without prickles; purplish black fruit. It is a native of almost all Europe, in hedges, thickets, and woods. There are no less than ten generally admitted varieties of this species, and some botanists make many more. The fruit of this species and its varieties are well known as blackberries, or bumblekites, and also scald-berries, from their supposed power of giving scald-head to children.

R. arcticus, the Arctic Bramble, is the smallest species of the genus. It has three glabrous obtusely-serrated leaflets, no runners, stem bearing only one flower, and without prickles, the petals notched. It is a native of the mountainous and colder regions of Europe. Its stem never attains a greater height than six inches, and is furnished with from three to four leaves, with a single large deep rose-coloured flower, which is succeeded by a purplish-red fruit highly prized for its flavour among the Swedes.

3. Leaves singly lobed, not digitate or pinnate.

R. odoratus, the Sweet-Scented Bramble. It has an upright stem, with large showy red flowers, numerous ovate velvety carpels, and red fruit. It is a native of North America, in the woods of Canada, and the Alleghanies. It grows to the height of 4 or 5 feet, and is called *odoratus* on account of the fragrance of its foliage. Another American species, resembling the last, is the *R. Nutkanus*, the Nootka-Sound Bramble. It flowers from May to October.

R. chamæmorus, the Cloud-Berry, is known by its dicecious flowers, simple-lobed leaves, and herbaceous single-flowered stem without prickles. It grows in great abundance on the Scotch Highlands, and, under the name of Roebuck-Berries and Knot-Berries, the fruit is gathered in great quantities by the inhabitants of those districts. It is the badge of the clan of M'Farlane.

RUBY. [SPINEL.]

RUD, or RED EYE. [LEUCISCUS.]

RUDBE'CKIA, a genus of Plants dedicated by Linnæus to the memory of his predecessors the Rudbecks, father and son, in the botanical chair at Upsal. It belongs to the natural order *Compositæ*, and possesses many species. Some of these are well known in gardens. They are herbaceous, biennial, and perennial.

RUDISTES. [HIPPURITES.]

RUE. [RUTA.]

RUE'LLIA, a genus of Plants belonging to the natural order *Acanthaceæ*, which was so named by Linnæus in compliment to J. Ruelle, physician of Francis I., who wrote commentaries on Dioscorides, as well as some other botanical works. The genus, as formerly constituted, embraced a great many Indian species, which are now distributed among some other genera. The species are distributed through the tropical parts of Asia, including the tropical and subtropical parts of Australia. It includes many highly ornamental plants, as are also those which have now been excluded from it; all are easily cultivated, and often to be seen in our hot-houses. Some of the species which have now been removed to other genera are found at considerable elevation on the sides of the Himalaya Mountains; of these the most remarkable is *Æchmanthera* formerly *Ruellia gossypina*, which has its stems covered with a thick coating of white tomentum, which probably enables it to withstand a greater degree of cold than most others of the family.

The leaves of *R. strepens* are subacrid. A valuable dye, called Room, is obtained in Assam from a species of *Ruellia*.

RUFF, a Bird. [SCOLOPACIDÆ.]

RUFFE, a Fish. [CERNUA.]

RUMEX, a genus of Plants, from 'rumex,' a sort of spike, spear, or

halberd, which the shape of its leaves resembles. It belongs to the natural order *Polygonaceæ*. Most of the species of this genus are well known as troublesome weeds to the agriculturist, under the name of Docks and Sorrels. Some of them have been used in medicine, but their incomplete flowers and inelegant appearance have caused their almost entire neglect in the garden. The essential characters of the genus are:—Calyx with 6 sepals, the outer 3 slightly coherent, the inner ones enlarged after flowering; stamens 6; styles 3, reflexed; stigmata 3 and cleft; fruit a 3-cornered nut, with a lateral embryo and superior radicle. In the descriptions of this genus by botanists, the three inner sepals are often designated as corolla, but it is more consistent with what we know of the general structure of the order *Polygonaceæ* to refer it to the apetalous or incomplete sub-class of Exogens, and thus to consider the flower of *Rumex* as destitute of corolla. *Rumex* is nearly allied to *Rheum*, but may be distinguished from that genus by its 3-cornered carpels not having wings, and by the embryo of the seed being lateral, not central as in *Rheum*. The wings that are observed upon the fruit of some species of *Rumex* are produced by the calyx.

R. acetosa, Common Sorrel, is known by its granular valves, dicecious flowers, oblong awl-shaped leaves, with converging (often notched) lobes. It is indigenous in this country, and it is also common in meadows and grassy pastures throughout Europe, from Lapland to Greece. It flowers early in June. The leaves are used in decoction as a febrifuge.

R. hydrolapathum, Great Water-Dock, is distinguished by having sepals petaloid, nearly entire, unequally tuberculated; lanceolate leaves acute at each end; almost leafless whorls. It is found growing in marsh-land ditches, stagnant waters, and the margins of great rivers throughout Europe, as well as in North America from Pennsylvania to Virginia. It is by far the largest and most conspicuous of our indigenous docks; flowering from July to August. This seems to have been the plant known under the name of *Herba Britannica* to Pliny (xxv., c. 3, 8), Galen, and others, and which was employed, on account of its astringent properties, in various diseases in which those remedies are indicated.

R. crispus, Curled Dock, is a common weed all over Europe. It has a tapering yellowish root. Stem two or three feet high, angular, furrowed, somewhat zigzag, smooth to the touch, panicled, and leafy. Leaves lanceolate-acute, strongly undulated, and crisped at the edges, smooth, of a lightish green-colour, the radical ones on long stalks, the uppermost narrower and nearly sessile. Clusters of numerous rather crowded tufts, or whorls, of drooping pale-green flowers, in the lower part leafy. The nut contracted at each end, with three blunt or tumid angles. This common weed has the reputation of being in decoction or ointment a cure for the itch; the root, which is astringent, is the part used.

There are 13 British species described in Babington's 'Manual,' which are commonly known by the names of Sorrel, or Dock. Besides the species just described, several others are used in medicine.

R. obtusifolius, the root of which, in powder, is employed as a dentifrice.

R. alpinus, Monk's Rhubarb, the root of which is thick, fleshy, and purgative.

(Lindley, *Flora Medica*.)

RUMINANTIA, Cuvier's name for his eighth order of Mammifères. They constitute the *Pecora* of Linnæus.

Cuvier remarks that this is perhaps the most natural and the best defined of the class; for these animals have the air of being nearly all constructed on the same model; and the camels alone present some small exceptions to the common character. [CAMELUS; LLAMA.]

The first of these characters, observes the great French zoologist, is the possession of incisor teeth in the lower jaw only, and these are nearly always eight in number. They are replaced above by a callous rim (bourrelet). Between the incisors and the molars is a wide space, where are found, in one or two genera only, one or two canines. The molars, nearly always six in number on each side of the upper and lower jaws, have their crown marked with two double crescents, the convexity of which is turned inwards in the upper and outwards in the lower teeth.

The four feet are terminated by two toes and two hoofs, which oppose to each other a flattened surface, so that they have the appearance of a single hoof which has been split; whence these quadrupeds have obtained the name of animals with divided or bifurcate hoofs, &c.

Behind the hoof there are sometimes two small processes or spurs, the vestiges of the lateral fingers. The two bones of the metacarpus and the metatarsus are united into a single one, the cannon bone, but in some species there are also vestiges of the lateral metatarsians and metacarpians.

The name Ruminants indicates the singular faculty possessed by these animals of masticating a second time their food, which they return into the mouth after a previous deglutition, a power which is the result of the structure of their stomachs, four of which they always have. Of these stomachs the three first are so disposed that the aliment can enter at the will of the animal into any one of the three, because the œsophagus terminates at the point of communication.

The First Stomach or Paunch (Rumen, Panula, Magnus Venter, Ingluvies—Panse of the French) is much the largest in the adult animal, but not so in the recently born calf or lamb. It is divided outwards into two bag-like appendages at its extremity, and it is slightly separated into four parts on the inside. The internal coat of this stomach is beset with innumerable flattened papillæ. Here are received the masses of herbage rudely broken up by the first mastication, and here it is (though they sometimes, but seldom, occur in the second) that the morbid concretions of a globular or elongated but rounded figure are generally found. These concretions are composed of three sorts of substances—of hairs, of the fibrous parts of plants, or of stony matter. The first of these are formed, particularly in the cow, by the animal's own hair, or that of another cow or ox licked off and gradually accumulated in the stomach. Sometimes these are hairy externally, but generally they are covered with a dark polished coat. The *Ægagropilæ* found in the Chamois consist of vegetable macerated fibres. The stony concretions have received the name of Bezoar Stones. They were formerly believed to be antidotes to poisons, and to possess other extraordinary virtues.

The herbage in the state above noticed is transmitted into the Second Stomach, Honey-Comb Bag, Bonnet, or King's-Hood (Reticulum, Ollula—Bonnet of the French), the walls of which are furnished with laminæ somewhat resembling the cells of bees: this, which is small and globular, may be considered as an appendage of the first stomach or paunch, but is distinguished from that by the elegantly arranged polygonal and acute-angled cells, forming superficial cavities on its internal coat. Here the herbage is arrested, imbibed, and compressed into small masses or balls, which are thence returned successively into the mouth for remastication. During this operation the animals remain in a state of repose,

"Some ruminating lie,"

until all the herbage swallowed has undergone the action of the molar teeth a second time. The aliment thus remasticated is transmitted into the third or smallest stomach, the Manyplus (Manyplies)—(Echinus, Conclave, Centipellio, Omasus, Psalterium—Feuillet of the French). This stomach is distinguished from the two former, both by its form, which has been fancied to resemble a hedgehog rolled up (whence the name Echinus), and its internal structure, the longitudinal laminæ of its walls resembling in some degree the leaves of a book (whence the name Feuillet). These numerous and broad duplicatures of its internal coat lie lengthwise and vary in breadth in regular alternate order, amounting to some forty in the sheep, and about a hundred in the cow.

From the third stomach the food is transmitted into the fourth, the Red (Abomasus, Faliscus, Ventriculus Intestinalis—Caillette of the French), which is next in size to the first stomach or paunch, of an elongated pyriform shape, and with an internal villous coat similar to that of the human stomach, with large longitudinal wrinkles. This last is, so to speak, the true organ of digestion, analogous to the simple stomach of ordinary animals.

We will now proceed to inquire how this complicated machine is connected together, and how it acts.

Blumenbach observes that the first three stomachs are connected with each other, and with a groove-like continuation of the œsophagus, in a very remarkable way. The latter tube enters just where the paunch and the second and third stomachs approach each other; it is then continued with the groove, which ends in the third stomach. This groove is therefore open to the first stomachs, which lie to its right and left. But the thick prominent lips which form the margin of the groove admit of being drawn together so as to form a complete canal which then constitutes a direct continuation of the œsophagus into the third stomach. The functions of this very singular part will vary according as we consider it in the state of a groove or of a closed canal. In the first case, the grass, &c., is passed, after a very slight degree of mastication, into the paunch as into a reservoir. Thence it goes in small portions into the second stomach, from which, after a further maceration, it is propelled, by a kind of antiperistaltic motion, into the œsophagus, and thus returns into the mouth. It is here ruminated and again swallowed, when the groove is shut, and the morsel of food, after this second mastication, is thereby conducted directly into the third stomach. During the short time which it probably stays in this situation between the folds of the internal coat, it is still further prepared for digestion, which process is completed in the fourth or true digestive stomach. (Lawrence's 'Blumenbach.') In notes to the same work it is stated that the shutting of the groove when the food is again swallowed after rumination supposes a power of voluntary motion in this part, and indeed, it is added, the influence of the will in the whole affair of rumination is incontestable. It is not confined to any particular time, since the animal can delay it according to circumstances when the paunch is quite full. It has been expressly stated of some men, who have had the power of ruminating (instances of which are not very rare), that it was quite voluntary with them. "I have known," continues Blumenbach, "two men who ruminated their vegetable food: both assured me that they had a real enjoyment in doing this, which has also been observed of others; and one of them had the power of doing it or leaving it alone according to circumstances."

Whilst the Ruminants remain at the teat and live upon nothing but

milk, the fourth stomach is the largest of all. The first stomach or paunch only develops itself into its enormous volume in proportion as it receives supplies of herbage.

The intestinal canal of these animals is very long, but little enlarged or sacculated in the great intestines. The cæcum is moderately long and smooth.

The student will find a series of preparations illustrative of the structure of the alimentary canal of the *Ruminantia* in the Museum of the Royal College of Surgeons of England. The structure of the particular forms of these animals will be found under the articles ANTILOPEÆ, BOVIDÆ, CAMELUS, CAPREÆ, CERVIDÆ, LLAMA, OVEÆ, and GIRAFFA.

Cuvier makes the Ruminants consist of two divisions:—first, those without horns; secondly, those with horns.

The first division embraces the Camels (*Camelus*, Linn.), or the Camels properly so called, and the Llamas; and the Chevrotains (*Moschus*, Linn.). Secondly, all the rest of the Ruminants, of the male sex at least, have two horns or prominences, more or less long, projecting from the frontal bones, which is not found in any other family of mammals.

In some these prominences are covered with a case of elastic substance, composed, as it were, of agglutinated hairs, which grows in layers, during the whole life of the animal. To this the name horn (corne) is specially applied. The bony prominence or core which this case envelops, grows, like it, during the whole life of the animal, and is never shed. Such are the horns of oxen, sheep, goats, and antelopes.

In others the prominences are invested only with a hairy skin, which is continued from that of the head, and is never destroyed during life. These prominences are never shed.

Finally, in the great genus *Cervus*, Linn., the prominences covered during a certain period with a hairy or velvety skin resembling that of the rest of the head, have at their base a ring of bony tubercles, which, as it increases, compresses and obliterates the nutrient vessels of that skin, which, when the horn is complete, dries and is removed. The naked bony prominence separates in due time from the skull, to which it grew, falls, and the animal becomes defenceless. But new horns soon begin to bud, ordinarily, and while the animal is in the vigour of life, larger than the preceding ones, and destined to fall in their turn. These horns, purely osseous and subjected to periodical changes, are termed by the French Bois, and are known in England by the name of Antlers.

Mr. Swainson divides the *Ungulata* into the following five tribes:—*Ruminantes*, *Pachydermes*, *Anoplotheres*, *Edentates*, and *Solipedes*.

The *Ruminantes* are thus arranged:—

1. Sub-typical group.—Horns sheathing; form gracile, slender.
Family *Antilopidæ*. [ANTILOPEÆ] (Sw.——*Caprida*, Smith).
Genera.—*Dicranocerus*, Sm.; *Aigocerus*, Sm.; *Oryx*, Sm.; *Gazella*, Sm.; *Antilope*, Sm.; *Redunca*, Sm.; *Tragulus*, Sm.; *Raphicerus*, Sm.; *Tetracerus*, Leach; *Cephalophus*, Sm.; *Neotragus*, Sm.; *Tragelaphus*, Sm.; *Nemorhædus*, Sm.; *Rupicapra*, *Ant.*, Sm.; *Aplocerus*, Sm.; *Capra*, Auct.; *Ovis*, Auct.; *Damalis*, Sm.; *Acronotus*, Sm.; *Boselaphus*, Sm.; *Strepsicerus*, Sm.; *Portax*, Sm.

2. Typical.—Horns sheathing; form heavy, robust.
Family *Bovidæ*, Sm. [BOVIDÆ.]

3. Aberrant. Horns solid, deciduous. (*Cervidæ*, Sm.; *Cervus*, Linn.) [CERVIDÆ.]

	Genera and Subgenera.
	1. *Alces*, Sm. (Subgenera *Rangifer*, Sm.; *Dama*, Sm.)
	2. *Cervus*, Linn., Sw. (Subgenera, *Rusa*, Sm.; *Axis*, Sm.)
	3. *Capreolus*, Sm. (Subgenus, *Mazama*, Sm.)
	4. *Subulo*, Sm.
	5. *Stylocerus*, Sm.
Horns wanting; fore legs shorter than the hinder. (*Moschidæ*, Sw.) [MOSCHIDÆ.]	1. *Moschus*, Linn.
Horns very short, covered with a skin. (*Camelopardæ*, Sw.) [GIRAFFA.]	1. *Camelopardalis*, Antiq.

The tribe *Solipedes*, which immediately follows the Camelopards, consists of the genera *Camelus*, *Auchenia*, and *Equus*. Thus the Camels and Llamas, with which Colonel Smith, following Cuvier, commences the Ruminants, are placed by Mr. Swainson at the conclusion. With the exception of this and a few other modifications, the two arrangements are similar.

RUMINATION. [RUMINANTIA.]

RUMPHIA, a genus of Plants named by Linnæus in honour of George Eberhard Rumph, is only known from a figure of Rheede, published in his 'Hortus Malabaricus,' vol. iv., t. 11, who describes it as being found in Parabaroo and other provinces of Malabar. It has not been seen by any modern botanist. It is usually referred to the natural family of *Terebinthaceæ*, and to the sub-order *Burseræ*. It has a tubular trifid calyx, 3 oblong petals of the corolla; stamens 3, equal to the petals, and exserted. The ovary is single, 3-cornered; style one; drupe coriaceous, turbinate, 3-furrowed, with the nut 3-celled, 3-seeded. But Messrs. Wight and Arnott remark, that as each apparent stamen may be composed of several filaments, this doubtful genus would be brought near *Byttneriaceæ*.

RUNNER. [EXOGENS.]

RUNNING. [LOCOMOTION IN ANIMALS.]

RUPELLARIA. [LITHOPHAGIDÆ.]

RUPICAPRA. [ANTILOPEÆ.]

RUPICOLI'NÆ, a sub-family of Insessorial Birds allied to the Manakins and generally arranged under the family *Pipridæ*. Mr. Swainson places both *Calyptomena* and *Rupicola* in the sub-family *Ampelinæ*, or Typical Chatterers; and *Rupicola*, in his arrangement, immediately precedes the sub-family *Piprinæ*, Manakins, which he considers as subtypical. Mr. G. R. Gray ('Genera of Birds') places *Rupicola* and *Calyptomena* at the head of the *Ampelinæ*, the fourth sub-family of the *Ampelidæ* in his method.

Rupicola (Briss.).—Bill moderate, robust, rather vaulted and curved at the point, upper mandible as wide as it is high, compressed at the base and notched at the point; lower mandible shorter, straight, and sharp; nostrils oval, lateral and hidden by the feathers of the elevated crest which covers the head. Feet large, strong, tarsi partially clothed with feathers, feet syndactyle, outer toe connected with the middle toe beyond the first joint; hallux very strong, and armed with a crooked nail. Wings short, rounded; fourth and fifth quills longest.

The species are found in central and South America.

R. aurantia, Vieillot. It is the *Pipra Rupicola* of Linnæus, *Rupicola Cayana* of Swainson, *R. elegans* of Stephens, and Rock Manakin and Cock-of-the-Rock of English ornithologists.

The male is about the size of a Ring-Pigeon (*Columba palumbus*), very bright orange-yellow; a crest, which is compressed and elevated, rises from the head with a helmet-like air, and is varied at the summit with brown and bright-yellow; there is some white at the bend and on the middle of the wing, which is filiform at the first quill; the tail-feathers are short, reddish-black bordered with yellow; bill and feet rosy-white. Female rather smaller, and with a less elevated crest; colour entirely dirty bistre-brown.

This beautiful bird inhabits Guyana, especially about the rocks which border the small river Oyapock, and is becoming daily more rare.

The Cock-of-the-Rock flies swiftly, and is a very shy bird. The nest is made of twigs and dry herbage; and there the female lays two white eggs about the size of those of a pigeon. The food consists of the smaller wild fruits.

Cock-of-the-Rock (*Rupicola aurantia*).

R. Peruviana (Dumont), the Chiachia Lacca of the Mexicans. Male.—Bright-orange, like the preceding, but the quills and tail-feathers are deep-black and the middle wing-coverts are bright gray-ash. The crest is of a uniform colour, wanting the deeper-coloured semicircular line, and not of a helmet-like contour. The tail-feathers are long.

The Peruvian Cock-of-the-Rock was for some time considered to be a mere variety of *R. aurantia*, but it differs in being of larger size, in colour, in the length of the tail-feathers, in the absence of the filiform wing-feathers, and in the crest, which is not circular as in the preceding species.

It has been brought to Europe from Lima.

Peruvian Cock-of-the-Rock (*Rupicola Peruviana*).

Calyptomena (Raffles); *Rupicola* (Temminck).—Bill depressed and wide at the base, curved or hooked at the point, and nearly hidden by the feathers of the erect and compressed crest. Wings large and very broad, first quill shortest, third longest, lesser quills notched at their tips. Tail and feet very short, hind toe as long as the tarsus, outer and middle toe connected up to the second joint.

C. viridis (Raffles). This very singular and beautiful bird is about 6½ inches in length. Its colour is a brilliant green, like that of the parrots. It is the Burong Tampo Pinang of the Malays. It is a native of Singapore and the interior of Sumatra.

Sir Stamford Raffles states that this species is found in the retired parts of forests, and as it is of the colour of the leaves, and perches high, it is not easily procured. He further tells us that the stomach contained nothing but vegetable substances, chiefly wild grains.

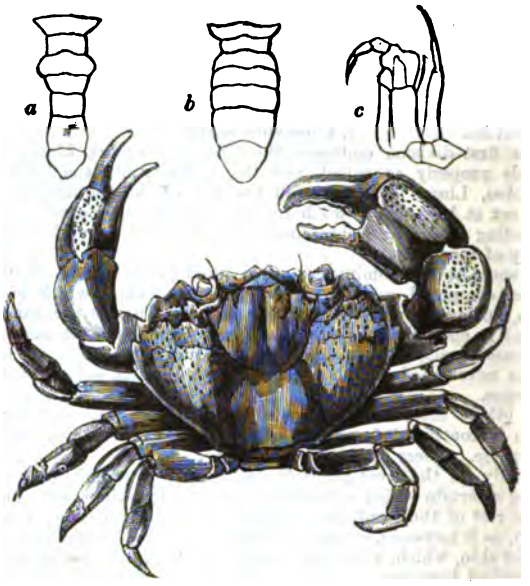
Dr. Horsfield observes that the bill greatly resembles that of the genera *Rupicola*, *Pipra*, *Phibalura*, *Pardalotus*, *Platyrhynchus*, and *Procnias*.

Calyptomena viridis.

RUPPE'LLIA (Milne-Edwards), a genus of *Crustacea* belonging to the family *Cancerida* (Cancériens Arqués), established on the *Cancer tenax* of the German zoologist and traveller Rüppell, and considered by M. Milne-Edwards as the type of the small group which leads to the genera *Ozius* and *Eriphia*.

The form of the carapace approximates closely to that of *Xantho* and *Ozius*; dorsal buckler slightly curved, and about once and a half as wide as it is long; the orbits are nearly circular, and are directed upwards and forwards. The internal antennæ bend back directly outwards, as in *Xantho*, &c.

R. tenax, *Cancer tenax*, Rüppell, has the upper border of the orbit marked by two fissures separated by a small tooth; there is a fissure at its external angle, and two teeth at its lower borders. Length about two inches. It is a native of the Red Sea.



Ruppellia tenax.

a, abdomen of male; *b*, abdomen of female; *c*, pedipalps.

RU'PPIA, a genus of Plants belonging to the natural order *Juncaginaceæ*. This genus was named by Linnæus after Henry Ruppius of Giessen, an active botanist, and author of 'Flora Janensis.'

R. maritima, Sea Ruppia, is found in salt-water pools and ditches; it has a slender filiform leafy stem, with linear leaves, which are furnished with sheaths sometimes narrow and small, at other times inflated. Its flowers, which are two in number and green, are seated one above another on opposite sides of a short spadix, which is included in a sheath or spathe; it has large sessile anthers 1-celled; the ovaries are four minute grains seated in the centre between the stamens, which are sessile and two in number. When the plant has flowered the spadix lengthens to the height of five or six inches or more, and becomes spirally twisted, as if to bring the fruit to the level of the water, in which the flowers are always immersed. After this the ovaries begin to swell, and their base is elongated into a footstalk, as the fruit ripens, one or two inches long. When the fruit is perfectly ripe it becomes an ovate acuminated drupe. It is a native of Great Britain.

R. rostellata has the cells of the anthers nearly round. The whole plant is very slender; the leaves rather filiform than linear; sheaths small and close; nut obliquely ascending. It is found in salt marshes in Great Britain.

(Babington, *Manual of British Botany.*)

RUSCUS, a genus of Plants belonging to the natural order *Liliaceæ*, known by the common name of Butcher's Broom. The species of this genus are evergreen, and on this account are frequently introduced for undergrowth in shrubberies. The genus is known by its dioecious flowers, of which the barren flowers have a perianth of 6 single leaves, 3-6-anthers with the filaments combined at the base; in the fertile flowers the same perianth with a tubular nectary, single style, fruit superior, 3-celled, cells 2-seeded.

R. aculeatus, Common Butcher's Broom, is found wild in Britain. It has ovate attenuated leaves, very acute, rigid, bearing the flowers upon the middle of their upper surface; flowers solitary, rarely 2 together, subtended by a flat subulate scarious 1-nerved bract. It is found in bushy places and woods. The Butcher's Brooms of Europe were once celebrated as aperients and diuretics on account of their bitter subacrid mucilaginous roots.

R. hypophyllum had considerable reputation at one time. Its seeds are very horny, and when roasted are said to form a pleasant substitute for coffee.

(Lindley, *Vegetable Kingdom*; Babington, *Manual of British Botany.*)

RUSH. [JUNCUS.]

RUSH, DUTCH. [EQUISETUM.]

RUSH, FLOWERING. [BUTOMACEÆ.]

RUTA, a genus of plants belonging to the natural order *Rutaceæ*. The following is a description of this genus:—Calyx 4-partite, deciduous, shorter than the petals, which are four and unguiculate, with the limb vaulted. Stamens eight, longer than the petals;

filaments subulate, glabrous; anthers ovate, obtuse. Receptacle broader than the ovary, marked round with eight nectariferous pores, bearing the petals and stamens at the base. Carpels 4, partly combined by means of the central axis (gynobase) into one 4-lobed ovary, ovules 6-12 in each cell. Styles 4, distinct at the base, united upwards into a single pistil which is attenuated towards the apex. Stigmas 4. Capsules 4, partly united, dehiscing internally at the apex. Seeds dotted. The species of this genus are suffrutescent, herbaceous, or perennial plants, with alternate exstipulate pinnated or decompound leaves covered with pellucid dots. The flowers are yellow, rarely white, and disposed in terminal corymbs or racemes. De Candolle enumerates 24 species of *Ruta*, of which comparatively few are generally known or cultivated.

R. graveolens, Common Rue, is a glaucous hairless erect herb or half-shrubby plant, with a strong heavy unpleasant smell, growing to the height of about two feet. The leaves are supradecompound, alternate, their lateral lobes linear or nearly so; the terminal ones obovate; they and all other parts of the plant are covered with transparent dots. Carpels terminal, leafless, trichotomous, cymose; petals four, wavy concave, a little irregularly toothed. Fruit roundish, warted, four-lobed, each lobe opening into two valves.

Rue is sometimes called Herb-Grace, or the Herb of Grace, and in some parts of England Ave-Grace. This name is said to have been given to it on account of its use in exorcisms. In company with rosemary it has been used from time immemorial as an emblem of remembrance and grace on account of its evergreen foliage. The stamens are remarkable for their presenting an instance of vegetable irritability. When the time is come for the pollen to be introduced into the stigma, and thus presented to the ovules, the stamens, which are hard and rigid, and almost at right angles with the style, approach the stigma one by one, and after remaining in contact with it long enough to discharge their pollen, they return back to their original position parallel with the petals. [RUE, in ARTS AND SC. DIV.]

RUTA'CEÆ, a natural order of Polypetalous Exogenous Plants, characterised by the possession of hypogynous stamens, two or three times as many as the petals, cohering carpels with from 3 to 5 valves, an entire ovarium with several cells, imbricate calyx with four or five divisions, symmetrical hermaphrodite flowers with petals either wanting or as many as the lobes of the calyx, mostly twisted in æstivation. Fruit capsular, the sarcocarp mostly separating from the endocarp. Leaves without stipules, opposite, or alternate, simple, deeply lobed or pinnate, and covered commonly with pellucid resinous dots. They are trees, small shrubs, or herbaceous plants.

Ruta graveolens.

a, lobed fruit surrounding the central axis; *b*, section of a seed, showing the embryo lying in the centre of the albumen; *c*, flower, showing a double row of stamens, concrete carpels, and rim of the disc.

This order embraces the *Rutex* and *Diosmeæ* of A. de Jussieu, which are now made the principal sections of *Rutaceæ*. *Rutex* are known by their seeds containing albumen, and by the sarcocarp of the fruit not being separable from the endocarp. In *Diosmeæ* the seeds have no albumen, and the sarcocarp and endocarp are separable into distinct bodies when the fruit is ripe. A. St. Hilaire says that the observation of the adhesion of the sarcocarp and endocarp in *Rutex* has been made on unripe specimens of the plants, and that when ripe they are as separable as in *Diosmeæ*. Whatever may be the real state of the case, the two sections are too obviously related in structure and general properties to permit of so slight differences elevating them into the importance of distinct natural orders. *Rutaceæ* agree with *Aurantiaceæ* in their dotted leaves, definite stamens, and fleshy disc. With *Xanthoxylaceæ*, *Simarubaceæ*, and *Humiriaceæ*, they have also many points of analogy. They are closely allied to *Zygophyllaceæ* through *Peganum*, which Jussieu and other writers place amongst *Rutaceæ*. They are found in the south of Europe, and in our hemisphere extend as far as the limits of the Old World. *Diosma* and allied genera are found at the Cape of Good Hope. Australia possesses Boronias, Phebaliums, Correas, &c.; and great numbers are found in the equinoctial regions of America.

Many of the plants of this order emit a powerful and usually offensive odour from the glands that cover their whole surface. These glands are sometimes so full of a volatile oil, that in hot weather the atmosphere surrounding the plant becomes charged with it, so that a lighted taper brought near the plant will cause the air to inflame. This is especially the case with *Dictamnus*. The Diosmas, or Bucku Plants, are used in medicine as antispasmodics. The celebrated Angostura Bark is produced by a plant (*Galipea officinalis*) [GALIPEA] belonging to this order. [RUTA; FRAXINELLA; DIOSMA.]

RUTILE. [TITANIUM.]

RYACOLITE, a Mineral resembling *Albite*. It contains 10 per cent. of soda. It comes from Mount Somma and the Eifel.

RYE. [SECALE.]

RYE-GRASS. [LOLIUM.]

RYNCHÆA, or RHYNCHÆA. [SCOLOPACIDÆ.]

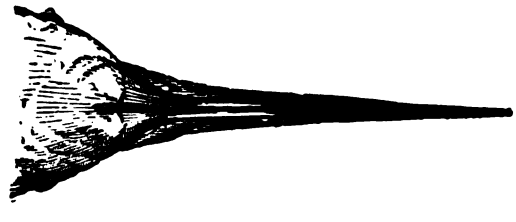
RYNCHOPS (Linnæus), a genus of Aquatic Palmipede Birds. The word would be more correctly written Rhynchops (Ῥύγχος), and indeed is so spelled by most ornithologists; but the word stands in the last edition of the 'Systema Naturæ,' published by Linnæus, as it appears at the head of this article, and the genus is arranged at the end of the *Anseres*, coming immediately after *Sterna*, which last is preceded by *Larus*.

This genus has been variously placed by zoologists. It has the following generic characters:—Bill longer than the head, straight or nearly so, compressed, and in form resembling the blade of a knife, truncated, and with the appearance of having been broken at the point; upper mandible much shorter than the lower, and with a groove into which the lower mandible is received; nostrils marginal, median. Feet moderately long, slender. Wings very long; the first quills longest.

The extraordinary structure of the bill in this bird immediately fixes the attention. In appearance it looks, at first sight, like a worn or imperfect organ: in reality it is an instrument of the nicest adjustment as applicable to the purposes which it has to execute. Buffon, as was too frequently his wont, condemns an organisation which he did not understand, and indeed could never have accurately examined. On account of the peculiarities of its bill the bird is popularly called the Scissors Bill.

The upper mandible at its base overlaps the lower with its edges; but the upper edge of the under mandible, which consists of a thin flattened plate or blade, is received in a groove with elevated sharp edges, on the lower surface of the upper mandible: this groove diverges at the base, and thus comes to overlap the lower at the gape as above noticed. Catesby speaks of it as "a wonderful work of nature," and accurately describes it. "The under mandible," says he, "is more compressed than the upper, and very thin, both edges being as sharp as a knife, and is almost an inch longer than the upper mandible, which has a narrow groove or channel into which the upper edge of the lower mandible shuts."

Bill of *Rynchops*.



Bill of *Rynchops*: the mandibles closed, and seen from below.

R. nigra is the Bec-en-Ciseaux and Coupeur d'Eau of the French; Sheerwater, Cut-Water, Skimmer, and Black Skimmer, of the Anglo-Americans; and Piscator of the Chilians.

The male is about 19 inches in length; the closed wings extend beyond the tail 4 inches; alar stretch 44 inches. Length of the lower mandible 4⅛ inches; of the upper mandible 3¼ inches; both red, tinged with orange, and tipped with black. Upper part of the head, neck, back, and scapulars, black; wings the same, except the secondaries, which are white on their inner vanes, and also tipped with white. Tail forked, the two middle feathers about an inch and a half shorter than the exterior ones, all black, broadly edged on either side with white; tail-coverts white on the outer sides, black in the middle. Front, cheeks and neck below the eye, throat, breast, and all the lower parts, white. Legs and webbed feet red-lead colour.

The female is only 16 inches long, and 39 inches in alar stretch; similar with the male in plumage, except in the tail, which is white-shafted and broadly centred with black.

There are oblique striæ on the lower mandible, which become most apparent in the dead and dry specimen.

It is a native of the tropical and temperate parts of America.

Cut-Water (*Rynchops nigra*).

Linnæus thus succinctly and truly describes its habits:—"Volando aquæ superficiem radit, ex illa insecta pisciculosque, mandibulo inferiore introducta, extrahit; victitat etiam conchiliis." Catesby says:—"These birds frequent near the sea-coasts of Carolina. They fly close to the surface of the water, from which they seem to receive somewhat of food. They also frequent oyster-banks, on which I believe they feed; the structure of their bills seems adapted for that purpose."

Wilson thus describes their mode of taking food on the wing:—"The Sheerwater is formed for skimming while on the wing the surface of the sea for its food, which consists of small fish, shrimps, young fry, &c., whose natural haunts are near the shore and towards the surface. That the lower mandible, when dipped into and cleaving the water, might not retard the bird's way, it is thinned and sharpened like the blade of a knife; the upper mandible, being at such times elevated above the water, is curtailed in its length, as being less necessary, but tapering gradually to a point, that on shutting it may suffer no opposition. To prevent inconvenience from the rushing of the water, the mouth is confined to the mere opening of the gullet, which indeed prevents mastication taking place there; but the stomach, or gizzard, to which this business is solely allotted, is of uncommon hardness, strength, and muscularity, far surpassing in these respects any other water-bird with which I am acquainted. To all these is added a vast expansion of wing, to enable the body to sail with sufficient celerity while dipping in the water. The general proportion of the wing of our swiftest hawks and swallows to their breadth is as one to two; but in the present case, as there is not only the resistance of the air but also that of the water to overcome, a still greater volume of wing is given, the Sheerwater measuring nineteen inches in length, and upwards of forty-four inches in extent. In short, whoever has attentively examined this curious apparatus, and observed the possessor, with his ample wings, long bending neck, and lower mandible occasionally dipped into and ploughing the surface, and the facility with which he procures his food, cannot but consider it a mere playful amusement, when compared with the dashing immersions of the tern, the gull, or the fish-hawk, who to the superficial observer appear so superiorly accommodated. The Sheerwater is most frequently seen skimming close along shore, about the first of the flood. I have observed eight or ten in company passing and repassing at high water, dipping with extended neck their open bills into the water with as much apparent ease as swallows glean up flies."

Mr. Nuttall states that the Cut-Water, or Black Skimmer, is a bird of passage in the United States, appearing in New Jersey (to the north of the sea-coast of which he believes it is unknown) from its tropical quarters early in May; and he thinks that it probably passes the breeding season along the whole of the southern coast of the United States. In New Jersey it "resides and breeds in its favourite haunts, along the low sand-bars and dry flats of the strand in the immediate vicinity of the ocean. Their nests have been found along the shores of Cape May about the beginning of June, and consist of a mere hollow scratched out in the sand, without the addition of any extraneous materials. The eggs are usually three in number, oval, about one inch and three-quarters to two inches by one inch and a quarter, and nearly pure white, marked almost all over with large umber-brown blotches and dashes of two shades, and other faint ones appearing beneath the surface. In some eggs these particular blotches are from half an inch to an inch in length. As the birds, like the terns and gulls, to which they are allied, remain gregarious through the breeding season, it is possible to collect half a bushel or more of the eggs from a single sand-bar, within the compass of half an acre; and though not very palatable, they are still eaten by the inhabitants of the coast. The female only sits on her nest during the night, or in wet and stormy weather; but the young remain for several weeks before they acquire the full use of their wings, and are during that period assiduously fed by both parents: at first they are scarcely distinguishable from the sand by the similarity of their colour, and during this period may often be seen basking in the sun, and spreading out their wings upon the warm beach. The pair, retiring to the south in September, or as soon as their young are prepared for their voyage, raise but a single brood in the season." ('Manual of the Ornithology of the United States and of Canada,' vol. ii.)

The same author states that this species is met with in the equatorial regions of America, where it is resident as far as Surinam, but never penetrates into the interior, being, properly speaking, an oceanic genus.

M. Lesson remarks that, though this bird closely approaches the species belonging to the Antilles, it it still possible that it may be distinct from it.

RYTINA. [Cetacea.]

S

SAARA. [Draconina.]

SABADILLA. [Cebadilla; Helonias.]

SABBA'TIA, a genus of North American Plants, belonging to the natural order *Gentianaceæ*. The genus is known by a 5-12-parted calyx, rotate 5-12-parted corolla, withering on its capsule, revolute anthers, stigma with two straight arms, becoming at length spirally twisted, and a 1-celled capsule, with the valves turned a little inwards. There are several species of *Sabbatia*, all of which are characterised by the possession of a pure bitter principle, and on this account they are extensively used, in North America, in intermittent and remittent fevers, and as tonics. The species most commonly used is the *S. angularis*.

SABELLA. [Annelida.]

SABELLA'RIA. [Annelida.]

SA'BIA, a genus of Plants named by Mr. Colebrooke from the Indian name, Sabja, of one of the species. It is usually referred to the natural family *Terebinthaceæ*, but it is now attached as an anomalous genus to the group *Anacardiæ* which is separated from them. The species form ornamental climbing-shrubs, with smooth lanceolate alternate leaves suited to the shrubberies of this country.

SABI'NEA (named by De Candolle, in honour of Joseph Sabine, F.R.S.), a genus of Plants belonging to the natural order *Leguminosæ*. The violet flowers of *S. Florida* are considered poisonous.

SABLE. [Mustelidæ.]

SACCHARITE, a Mineral resembling granular felspar, of a greenish-white colour, and with the constitution of *Leucite*. It is found in Silesia.

SA'CCHARUM, a genus of Plants belonging to the natural order *Graminaceæ*. One of the species yields the well-known product sugar, and is called the Sugar-Cane.

The Sugar-Cane was introduced by the Saracens into the south of Europe, but the period is not well ascertained. Gibbon says they introduced it into Sicily soon after they got possession of the island. About the year 1420 sugar was much cultivated by the Portuguese in Madeira. In 1503 we read of sugar being imported from the Canaries, and in 1506 sugar-canes were carried thence to Hispaniola in the West Indies. But, besides the Indian cane, another, and a much more prolific kind, that of Otaheite, was introduced into the West Indies about 1794, and about the same time, or in 1796, the China sugar-cane was introduced into India. The Chinese and Indians seem both therefore to have had independent means, that is, distinct plants from which they could extract sugar; and, as history shows, they did so at very early periods. [Sugar, in Arts and Sc. Div.]

The genus *Saccharum* contains numerous species, which are usually easily distinguished by their highly ornamental nature, by the light

and feathery or rather silk-like inflorescence. The species are widely distributed through the tropical parts of the world. The genus is distinguished by the spikelets being all fertile and in pairs, one sessile, the other stalked, articulated at the base, 2-flowered, the lower floret neuter with one palea, the upper hermaphrodite with two paleæ. Glumes 2, membranous. Paleæ transparent, awnless; those of the hermaphrodite flowers minute, unequal. Stamens 3. Ovary smooth; styles 2, long; stigmas feathered with simple hairs. Scales 2, distinct, obscurely 2- or 3-lobed at the point. Caryopsis smooth.

S. officinarum, the best known species, or that yielding sugar in India, is cultivated in all parts of that country, and several varieties are known. It was introduced into the south of Europe and the Canaries, and thence into the West Indies. Another species introduced from China, was named *S. Sinense* by Dr. Roxburgh. It was extensively distributed throughout India, and still is so to some extent, as the canes are large, rich in juice, and hard enough to resist the attacks of the white ants. Within the last few years, the Otaheite sugar-cane has been introduced from the Mauritius into India, and rapidly spread through the country. It is no doubt the same species that was many years since introduced into the West Indies. It is probably the Canne de Haite of Tussac, or *S. violaceum*.

Some of the species of *Saccharum*, owing to the silex in their cuticle, are so durable that they are employed in India for thatching, such as *S. canaliculatum* and *S. cylindricum*. This is the case with *S. spontaneum*, which also makes good mats. The natives of Bengal make their pens of the hollow stems of *S. semidecumbens* and of *S. fuscum*. The latter, as well as the culms of *S. porcerum*, are also used for screens and light fences, and other economical purposes.

SACCOLA'BIUM, a genus of Plants belonging to the tribe *Vandeæ* and the natural order *Orchidaceæ*, now extensively cultivated in hothouses especially dedicated to their cultivation. This is an Asiatic genus, found in the Indian Archipelago, the Malay Peninsula, and thence extending north along the Himalayan Mountains to 30° 4′ N. lat., where *S. guttatum* is found on trees, as well as in more southern latitudes. The genus consists of caulescent epiphytes, with 2-rowed coriaceous leaves, which are often oblique at the apex. The flowers are axillary, and either racemose or solitary.

SA'CCOMYS. [Muridæ.]
SACRED-BEANS, or Lotos, [Nelumbium.]
SAFFLORITE, a variety of tin white cobalt.
SAFFLOWER. [Carthamus.]
SAFFRON. [Crocus.]
SAGAPENUM. [Ferula.]
SAGE. [Salvia.]
SAGENA'RIA. [Coal-Plants.]
SAGENO'CRINUS. [Echinodermata.]

SAGERE'TIA, a genus of Plants belonging to the natural order of *Rhamnaceæ*, formed, by M. A. Brongniart, of old species of *Zizyphus* and of *Rhamnus*, and named after M. Sageret, a French vegetable physiologist. The species are found in both South and North America, Java, China, and in India along the foot of the Himalayas. The only species which requires particular notice is *S. thee'zans*, which is remarkable as being employed as a substitute for tea, even in China, where the poor are described by Osbeck as making use of the leaves in the same manner as those of the true tea, and for which it makes a good substitute from its astringency and fragrance.

SAGI'NA, a genus of Plants, from 'sagino,' to cram or fatten, a name not very appropriate. This genus belongs to the natural order *Alsinaceæ*, and is characterised by possessing an inferior calyx, with 4 spreading permanent sepals; 4 ovate obtuse petals, shorter than the calyx; 4 stamens; superior ovary, with 4 short styles; capsule splitting into 4 valves, and numerous minute seeds attached to a central placenta. They form small herbs, which are very generally diffused over the temperate regions of the globe.

The following species are British:—

S. procumbens, with the central stem very short; the leaves linear, curved; the apex of the peduncles reflexed, but, after flowering, ultimately erect.

S. apetala, with the leaves linear-mucronate.

S. ciliata has the outer sepal pointed, exceeding and adpressed to the mature capsule; their lips patent.

S. maritima has the central stem elongated, forked; leaves fleshy, blunt; peduncles always erect.

S. saxatilis has the central stem short and barren; peduncles and calyx glabrous.

S. subulata has the leaves awned; peduncles and calyx glandular, hairy.

S. nodosa has the upper leaves fasciculated; petals much longer than the calyx. This species is called Knotted Spurrey.

(Babington, *Manual of British Botany.*)

SAGITTA'RIA (from 'sagitta,' an arrow, a term indicating the shape of the leaves), a genus of Plants belonging to the natural order *Alismaceæ*. The genus is characterised by possessing barren and fertile flowers, with a 3-leaved calyx and 3 petals. The fertile flowers have numerous pistils collected into a head, and 1-seeded compressed and margined pericarps. The species of this genus are water-plants, and are found in the hotter and temperate parts of the globe, and are frequently remarkable for the beauty of their flowers. The only species indigenous in this country is the *S. sagittifolia*, Common Arrowhead, which is known by its arrow-shaped leaves with lanceolate straight lobes. The rhizomata of many of the species contain amylaceous matter, and form a nutritious food, for which purpose they are said to be used by the Kalmuk Tartars.

SAGO. [Food.]
SAGOUIN. [Sapajous.]
SAGRA. [Eupoda.]
SAGUERUS. [Sagus.]
SAGUINUS. [Sapajous.]

SAGUS, or SAGUERUS, a genus of Plants belonging to the family of Palms. The leaves are pinnated; the flowers monœcious; the spadix branched, without any common spathe, but with numerous partial ones; the fruit hard, shining, its surface divided into numerous rhomboidal spaces. The species are natives of the islands of the Indian Archipelago, and yield sago.

S. lævis, the True Sago-Palm, has the petioles and spathes unarmed. This palm furnishes most of the sago sent to Europe.

S. Rumphii has the petioles and spathes guarded by strong prickles. According to Martin, the sago yielded by this plant is used principally in India, and seldom exported. [Food.]

SAHLITE. [Augite.]
SAÏGA. [Antilopeæ.]
SAIMIRI. [Sapajous.]
SAINFOIN. [Onobrychis.]

SAINT BONIFACE'S PENNIES, the separated portions of the stalk of the Lily Encrinite. [Encrinites.]

SAINT CASSIAN BEDS. [*See* Supplement.]
SAINT CUTHBERT'S BEADS. [Encrinites.]
SAINT IGNATIUS'S BEAN. [Loganiaceæ.]
SAISIN. [Antilopeæ.]
SAJOU. [Sapajous.]

SAKIS. The genus *Pithecia* of Desmarest and Illiger comprehends those American Monkeys which are generally known by the name of Sakis, or rather those Sakis which have for the most part long and bushy tails, and thus have obtained the name of Fox-Tailed Monkeys; for the term Saki, in its general application, designates any American monkey whose tail is not prehensile.

Pithecia has the facial angle 60 degrees; head round; muzzle short; ears moderate, rounded; canine teeth very strong. Tail shorter than the body, not prehensile, and covered with very long hairs. Feet pentadactyle; nails claw-like, short and bent. Habits nocturnal.

Dental Formula:—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6} = 36$.

P. Satanas is the Cuxio of Humboldt; *Cebus Satanas*, Hoffm.; *Brachyurus Israelita*, Spix.

Colour entirely dusky black, paler beneath, where the hair becomes very thin, and has a purplish tinge which is visible on the face and hands. Hair of the very bushy tail, which is nearly of the length of the body, long and soft. Total length, including the tail, about 2 feet 9 inches.

The hair of the head is thick, and falls over the forehead, and the beard is very much developed.

The female is rusty brown.

It inhabits the forests of Brasil—Para, on the banks of the Orinoco.

It is partial to the fruit of a kind of palm; and it is represented in the act of eating it, by Humboldt, from whose figure ours is taken.

Pithecia Satanas.

P. melanocephala. This is the *Simia melanocephala* and Cacajao of Humboldt and Bonpland; also called in America Caruiri, Monofeo, Chacuto, Chucuzo, and Mono-Robon.

Head very round, naked, and of a dull black colour, its physiognomy reminding the spectator of an old negro; the hair of the head directed forwards; eyes large and sunk, and the eyebrows composed of strong bristles; nose flat, separation of the nostrils wide; no beard; ears bare and very large.

It inhabits the forests which border the Rio Negro and Rio Cassiquiare.

All kinds of fruit are acceptable to the voracious Cacajao, which is a weak, very inactive, mild-tempered, and timid animal. It even shrank from some of the small *Sapajous.* It trembled violently at the sight of a crocodile or serpent. When about to seize anything, it stretches forth its arms in the manner indicated in the cut, and holds the object with difficulty, on account of the length and slenderness of the fingers. It lives in troops.

Pithecia melanocephala.

P. Chiropotes, the Capuchin of the Orinoco, is very like *P. Satanas*, except in colour, indeed so like, that an uncoloured figure of the one might well serve for that of the other. *P. Chiropotes* is brownish-red; the beard is blackish-brown, arises below the ears, and covers a part of the breast. The eyes are sunk and large. The tail, like that of *P. Satanas*, is bushy. The claws are bent, except on the thumbs.

SAL-AMMONIAC, a Hydrochlorate of Ammonia, occurring in volcanic regions, as Etna, Vesuvius, and the Sandwich Islands. The sal-ammoniac of commerce is manufactured from animal matter and coal-soot. [AMMONIA, in ARTS AND SC. DIV.] Sal-Ammoniac occurs in white crusts or efflorescences. It crystallises in regular octahedrons, and is soluble in three parts of water. When quick-lime is mixed with it, it gives off a strong smell of ammonia.

SALA'CIA, a genus of Plants belonging to the natural order *Hippocrateaceæ*, which has been so differently defined by different botanists, that it sometimes includes species found in Asia, Africa, and America. At other times, the American species are referred to the genus *Tonsella*, and the African species to the genus *Calypso*, and those of India to the genus *Johnia*, the last named in compliment to Dr. John, a Danish missionary, who was one of the founders of the Botanic Garden at Tranquebar, and sent many new plants to Dr. Roxburgh. The whole are formed of species which have little beauty, but the fruit of both the species of *Johnia* is eatable.

SALAMANDER. [AMPHIBIA.]

SALAMANDRIDÆ. [AMPHIBIA.]

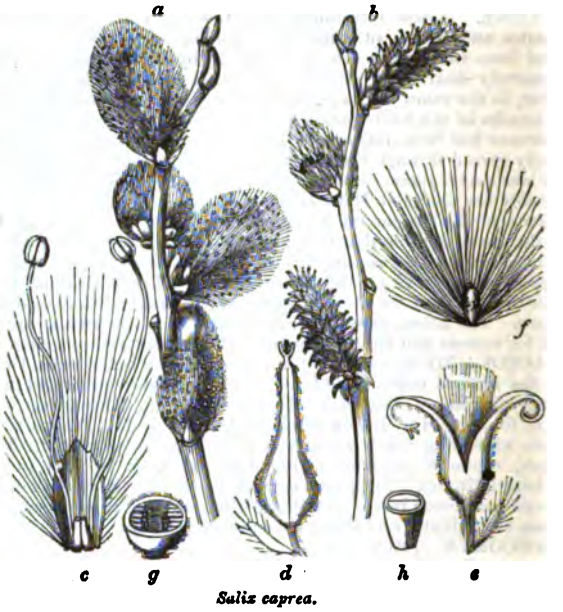
SALANX, a genus of Fishes belonging to the family *Esocidæ*.

SALARIAS, a genus of Indian Fishes belonging to the family *Gobioidæ*.

SALEA. [DRACONINA.]

SALE'NIA. [ECHINODERMATA.]

SALICA'CEÆ, *Willow-Worts*, a natural order of Apetalous Exogenous Plants, possessing the following characters:—Flowers with pistils or stamens alone, growing on the same or different plants, and arranged in the form of an amentum; stamens separate, or united together with 2-celled anthers; a superior ovary, with 1 or 2 cells; numerous erect ovules; style single, with 2 stigmas, or absent; many-seeded, comose, 10-12-celled, coriaceous fruit; seeds comose, and either attached to the lower part of the axis of each valve, or to the base of the cell; albumen absent; embryo erect; radicle inferior. They are trees or shrubs, with simple alternate leaves, and deciduous or persistent stipules. Combined with *Corylaceæ* and *Betulaceæ*, they formed part of the natural order *Amentaceæ* of Jussieu, but they have been separated by Richard. They are distinguished from *Corylaceæ* by the absence of a calyx, and frequently by the venation of their leaves: from *Betulaceæ* they are known by their hairy seeds and polyspermous 2-valved fruit. They are generally found inhabiting woods in the northern districts of Europe, Asia, and America. The most northern woody plant that is known, the *Salix arctica*, belongs to this order. There are only two genera in this order, *Salix* and *Populus;* but they are of great importance on account of their timber and various economical uses. [SALIX; POPULUS.]



Salix caprea.

a, branch with staminiferous flowers; *b*, ditto, with pistilliferous flowers; *c*, staminiferous bract, with abortive pistil; *d*, pistilliferous bract, with closed ripened pistil; *e*, ditto, with valves open; *f*, seed, with hair; *g*, section of fruit, showing seeds; *h*, section of seeds, showing cotyledons.

SALICARIA, a genus of Birds belonging to the family *Sylviadæ*, and separated by Mr. Selby from the genera *Locustella* and *Sylvia*. "The rounded form of the tail," says Mr. Yarrell, "the outer feathers being much shorter than those in the middle, and the partiality of these birds to moist situations, particularly conspicuous in the Sedge and the Reed Warblers, appear to separate them from the Sylvan Warblers." There are four British species of this genus.

S. locustella, the Grasshopper Warbler, is so called from its very peculiar and almost incessant cricket-like note. It comes to this country from the south, and appears about the middle of April, and departs in September. It is a shy bird, keeping at the bottom of a hedge, and creeping along more like a mouse than a bird. It feeds on small snails, slugs, and insects.

S. phragmites, the Sedge-Warbler, Sedge-Bird, is found during the summer in thick patches of reeds or willows, in marshes, or on the low sides of rivers, or on islands. Like the last, it is a summer visitor, arriving in April and leaving in September. White of Selbourne first observed its power of imitating the notes of other birds, as well as of its occasionally singing at night. It measures 4¾ inches, and is somewhat a less bird than the last.

S. luscinoides, Savi's Warbler, Willow Locustella. It is a rare bird in this country, but, like the group to which it belongs, it frequents moist and shaded situations, among reeds and bushes, near water.

S. arundinacea, the Reed-Warbler, the Night-Warbler, the Reed-Wren. It is always found in company with the Sedge-Warbler, but is not so numerous in this country as that bird. It arrives here in April and departs in September. It sings usually in the day, but sometimes at night. "The character of the beak, the entire absence of the buffy white stripe over the ear-coverts, and the uniform colour of the whole of the upper surface of the body of this bird, distinguish it from either the Grasshopper-Warbler or the Sedge-Warbler, with both of which however it has many habits in common." [SYLVIADÆ.] (Yarrell, *History of British Birds.*)

SALICI'NLÆ. [SALICACEÆ.]

SALICORNARIA. [POLYZOA; CELLARIÆA.]

SALICO'RNIA (from 'sal,' salt, and 'cornu,' a horn, in reference to the taste and form of the plant), a genus of Plants belonging to the natural order *Chenopodiaceæ*. It is characterised by a single turbinate fleshy obscurely-lobed perianth; 10-12-stamens; short style; bi-trifid stigmas; fruit a utricle with a single seed. The species are mostly weeds inhabiting moist salt districts on the coasts of the north of Europe, Africa, and America.

S. herbacea, Jointed Glasswort, is a common plant in the salt marshes

and on the banks of salt rivers in Great Britain. It is known by its herbaceous stem, compressed and notched articulations, somewhat thickened upwards, and cylindrical spikes slightly tapering at the extremities. This and many other species belonging to the genus, and to the other genera of the same natural family, yield a great quantity of soda, for the purpose of obtaining which they are collected on the coasts of the South of Europe and the North of Africa. This species is often eaten as a salad or pickle under the name of Samphire, but is a different plant from the true Samphire. [CRITHMUM.]

S. radicans has a creeping stem, and is considered by some botanists a variety of the last.

S. fruticosa, Shrubby-Jointed Glasswort, is a doubtful native of Great Britain, but grows largely in the south of Europe and in North America, and is used for the same purposes as the above.

SALIFEROUS SYSTEM. [RED-SANDSTONE FORMATION.]

SALISBURIA, a genus of Plants belonging to the natural order *Taxaceæ*, named in honour of R. A. Salisbury, a modern botanist of distinction. The tree, which is the only one of the genus, has long been known by the Japanese name Gingko. The genus is characterised by having monœcious flowers. The male flowers disposed in a filiform naked catkin, without calyx or corolla; stamens numerous; the anthers composed of 2 cells, which are pendulous, and united only at the apex. Female flowers solitary and terminal; calyx 4-fid, or rather a cup-shaped disc, from the thickened apex of the peduncle, surrounds the base of the solitary ovule; fruit forming a drupe, which has its base supported by a fleshy cup, with a juicy white pulp; seed nut-like, with an osseous shell; kernel white; embryo axillary, dicotyledonous, radicle above.

S. adiantifolia, the Gingko, grows naturally in Japan, is much cultivated in China, and is found in many gardens in Europe. Fine old specimens may be seen at Kew and in the Apothecaries' Garden at Chelsea. In congenial climates it attains the size of the walnut. It is remarkable for the form of its leaves, which are wedge- or fan-shaped, deeply cut in the centre or bilobed, and finely striated with veins, having some resemblance to the leaves of some species of *Adiantum*, whence it is commonly called Maiden-Hair Tree in this country. The pulp of the fruit is austere-tasted, but the kernel is sweet, with some degree of bitterness when raw, but agreeable as a dessert when roasted like chestnuts. They are much eaten in China. Dr. Abel says he saw the fruit exposed in the markets in China, but could not find out to what purpose it was applied. [CONIFERÆ.]

SALIVA, SALIVARY GLANDS. The principal glands by which the saliva is secreted are six in number, three being situated on each side of the face, namely, the parotid, the submaxillary, and the sublingual glands. Of these the parotid is considerably the largest, and has been already described. [PAROTID GLAND.] The submaxillary gland, which is next in size, has its principal mass situated immediately behind and beneath the middle of the base of the lower jaw, below the mylohyoideus muscle, round the posterior edge of which a portion of it is continued, and leads to the submaxillary or Whartonian duct. The latter passes forwards and inwards, and opens on the surface of the mucous membrane of the mouth, just by the side of the frænum of the tongue. The sublingual gland is the smallest of the chief salivary glands; it is situated close by the duct of the submaxillary, into which several of its ducts open; others have their orifices on the surface of the mucous membrane of the mouth, by the side of the frænum linguæ, and further outwards. Besides these larger glands there are a vast number more which secrete saliva, and which are situated in the substance of the lips and cheeks immediately beneath their mucous membrane, on whose surface their ducts open. Indeed the whole interior of the lips and cheeks is lined by a congeries of small glands, which in structure closely resemble the salivary, and probably do not differ from them in function.

The saliva as it exists in the mouth is not only the produce of these glands, but also of the buccal surface of the mouth. When not mixed with air it is a transparent, rather viscid fluid, which is usually weakly alkaline, but during the mastication of food it is often slightly acid. It is composed of a great proportion of water, mixed with portions of the epithelium of the mucous membrane lining the mouth, and holding in solution about seven parts in one thousand of albumen, salivine (a principle almost peculiar to itself), and other animal matters, together with the saline substances found in the blood, and a very minute quantity of sulpho-cyanide of potassium.

One of the purposes served by the saliva seems to be the softening of the food, with which it is intimately mixed in mastication. Glands for its formation exist in all classes of animals from the insects upwards (with the exception of fish), and even in many that are lower in the animal kingdom than the insects. The saliva appears also to exert a chemical influence on the starchy parts of food, converting them into sugar. This power is not possessed by the secretion from the glands alone, but resides in the common saliva of the mouth.

The quantity of saliva secreted when the mouth is at rest is only sufficient to keep its internal membrane moist and slippery. When however the jaws are actively moved, and especially during feeding, or even at the thought of a meal or of certain kinds of palatable food, the quantity is greatly increased. During the twenty-four hours it is probable that from sixty to ninety grains of saliva are secreted by one parotid gland (Mitscherlich), and the quantity produced by all the salivary glands of an adult man together may therefore be estimated at from four to five hundred grains.

(Lehmann, *Physiological Chemistry*, translated by Dr. Day for Cavendish Society.)

SALIX (Latin, 'salix,' a willow), the name of a genus of Plants, which, in conjunction with *Populus*, constitutes the natural order *Salicaceæ*. In many respects this is one of the most important genera of plants: the rapidity of their growth, the toughness and lightness of their wood, and their uses in medicine and the arts, have caused them to be extensively cultivated. But although largely cultivated and well known in most parts of the world, the botanical arrangement of these plants presents considerable difficulties, and few genera have had more time and labour spent upon them than *Salix;* and up to the present time the most able botanists differ as to the real nature of many species or varieties.

The genus *Salix* is known by possessing diœcious flowers; catkins many-flowered, imbricated, composed of a single-flowered flexible bract. The barren flowers have a small lateral abrupt gland, sometimes double; filaments 1, 2, 3, 5, or more, longer than the bract, and in some partly combined; 2-lobed anthers, opening longitudinally. The fertile flowers with a nectariferous gland; ovate, 1-celled, many-seeded ovary; permanent terminal style, with two stigmas, which are notched and obtuse or cloven acute, and spreading; ovate capsule composed of two revolute concave valves and one cell; numerous minute oval seeds, tufted with soft, simple, upright hairs. The willows are chiefly natives of the colder parts of the temperate regions of the northern hemisphere. *S. herbacea* and *S. arctica* are found nearer the pole than any other woody plants. *S. Babylonica* is a native of China, Japan, Armenia, and the north of Africa. Of all the species enumerated, only 17 are extra-European.

The Willow was known to the Greeks and Romans; in fact little has been added to our knowledge of the properties and uses of these plants since their time. On account of the flexible nature of their shoots and the toughness of their woody fibre, they have always been used as materials for making baskets, hoops, crates, &c., and for these purposes great quantities are cultivated in this and other countries. The bark is made use of in the north of Europe for the purpose of forming mats in the same manner as the bark of the common linden-tree. In Tartary the woody fibre is macerated and separated, and then spun into threads, from which cloth is woven. Willows are much used in the manufacture of charcoal; and it has been proved that Willow Charcoal is superior to that procured from the wood of most other trees for the preparation of gunpowder. The bark of all the willows contains the tanning principle, and, according to Sir H. Davy, some of the species, especially *S. Russelliana*, *S. alba*, and *S. purpurea*, contain as much as the oak itself. From the bark of some is obtained a vegetable principle called Salicin, which acts upon the system in the same manner as quinine, and is used for the same purposes.

In order that the species of this genus may be studied successfully, a number of points require consideration, and it is only lately that an approach has been made to accuracy in their investigation. The flowers of the *Salix* are subject to many anomalies which have been productive of not a little difficulty, and have sometimes led to the supposition that this genus was an exception to the ordinary laws of vegetable development. The principal anomalies that are found are—1, male and female flowers occurring in the same catkin; 2, stamens apparently changed into pistils; 3, stamens accompanied by an imperfect pistil; 4, entire union of the filaments of the stamen. In the study and description of the species, it is of importance that the tendency to these anomalies should not be overlooked. Another difficulty in the way of the study of this genus is the occurrence of hybrids.

There are at present described nearly 300 species of *Salix;* of all which we shall not here give a description, but arrange the more common species under the heads Sallows, Osiers, and Willows. These terms are often applied to any of the species, but some have more frequently one of the designations than the other.

SALLOWS.

These are trees or low shrubs belonging mostly to Borrer's group *Cinereæ*, and are characterised by downy branches, and mostly obovate, gray, hoary, toothed, more or less wrinkled, and stipuled leaves, very veiny beneath. Ovaries sericeo-tomentose.

S. cinerea, Gray Sallow. Stem erect; lower leaves entire, upper serrated, obovate-lanceolate, glaucous, downy, and reticulated with veins beneath; stipules half-heart shaped, serrated; ovary silky, style short, stigmas mostly entire. It attains a height of 20 or 30 feet, and is abundant in England on banks of rivers and in moist woods.

S. aquatica, Water-Sallow. Stem and branches erect; leaves slightly serrated obovate-elliptical, minutely downy, and rather glaucous beneath; stipules rounded, toothed; ovary silky, stalked, stigmas nearly sessile. This is also a British species, and one which Koch has made a variety of *S. cinerea*. The Olive-Leaved Sallow (*S. oleifolia*) is also referred by Koch to *S. cinerea*.

S. aurita, Round-Eared Sallow. Branches trailing; leaves obovate, somewhat serrate, convex, obtuse with a small hooked point, hairy, and reticulated with veins on both sides: stipules roundish, convex, toothed; ovary silky, stalked, stigmas nearly sessile.

S. caprea, Goat-Willow. Stem erect; leaves roundish-ovate, pointed, serrated, waved, pale, and downy beneath; stipules somewhat crescent-shaped; catkins oval; ovary stalked, ovate, silky; stigmas nearly sessile, undivided; capsules swelling. It is a native of Britain, and is distinguished early in the spring by putting forth its handsome yellow blossoms before other trees have assumed their foliage. The bark is much used for tanning, and the wood is used for making implements of husbandry. It is also grown for hoop-making, and in medicine the bark is sometimes used as a substitute for cinchona.

OSIERS.

The species of *Salix* called mostly by this name belong to Borrer's group *Viminales*, which are described as trees of a more or less considerable size with long pliant branches and lanceolate leaves; ovaries nearly sessile, hairy or silky; their styles elongated; their stigmas linear, mostly entire. Any willow however that has long pliant twiggy branches, and is grown on this account, is called an Osier.

S. viminalis, Common Osier. Leaves linear-lanceolate, obscurely crenate, white, and silky beneath; stipules very small, sublanceolate; branches straight and twiggy; ovary upon very short stalks, lanceolate; style elongate; stigmas long, linear, mostly entire. This is the species that is used for the various kinds of basket-work, bands, &c., and for this purpose is largely cultivated in this country.

There are two other species, *S. stipularis*, Auricled Osier, and *S. incana*, Hoary Osier, growing on the continent of Europe, which are used for the same purposes as the above.

WILLOWS.

Amongst these we shall include a few species useful in the arts and medicine, belonging to the various groups into which Koch and Borrer have distributed the species of *Salix*.

S. Russelliana, Russell or Bedford Willow. Leaves lanceolate, tapering at each end, serrated throughout, very glabrous; foot-stalks glandular or leafy; ovary tapering, stalked, longer than the bracteæ; style as long as the stigmas. A native of Britain, growing in marshy woods, osier-grounds, &c. This tree was first brought into notice by the Duke of Bedford, and has on that account received its present name. The best history or it is to be found in the introduction to the Duke of Bedford's splendid work on Willows, the 'Salictum Woburnense.' It was a tree of this species that was a favourite with Dr. Johnson at Lichfield, and hence called Johnson's Willow. It was destroyed by a hurricane, having attained a height of 60 feet and a girth of 13 feet. The growth of this species is very rapid, and as it may be extensively used for poles, &c., it is a profitable tree for growing in plantations. Its bark is said to contain as much tannin as the oak. The medicinal properties attributed to the bark of *S. fragilis* belong properly to this species. It acts as an astringent and tonic.

S. alba, Common White Willow. Leaves elliptical-lanceolate, pointed, serrated, silky on both sides; lower serratures glandular; stamens hairy; ovary smooth, almost sessile; stigmas deeply cloven; scales notched. It is a native of most countries of Europe, and is more extensively planted as a timber-tree than any other species. It grows rapidly, attaining a height of 30 feet in 10 or 12 years. Hundreds of miles of road between Moscow and the Austrian frontier are planted with this tree. The bark is used in the north of Europe both for tanning and dyeing. The wood is very useful, and is employed for making the handles of all sorts of instruments, in turnery, millwork, coopery, weather-boarding, &c. Willow hats and bonnets are made from the shavings of this willow. The bark may be used in medicine instead of *S. Russelliana*, but it is not so valuable. It is frequently called the Huntingdon Willow, and under that name is recommended by Gilpin and others as an ornamental tree.

S. Babylonica, the Weeping Willow. Leaves lanceolate acuminate, finely serrated, glabrous, glaucous beneath; catkins protruded at the same time with the leaves; ovary ovate, sessile, glabrous. This, the most favourite species of the genus, is a native of Asia, on the banks of the Euphrates near Babylon, whence its name; also of China, of Egypt, and other parts of North Africa. It is said that this willow was introduced into England by the poet Pope, who, being with Lady Suffolk when she received a parcel from Spain bound with withes, which appeared alive, took one, and planted it in his garden, which grew up, and afterwards became so well known as Pope's Willow at Twickenham. It is however more probable that it was introduced by the botanist Tournefort into Europe. This tree is increasingly cultivated in this country and on the Continent. It is one of the greatest favourites in China, as might be inferred from its constant introduction into Chinese pictures. Growing on the banks of its native Euphrates, it was the willow on which the weeping daughters of Zion "hanged their harps." (Psalms, cxxxvii.)

S. pentandra, Sweet Bay-Leaved Willow, is one of the latest flowering willows, not expanding its flowers till the beginning of June, which are very fragrant.

S. purpurea, Purple Willow, is a small decumbent shrub; a native of Britain. Of all the willows it possesses the largest amount of bitter principle in its bark, and on this account has been recommended for medicinal use.

S. vitellina, the Yellow Willow. It is a native of Great Britain in hedges, osier-grounds, and other places.

Babington, in his 'Manual of British Botany,' describes 33 species of *Salix*. Hooke and Arnott, in the 'British Flora,' describe 37 species. In addition to these two works the student should consult Koch, 'De Salicibus Europæis Commentatio, and Loudon's 'Arboretum et Fruticetum Britannicum.'

SALLOWS. [SALIX.]

SALMON. [SALMONIDÆ.]

SALMO'NIDÆ, *Salmon Tribe*, a family of Fishes belonging to the *Malacopterygii Abdominales*. These fishes have the body covered with scales, the first dorsal fin has soft rays only, and the second dorsal is small and destitute of rays, and of a soft fleshy nature; they are furnished with an air-bladder, and have numerous cæca. The more typical species appear to be confined to the northern hemisphere.

The genus *Salmo*, as at present restricted, contains those species, such as the Salmon and Trout, in which the upper boundary of the mouth is formed chiefly by the superior maxillary bones, the intermaxillaries being small, confined to the fore-part, and situated between the maxillaries; usually these latter bones descend in front of the superior maxillaries, and form the upper boundary of the mouth. The maxillary bones, intermaxillaries, palatines, vomer, and even the tongue, are furnished with teeth; the branchiostegous rays are about ten in number; the natatory bladder, or air-bladder, extends the whole length of the abdomen.

Numerous species of this genus are found in the seas of the northern hemisphere, one of the largest of which is the Common Salmon (*S. salar*, Linn.), a fish too well known both in flavour and appearance to require any particular description. This fish, Cuvier states, is found in all the arctic seas, whence it enters the rivers in the spring. Mr. Yarrell observes that fishes ascend the rivers in some situations much earlier than others, depending on the time of their being in a breeding condition. "Rivers issuing from large lakes afford early salmon, the waters having been purified by deposition in the lakes; on the other hand, rivers swollen by melting snows in the spring months are later in their season of producing fish, and yield their supply when the lake rivers are beginning to fail. 'The causes influencing this,' says Sir William Jardine, 'seem yet undecided; and where the time varies much in the neighbouring rivers of the same district, they are of less easy solution. The northern rivers, with little exception, are however the earliest, a fact well known in the London markets; and going still farther north, the range of the season and of spawning may be influenced by the latitude.'" Artedi says, in Sweden the salmon spawn in the middle of summer. From some further observations in Mr. Yarrell's excellent work, it appears that the temperature of the water has considerable influence.

The number of fishes procured for food increases as the summer advances. "During the early part of the season the salmon appear to ascend only as far as the river is influenced by the tide, advancing with the flood, and generally retiring with the ebb, if their progress be not stopped by the various means employed to catch them. It is observed that the female fishes ascend before the males; and the young fish of the year, called grilse till they have spawned once, ascend earlier than those of more adult age. As the season advances, the salmon ascend higher up the river, beyond the influence of the tide; they are observed to be getting full of roe, and more or less out of condition, according to their forward state as breeding fish. Their progress forwards is not easily stopped; they shoot up rapids with the velocity of arrows, and make wonderful efforts to surmount cascades and other impediments by leaping, frequently clearing an elevation of eight or ten feet, and, gaining the water above, pursue their course. If they fail in their attempt and fall back into the stream, it is only to remain a short time quiescent, and thus recruit their strength to enable them to make new efforts.

"The fish having at length gained the upper and shallow pools of the river, preparatory to the important operation of depositing the spawn in the gravelly beds, its colour will be found to have undergone considerable alteration during the residence in fresh water. The male becomes marked in the cheeks with orange-coloured stripes, which give it the appearance of the cheek of a *Labrus;* the lower jaw elongates, and a cartilaginous projection turns upwards from the point, which, when the jaws are closed, occupies a deep cavity between the intermaxillary bones of the upper jaw; the body partakes of the golden orange tinge, and the salmon in this state is called a red-fish. The females are dark in colour, and are as commonly called black-fish; and by these terms both are designated in those local and precautionary regulations intended for the protection and preservation of the breeding fish."

The process of spawning is thus described in Ellis's 'Memoir on the Natural History of the Salmon:'—"A pair of fish are seen to make a furrow, by working up the gravel with their noses, rather against the stream, as a salmon cannot work with his head down stream, for the water, then going into his gills the wrong way, drowns him. When the furrow is made, the male and female retire to a little distance, one to the one side and the other to the other side of the furrow; they then throw themselves on their sides, again come together, and, rubbing against each other, both shed their spawn into the furrow at the same time. This process is not completed at once; it requires from eight to twelve days for them to lay all their spawn, and when they have done they betake themselves to the pools to recruit themselves.

Three pairs have been seen on the spawning-bed at the same time, and even closely watched while making the furrow and laying the spawn.

"The adult fish having spawned, being out of condition and unfit for food, are considered as unclean fish. They are usually called kelts; the male fish is also called a kipper, the female a baggit. With the floods of the end of winter and the commencement of spring they descend the river from pool to pool, and ultimately gain the sea, where they quickly recover their condition, to ascend again in autumn for the same purpose as before, but always remaining for a time in the brackish water of the tideway before making either decided change, obtaining, it has been said, a release from certain parasitic animals, either external or internal, by each seasonal change, those of the salt water being destroyed by contact with the fresh, and vice versâ." It is moreover probable that the constitution of the fish is such as to require a gradual change; that the salmon is considerably affected in passing from the salt water into the fresh, is evident from the change of colour which accompanies the difference of the state of the element.

To Mr. John Shaw of Drumlanrig, Dumfriesshire, naturalists are indebted for numerous important and interesting experiments instituted by him to determine certain doubtful points connected with the natural history of the salmon, and more especially to determine the developments and growth of the salmon-fry. Mr. Shaw's first paper, entitled 'An Account of some Experiments and Observations on the Parr, and on the Ova of the Salmon, proving the Parr to be the Young of the Salmon,' will be found in the 'Edinburgh New Philosophical Journal' for July, 1836, vol. xxi. His second paper, in which he gives an account of 'Experiments on the Development and Growth of the Fry of the Salmon, from the Exclusion of the Ovum to the Age of Six Months,' is published in the same work, vol. xxiv., p. 165; and lastly in the 'Transactions of the Royal Society of Edinburgh,' vol. xiv., p. 547, the author gives a summary of the preceding papers, and adds the result of further investigations.

The author, who has lived the whole of his life, with the exception of a few seasons, on the banks of streams where salmon are in the habit of depositing their spawn, had long been of opinion that the fish commonly called the Parr, and supposed to be a distinct species from the salmon, was the natural produce of the salmon; and by a series of very conclusive experiments he has evidently demonstrated the fact, that Parr are young Salmon.

The salmon has been known to attain upwards of 80 lbs. weight, but a salmon of half that size is considered a fine fish: "the largest known, as far as I am aware," observes Mr. Yarrell, "came into the possession of Mr. Groves, the fishmonger of Bond-street, about the season 1821. This salmon, a female, weighed 83 lbs.; was a short fish for the weight, but of very unusual thickness and depth. When cut up, the flesh was fine in colour, and proved of excellent quality."

Salmon have been kept in fresh-water lakes and other pieces of water having no outlet to the sea; these fish however, though of tolerably good colour and flavour, did not obtain the size of those which visited the sea annually. They are caught by nets of various kinds.

The other British species of *Salmo* are:—

S. trutta, the Salmon-Trout, Sea-Trout, or Phinock.

S. fario, the Common Trout, Trout, or River-Trout.

S. ferox, the Great Lake-Trout.

S. Levenensis, the Lochleven-Trout.

S. salvelinus, the Charr, Case-Charr, Alpine Salmon, Salvelian Charr.

The plan of hatching the ova of the species of trout in boxes before permitting them to live free in their native haunts, has been found very successful.

The following are the other principal genera of the *Salmonidæ*:—

Osmerus.—Of this genus the Common Smelt (*O. eperlanus*) affords a familiar example. The smelts differ from the species of *Salmo* in having two ranges of teeth in each palatine bone, but there are only a few in front of the vomer; they have eight branchiostegous rays; the ventral fin is on a line with the anterior dorsal. They are taken in the sea, and at the mouths of great rivers. Mr. Yarrell, in the supplement to his volumes on 'British Fishes,' describes a new species of the present genus, which he names the Hebridal Smelt (*O. Hebridicus*), a name suggested by the locality in which the specimen was found.

Mallotus, Cuvier.—This genus is founded on a single species, the *Salmo Grœnlandicus* of Bloch, a small fish employed as a bait in the cod fisheries: its teeth are dense, like the pile on velvet, in both jaws, as well as the palate and tongue; the branchiostegous rays are eight in number; the body is elongated and covered with small scales; the anterior dorsal and ventrals are situated rather behind the middle of the body; the pectorals are large and rounded, and almost meet beneath.

Thymallus, Cuvier.—Of this genus the Grayling (*T. vulgaris*) is the type. This fish is common in some of our streams, but is a local species; it differs chiefly from the trouts or salmons in having the mouth less deeply cleft, the orifice square, the anterior dorsal very high, and the scales larger.

Coregonus, Cuvier.—Here the teeth are very small, and the species are often edentate; the scales are very large, and the first dorsal is not so long as it is high in front. Numerous species of this genus are found in Europe. The Gwyniad (*C. fera*, Cuvier) and the Vendace (*C. Willughbii*, Jardine) afford British examples of the genus. "The Gwyniad of Wales," says Mr. Yarrell, "was formerly very numerous in Llyn Tegid (Fair Lake) at Bala, until the year 1803, when pike were put into the lake which have very much reduced their numbers." It is very numerous in Ullswater and other large lakes in Cumberland.

The Vendace was originally described by Sir William Jardine, in the third volume of the 'Edinburgh Journal of Natural and Geographical Science.' This author considered the fish in question as very closely allied to the *Salmo albula* of Linnæus, but the difficulty of determining this point has induced him to apply to it the name of our distinguished naturalist. It is only known to inhabit the lochs in the neighbourhood of Lochmaben in Dumfriesshire. *C. Lacepedii*, the Powan; *C. Pollan*, the Pollan, are also British species.

Argentina, Linnæus.—But one species (*A. sphyræna*, Linn.) of this genus is known, an inhabitant of the Mediterranean. This fish has the mouth horizontally depressed; the tongue is armed, as in the trouts and smelts, with strong curved teeth; in front of the vomer is a transverse range of little teeth; the branchiostegous rays are six in number; the air-bladder is very thick, and loaded with that silvery substance which is used in colouring artificial pearls.

Crumata, Cuvier.—These are *Salmonidæ* with the same general form and small mouth, as observed in the Graylings, but differ in the number of the branchiostegous rays.

Anastomus of Cuvier differs chiefly from the last in having the lower jaw turned up in front of the upper one, and gibbous, so that the little mouth appears like a vertical slit at the end of the muzzle. The species inhabit the rivers of South America.

The genus *Gasteroplectus* of Bloch also has the opening of the mouth directed upwards, but the abdomen is compressed and prominent; the ventrals are very small and far back; the first dorsal fin is situated over the anal, which is long; in the upper jaw are conical teeth, and in the lower the teeth are sharp and denticulated.

The species of the next genus, *Serasalmo*, are remarkable for the short, high, and compressed form of the body, which is furnished with small scales; their teeth are sharp, of a triangular form, and denticulated; there is often an adpressed spine in front of the dorsal fin. They inhabit the rivers of South America. To these may be added the genera *Tetragonopterus* of Artedi, *Chalceus*, *Myletes*, *Hydrocyon*, *Citharinus*, *Saurus*, *Scopelus*, and *Aulopus* of Cuvier, and *Sternopteryx* of Herman.

SALPA. [SALPIDÆ]

SALPIDÆ, or SALPA'CEA, a family of animals belonging to the Tunicated division of the *Mollusca*. Lamarck places the genus *Salpa* in his third section of *Tunicata* ('Tuniciers Libres ou Ascidiens'), with the following definition: "Animals disunited, either isolated or assembled in groups, without internal communication, and not forming essentially a common mass." These form his second order of *Tunicata*, with the title above given, and consist of the genera *Salpa*, *Ascidia*, *Bipapillaria*, and *Mammaria*. *Pyrosoma* is arranged under his second section: "Animals floating with their common mass in the bosom of the waters," in his first order ('Tuniciers Réunis ou Botryllaires').

These animals float in the open sea, and are characterised by a transparent elastic external membrane which is elongated and open at both extremities. The muscular fibres of the mantle, or membrane, lining the cartilaginous tissue, are arranged in flattened bands. The mouth and stomach, liver, and heart, are aggregated together into a small mass near the anterior aperture of the tunic; the intestine extends towards the opposite aperture, and terminates freely in the common cavity of the mantle. A narrow plicated riband-shaped band extends across the internal cavity, which is the branchiæ. The heart communicates with a large vessel at each extremity, one of which is ramified upon the visceral mass, the other upon the branchiæ and muscular tissues.

Whilst in the water the tunic expands and contracts. At each expansion the sea-water enters by the posterior aperture, and is expelled during contraction by the anterior one, its exit from the former orifice being prevented by a valve. It is the reaction of this jet of water that causes the animal to move along. The currents which thus pass through the animal yield nutrient matter, oxygenate the chylaqueous fluid, and carry away from the animal the excretory matters and the ova.

The *Salpæ* are divided into 'aggregate' and 'solitary,' but these are states of the same species. Each solitary *Salpa* has the power of producing from an 'internal stolon' a number of other *Salpæ*, or new individuals (Zooids). They are in fact buds, or germs, and afford an instance of the gemmiparous method of reproduction. Each of these zooids has an organisation resembling its parent, and some of them possess an ovarium and ova, and others possess testes and spermatic filaments, but the ova are not fertilised by the spermatic filaments of its own set, but always by another. The result of the fertilisation of an ovum is the production of a solitary *Salpa*, which now produces again aggregated *Salpæ*. This is one of the instances brought forward by Steenstrup in illustration of his views of the alternation of generations. Here the first salp produces aggregated salps which are unlike itself, but the aggregated salps produce solitary salps unlike their parents, but resembling their grand-parents. It is the second generation to which Steenstrup has given the name 'Nurses.'

The following is Rang's arrangement of the *Salpidæ*:—

Simple *Salpidæ*.

Genera, *Salpa*, Cuv.; *Timoriensis*, Quoy et Gaim.; *Monophorus*, Quoy et Gaim.; *Phyllirhe*, Péron et Lesu.

Aggregated *Salpidæ*.

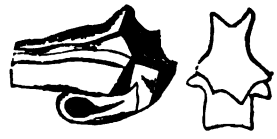
Genus, *Pyrosoma*, Péron.

Salpa.—M. De Blainville divides the genus into the following sections and subdivisions:—

* Species as it were truncated, without any prolongation going beyond the apertures.

A. Recurved species; the two terminal orifices very much approximated; aggregation (?).

S. polymorpha, Quoy et Gaim.



Salpa polymorpha.

B. Straight species; the orifices distant and terminal; the cartilaginous envelope consisting of three pieces; aggregation linear, oblique, two and two.

S. vaginata. Length two inches. It is a native of the Straits of Sunda.

C. Straight species: the orifices distant; the envelope of a single piece; aggregation circular.

S. pinnata. The body is marked with two dorsal lines, one yellow, the other white, and on each side of the belly is a violet line. There is also a variety with interrupted lateral lines. It is found in the Mediterranean Sea.

** Body pointed at one or both extremities, arising from a prolongation reaching more or less beyond the apertures.

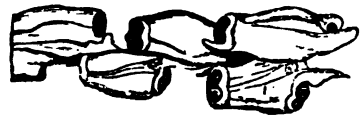
D. A prolongation at the anal extremity only; the aperture of the side very small; aggregation (?). (Genus, *Monophorus*, Quoy et Gaim.).

S. conica, Quoy et Gaim. ('Voyage de l'Uranie.)

E. A prolongation nearly of the same size at each extremity; mode of aggregation linear, oblique, two and two, or three and three.

1. Prolongation to the left.

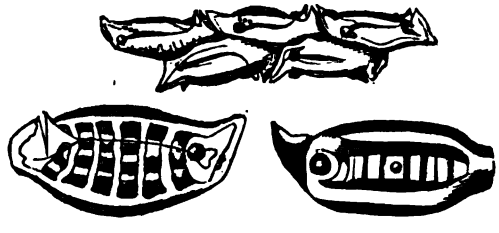
S. fusiformis.



Salpa fusiformis.

2. Prolongation to the right.

S. Zonaria. Sheath flesh-colour; zones yellow. A native of the ocean near Antigua.



Salpa Zonaria.

F. A prolongation at each extremity; the anterior much the longest and caudiform; aggregation (?). (Genus, *Timoriensis*, Quoy et Gaim.).

S. froloidea.

G. Two prolongations, in the form of horns, at the posterior extremity only; aggregation (?).

S. bicornis. Found in the Straits of Sunda.

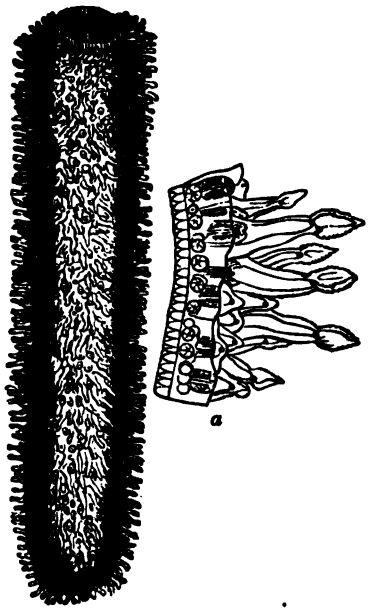
H. Three prolongations at the posterior extremity; aggregation (?).

S. tricuspidata.

Pyrosoma.—Animals elongated, fusiform, terminating in a point on one side and obtuse on the other, furnished with two apertures, one external, not terminal, the other internal and terminal, united among themselves towards their base by means of their external envelope, so as to compose numerous and regular rings, which concur to form a long free cylinder, rough with points externally, hollow and mammillated internally, and open at one extremity only. (Rang.)

Cuvier states that this great cylinder swims in the sea, by means of

Salpa froloidea.



Pyrosoma giganteum; *a*, a portion magnified.

the combined contractions and dilatations of all the individual animals which compose it. The branchial orifices are pierced near the points, and the anus opens into the interior cavity of the tube. Thus, says Cuvier, one may compare a *Pyrosoma* to a great number of stars of *Botrylli* [BOTRYLLUS] strung one after the other, but the whole of which would be moveable.

Mr. George Bennett, in his interesting 'Wanderings in New South Wales,' after some remarks on the luminosity of the ocean says, "On the 8th of June, being then in latitude 30′ south, and longitude 27° 5′ west, having fine weather and a fresh south-easterly trade-wind, and the range of the thermometer being from 78° to 84°, late at night the mate of the watch came and called me to witness a very unusual appearance in the water, which he, on first seeing, considered to be breakers. On arriving upon the deck, this was found to be a very broad and extensive sheet of phosphorescence, extending in a direction from east to west as far as the eye could reach; the luminosity was confined to the range of animals in this shoal, for there was no similar light in any other direction. I immediately cast the towing-net over the stern of the ship as we approached nearer the luminous streak, to ascertain the cause of this extraordinary and so limited a phenomenon. The ship soon cleaved through the brilliant mass, from which, by the disturbance, strong flashes of light were emitted; and the shoal (judging from the time the vessel took in passing through the mass) may have been a mile in breadth; the passage of the vessel through them increased the light around to a far stronger degree, illuminating the ship. On taking in the towing-net it was found half-filled with *Pyrosoma* (*Atlanticum?*), which shone with a beautiful pale-greenish light, and there were also a few small fish in the net at the same time; after the mass had been passed through, the light was still seen astern until it became inviaible in the distance, and the whole of the ocean then became hidden in darkness as before this took place. The sceno was as novel as it was beautiful and interesting, more so from having ascertained, by capturing the luminous animals, the cause of the phenomenon." On a second occasion Mr. Bennett took in the towing-net a number of *Pyrosoma Atlanticum*, whilst the sea was phosphorescent.

Preparations of these curious animals will be found in the Museum of the Royal College of Surgeons of England. [MOLLUSCA.]

SALSIFY. [TRAGOPOGON.]

SA'LSOLA, a genus of Plants belonging to the natural order *Chenopodiaceæ*, so named from 'salsus,' salt, in consequence of many of the species yielding kelp and barilla. The species are chiefly found on the sea-shore in temperate parts of the world, and also in hot parts of the world where the soil is saline, or there is salt water in the vicinity. The genus is characterised by having perfect flowers; the perianth 5-cleft, persistent, enveloping the fruit with its base, and crowning it with its enlarged scariose limb; stamens 5; styles 2; embryo spiral; herbs or small shrubs, smooth or pubescent; leaves alternate or opposite, roundish, seldom flat; flowers axillary and sessile.

S. Kali, Saltwort, so named from yielding barilla or kali, that is,

alkali, is found on the coasts of Europe, and of many parts of the world, and is one of the species which is burnt for the purpose of yielding kelp and barilla.

S. sativa is a species found on the southern coast of Spain, where some pains are taken to extend both it and the following species by cultivation, for the purpose of yielding barilla when burnt. The crop is cut in September, and laid in small heaps to dry. These heaps are collected and burned, forty or fifty of them, in a hole in the ground.

S. soda is found on the southern coast of Europe, and in the north of Africa.

Merat and Delens conceive that the species which yields the soda of Alicant is a new species, and not yet described, which they propose calling *S. Beril*. Other species are described by Forskäl as yielding soda on the coasts of the Red Sea.

S. nudiflora Dr. Roxburgh describes as a native of salt barren lands near the sea in India, where it is gathered for fuel only; but as the taste is strongly saline, it would no doubt yield good fossil alkali; and he gave it as his opinion that this plant, with two Indian species of *Salicornia*, might be made to yield barilla sufficient to make soap and glass for the whole world.

S. Indica is another Indian species, growing in similar localities. The green leaves are eaten by the natives.

SALT. [SODIUM.]

SALTPETRE. [POTASSIUM.]

SALTWORT. [GLAUX; SALSOLA.]

SALVADORA. [SALVADORACEÆ.]

SALVADORA'CEÆ, a natural order of Monopetalous Exogenous Plants, comprising only one genus, *Salvadora*. It is characterised by possessing a superior ovary, regular flowers, single carpel, single style with a simple stigma, and a 1-celled fruit with a single seed. The position of the genus *Salvadora* has always been doubtful: by one author it has been referred to *Chenopodiaceæ*, although it has a monopetalous corolla; by others it is referred to *Myrsinaceæ*, from which it differs in the position of its stamens and the structure of the ovary and seeds. It is most nearly allied to *Plumbaginaceæ* and *Plantaginaceæ*; with the former it agrees in habit, and with the latter in the number of the parts of the flower, its membranous corolla, and simple style. They are Indian and North African plants, with eatable fruit.

S. Persica, the Mustard-Tree of Scripture, has a succulent fruit with an aromatic smell, and tastes like garden cress. The bark of the root is extremely acrid; bruised and applied to the skin, it soon raises blisters, for which the natives of India often use it. The leaves of *S. Indica* are purgative, and the fruit is said to be eatable.

SA'LVIA (perhaps from 'salvus,' healthy), a genus of Plants belonging to the natural order *Lamiaceæ*, or *Labiatæ*. It belongs to the Monopetalous division of Exogenous Plants, and is known by its 2-lipped tubular or campanulate calyx; bilabiate corolla, with the upper lip usually arched; 2 stamens with halved anthers, having a flat dilated connective, which is placed vertically with the anther on the upper end. The species of this genus are well known both as ornamental shrubs and on account of their uses in domestic economy. The best known, and that which is used most frequently in this country, is the *Salvia officinalis*, the Garden Sage. It is a native of various parts of the South of Europe. It is a low straggling shrub, with erect branches, hoary with down, leafy at the base; entire, stalked, oblong, narrowed at the base or rounded leaves; nearly simple racemes; many-flowered distinct whorls; campanulate coloured membranous calyx; corolla two or three times as long as the calyx, with a large projecting tube ringed inside; the lips erect, the upper lip straight, the lateral lobes of the lower one reflexed. This plant is much used in cookery, and is supposed to assist the stomach in digesting fat and luscious foods. Sage-tea is also commended as a stomachic and slight stimulant.

S. pomifera, Apple-Bearing Sage. Leaves crenate, hoary, articulated with veins, lanceolate; heart-shaped at the base; calyx 3-lobed, bluntish. It is a native of rough open hills in Crete and various parts of the Levant. It is remarkable for being liable to the attacks of an insect of the *Cynips* genus, which produces upon their branches little protuberances similar to galls upon the oak, but much larger. These morbid growths contain an acid aromatic juice, and on this account are valued by the inhabitants of Crete as an article of diet.

S. sclarea, Common Clary. Leaves oblong, heart-shaped, rugged, villous, doubly crenate; bractes coloured, concave, longer than the calyx. This plant is a native of Italy, Syria, and Bithynia, and is one of the longest known of the exotic herbs found in British gardens. It is sometimes used for making wine, which has a taste resembling that of Frontignac, and is remarkable for its narcotic qualities.

S. splendens, *S. Indica*, *S. formosa*, and *S. fulgens*, are all handsome ornamental flowers, and as such are much cultivated.

S. pratensis, Meadow Clary, and *S. verbenacea*, Wild English Clary, are natives of Great Britain.

SALVINIA. [MARSILEACEÆ.]

SAMADE'RA, a genus of Plants belonging to the natural order *Simarubaceæ*, which was named by Gaertner, though the origin of the name is unknown. The genus, though containing but few species, includes *Vittmannia* of Vahl and *Niota* of Lamarck. The genus is characterised by having bisexual flowers; calyx 4-5-partite; petals 4-5, much longer than the calyx; stamens 8-10; ovaries 5-seeded, on a short stalk-like gynophore; styles as many. Fruit of one or more carpels, usually drupaceous. The genus is composed of trees or shrubs, with simple alternate and reticulately-veined leaves. Peduncles are axillary or terminal, pendulous when in fruit, and divided at the apex into a 5-12-flowered umbel. *S. tetrapetala* is a shrub, 10 feet in height, a native of Madagascar. *S. lucida* (*Niota lucida*) is another shrub, figured by Dr. Wallich ('Pl. As. Rar.,' t. 168), from Amherst, on the coast of Martaban. *S. Indica* (*S. pentapetala* of authors) is a large tree, a native of Southern India, especially on the Malabar coast; the fruit and bark are intensely bitter, like that of the other plants of the Quassia family. Niepa Bark, an Indian febrifuge, is obtained from this species.

SAMARSKITE. [URANIUM.]

SAMBU'CUS (from *σαμβύκη*, a musical instrument), a genus of Plants belonging to the natural order *Caprifoliaceæ*. It is known by possessing a 5-cleft calyx; rotate urceolate 5-cleft corolla; 5 stamens; 3 sessile stigmas; a roundish pulpy 1-celled berry hardly crowned by the remains of the calyx, with 3 or 4 seeds. The species are low deciduous trees inhabiting Europe and North America. The best known of the species is the Common or Black Elder (*S. nigra*). It is a small tree or large bush; the stem is irregularly, but always oppositely, branched; the young branches are clothed with a smooth gray bark, and filled with a light spongy pith; the leaflets are deep green and smooth, usually with an odd one; the inflorescence is a cyme composed of numerous cream-coloured flowers, with a sweetish but faint and heavy smell; fruit a globular purplish-black berry, with reddish stalks. This plant is a native of Europe, the north of Africa, and the colder parts of Asia. It is very common in most parts of Great Britain, and is generally found near human habitations. Considerable medicinal value has at all times been popularly attributed to this plant, and it is only recently that it has fallen into comparative disuse amongst medical practitioners. In the rural districts of England a wine is made from the berries, which is in great repute, and when drunk hot is an agreeable stimulant. The flowers are employed for making a distilled water, which is frequently used as a refrigerant, and on account of its agreeable odour is introduced into many articles of confectionery. The pith, on account of its solidity and great lightness, is used for making small figures and balls for electrical experiments. The undeveloped buds, when pickled, form a good substitute for capers.

S. Ebulus, the Dwarf Elder or Danewort, is distinguished by its cymes with three principal branches, lanceolate leaves, foliaceous stipules, and herbaceous stem. It is not an uncommon plant in England and Scotland in waysides and waste places. It has a very fetid smell, and the roots are violently purgative.

S. Canadensis, the Canadian Elder. Cymes with 5 principal branches; leaflets 4 pairs and an odd one, oblong, oval, acuminated more or less, pubescent beneath. The flowers are nearly scentless. It is a native of North America throughout Canada to the Carolinas.

S. racemosa, the Red-Berried Elder. Leaflets 5, membranous, oblong, acuminated, serrated, unequal at the base; petioles glabrous; flowers of a whitish-green colour. It is a native of the south of Europe and Siberia. It is a showy plant, and has a splendid appearance when covered with its fine large scarlet fruit. Many other species of this genus are worth cultivation, on account of their flowers, fruit, and foliage. Amongst these, *S. laciniata*, the Parsley-Leaved Elder, and *S. pubens*, the Downy Elder, may be mentioned.

SA'MOLUS, a genus of Plants belonging to the natural order *Primulaceæ*. It has a 5-parted calyx, its tube adhering to the lower half of the germen; the corolla is salver-shaped, with a short tube and a 5-parted limb with interposed converging scales; the stamens, 5 in number, are inserted near to the base of the tube of the corolla; the capsules half covered by the persistent calyx, many-seeded, and opening with reflexed teeth.

S. valerandi, the Brook-Weed, or Water-Pimpernel, has obovate or roundish-blunt leaves; the upper leaves blunt with a point; the racemes many-flowered, ultimately elongated; the capsules sub-globose. It is found in damp watery places in Great Britain.

(Lindley, *Vegetable Kingdom*; Burnett, *Outlines of Botany*; Babington, *Manual of British Botany*.)

SAMPHIRE. [CRITHMUM.]

SAMY'DA, a genus of Plants belonging to the natural order *Samydaceæ*. The genus having all the characters of the family to which it belongs, is distinguished by possessing 10-12 stamens, all of which bear anthers, while the stigma is globose. The species consist of small trees or shrubs, found in the hot parts of America, such as the West Indies, Mexico, and Brasil, with a few doubtful species in the East Indies. The branches are sometimes thorny; the leaves alternate, entire, or serrate, with pellucid dots and twin stipules; flower-stalks axillary, single-flowered, solitary or fascicled with white but sometimes purple flowers.

SAMYDA'CEÆ, *Samyds*, a natural order of Apetalous Plants, of uncertain station, and placed by De Candolle amongst Polypetalous Exogens. They have 3, 5, or 7 sepals more or less cohering at the base; stamens perigynous, two, three, or four times as numerous as the sepals, with monadelphous filaments; superior 1-celled ovary; indefinite ovules attached to parietal placentæ; capsules with 3-5 valves; numerous seeds fixed to the valves; fleshy albumen and a radicle pointing away from the hilum. The leaves are alternate with

the stipules, marked with round and linear pellucid dots. The apetalous flowers and fruit of this order approximate it to *Bixaceæ*, and its perigynous stamens and alternate stipulate leaves ally it to *Rosaceæ*. It is an entirely tropical order, composed of small trees or shrubs. The bark and leaves are slightly astringent. One of the species (*Casearia ulmifolia*) is used in Brazil as a remedy against the bite of snakes, for which purpose the leaves are applied to the wound, and an infusion of them is taken internally. Several other species of *Casearia* are used in native medicine.

Samyda serrulata.

a, branch with stipulate leaves and flowers; *b*, flower opened, showing the monadelphous stamens and the pistil; *c*, anther with its double cell; *d*, transverse section of ovary, showing seeds attached to five parietal placentæ.

SAND. A mass of any comminuted minerals is in popular language called Sand; but the most abundant ingredient in the extensive sands of the deserts, sea-shores, river-banks, and soil, is granular quartz or flint.

Little attention has been paid by geologists to this abundant covering of the earth's surface. Most of the sands which we observe are the ruins of disintegrated rocks—red, white, gray, black, according to the rocks from which they were derived. On examining these rocks themselves, we find them composed of grains of such sand, not crystallised grains, but worn and rounded on their surfaces like small pebbles. The parts of these solid rocks then have once existed as mere loose sand, and we seem to return in a circle to the point of departure. The origin of sand is however seen in volcanic dust and ashes—in the disintegration of granitic, porphyritic, and other pyrogenous rocks; the aggregation of them is easily understood by examining Millstone-Grit, New Red-Sandstone, or the Grès de Fontainbleau; and the disintegration of sandstones is too common a phenomenon in English gothic buildings.

Soil often contains sand, though the subjacent strata be wholly calcareous or finely argillaceous. This is a phenomenon of the same order as the accumulation of detritus (boulders, gravel, clay, &c.) in situations far from the native place of such materials. It proves that the surface has been traversed by currents of water; and there can be little doubt in the mind of an observing agriculturist, that these washings of the earth's surface, by mixing materials of different qualities, have been in many cases the cause of the fertility of soils.

Some sands impregnated with oxide of iron (and thus often blackened or rendered ochraceous), and others which are nearly white, are very sterile; others of a gray or green brown, or redder hue, are often fertile. The latter almost always contain argillaceous ingredients (often a proportion of felspar), and probably it is in a great degree to the presence of potash in the felspar or the clay that their superiority is owing. [Manure, in Arts and Sc. Div.]

SAND-BOX-TREE. [Hura.]
SAND-EEL. [Ammodytes.]
SAND-GROUSE. [Tetraonidæ.]
SAND-LANCE. [Ammodytes.]
SAND-MARTIN. [Hirundinidæ.]
SAND-PIPER. [Charadriadæ.]
SAND-PRIDE. [Petromyzidæ.]
SAND-SMELT. [Mugilidæ.]
SAND-STAR. [Ophiura.]
SAND-TUBES. [Fulgurites.]
SANDAL-WOOD. [Santalum.]
SANDAL-WOOD, RED. [Pterocarpus.]
SANDARAC. [Callitris.]
SANDERLING. [Calidris.]

SANDO'RICUM, a genus of Plants belonging to the natural order *Meliaceæ*, which is named from a change in one of its eastern names, Suntoor or Sundoor. The genus contains only a single species, found in the hot parts of Asia, and is characterised by having the calyx 5-toothed; petals 5; stamens 10, joined into a tube, which is 10-toothed, and bears the anthers inside; stigmas 5-bifid. The drupe contains 5 ovate compressed nuts, which are 2-valved at the base, and 1-seeded.

S. Indicum, the only species, is an elegant tree of considerable size which is found in the Molucca and Philippine Islands, as well as in the southern parts of India. The leaves are alternate and trifoliate; leaflets entire; panicles axillary, with the flowers crowded on the short partial peduncles. The fruit is acid, and sufficiently agreeable to be mixed with syrups to make cooling drinks. Its root is bitter, and used in medicine in bowel complaints. It is sometimes called False Mangosteen, from some resemblance to its fruit, and also Indian Sandal-Wood.

SANDSTONE, OLD RED. [Old Red-Sandstone.]
SANDSTONE, RED. [Red-Sandstone.]
SANGUINOLARIA. [Pyloridia.]

SANGUISORBA, the name of a genus of Plants, the type of the sub-order *Sanguisorbeæ*, in the natural order *Rosaceæ*. Of this genus (called Burnet) there are 9 known species. Most of them possess astringent properties. The Common Burnet (*S. officinalis*) is a native of Great Britain, and was at one time cultivated in chalky districts to a very considerable extent, but it has lately been superseded by sainfoin and other artificial grasses. It has a stem one or two feet high, branching upward; leaves pinnate; leaflets ovate, somewhat cordate at the base. Heads of flowers much crowded, dark purple; limb of the perianth in 4 ovate segments, its tube enveloping the germen, and having at its base 4 ciliated scales or bracteas; achene 1, rarely 2.

SANGUISORBACEÆ, *Sanguisorbs*, a natural order of Plants in Lindley's 'Vegetable Kingdom.' It constitutes an apetalous sub-order in the order *Rosaceæ* of most other botanists. [Rosaceæ.]

SANGUISUGA. [Annelida.]

SANICULA, a genus of Plants belonging to the natural order *Umbelliferæ* and the tribe *Saniculeæ*. The calyx has 5 leaf-like teeth; the petals erect, obovate, with a long inflexed connivent point. Fruit sub-globose, covered with hooked spines; no ridges; vittæ numerous.

S. Europæa, the Wood-Sanich, is a native of Great Britain, in woods and thickets. The lower leaves are palmate, 3-5-lobed; lobes bifid, unequally serrate. The fertile flowers are sessile; barren flowers slightly stalked.

(Babington, *Manual of British Botany.*)

SANSEVIE'RA, a genus of Plants belonging to the natural order *Liliaceæ*, found on the coasts of Western Africa, of Ceylon and other eastern islands, as well as of India, remarkable for the strength and fineness of the fibres of their leaves. The genus is characterised by having a corol-like funnel-shaped perianth, which has a long rather straight tube, a sexifid limb, of which the divisions are either spreading or revolute. Stamens 6, inserted into the throat; filaments filiform; ovary 3-celled; ovules solitary; style filiform; stigmas obtuse, obscurely 3-lobed. Berry 3-celled, 3-seeded, or, from becoming abortive, 1-celled and single-seeded. The plants have a thick creeping root-stock, with radical equitant leaves, which are fleshy and often spotted; the stem-leaves are scale-like, and the flowers in racemes or thyrsi. They are easily cultivated and propagated in sandy loam in bark stoves.

S. Zeylanica, a species found in Ceylon, has smooth oblong-acute, flat, and linear-lanceolate, channelled, glaucous leaves, which are shorter than the scape; the style as long as the stamens, the bracts equalling the peduncle in length. This, like some of the other species, is remarkable for the tenacity and fineness of the fibres of its leaves.

S. Roxburghiana is a species, according to Mr. Haworth, which was confounded with the former by Dr. Roxburgh, and which the latter has figured in his 'Coromandel Plants.' It has linear ensiform leaves, which are channelled, keeled, subulate at the apex, green, and longer than the scape; style as long as the stamens; the bracts minute. Dr. Roxburgh describes this plant, and says it is called Moorva in Sanscrit, and in Bengalee Moorba, that in English it may be called Bow-String Hemp, and that it grows very commonly under bushes in the jungles in almost every soil in the southern parts of India. It flowers from January to May. In a good soil, and where the plants are regularly watered, the leaves become three or four feet long, and contain a number of fine remarkably strong white fibres, which run their whole length. The natives make their best bow-strings of these fibres, which are separated by the leaves being placed upon a flat strong table, when one end is pressed down with the foot, and the rest scraped with a piece of hard wood held in both hands. Forty pounds of leaves thus scraped yield about one pound of clean dry fibres.

The fibres may be applied to a great variety of uses. Dr. Roxburgh was inclined to think that the fine line called China grass is made of these fibres. As the plant grows readily from the slips which issue in great abundance from the roots, and as they require little or no care, Dr. Roxburgh recommended their cultivation in sandy soils. It has

lately been proposed in Calcutta to try the fibre on a large scale for rope-making.

S. lanuginosa is a third species, found on the sands of Malabar, while *S. Guineensis* is a species found along a great extent of the west coast of Africa, and which, from affording fibres which, like those of the Indian species, are fine and strong, has been called African Bow-String Hemp. This has been proposed as a substitute for and considered even superior to New Zealand flax. *S. Guineensis* is distinguished by having uniform lanceolate leaves, the style twice as long as the stamens; the bracts only a third of the length of the tube of the corolla; the flowers sessile.

SANTALA'CEÆ, a natural order of Plants belonging to the class of Exogens and sub-class *Incompletæ*. They are trees, shrubs, or herbaceous plants, with round or irregularly-angled branches; alternate or nearly-opposite undivided leaves, sometimes minute, and resembling stipules. The flowers are small, in spikes, racemes, umbels, or solitary. The calyx superior, 4- or 5-cleft. Stamens 4 or 5, opposite the segments of the calyx. Ovary 1-celled, with from 1 to 4 ovules. Fruit 1-seeded, hard, dry, and drupaceous. Albumen fleshy. This order is closely allied to *Loranthaceæ* and *Aristolochiaceæ*. One of its most remarkable characters is that its unilocular ovary contains always more ovules than one, which are pendulous and attached to the apex of a central receptacle. In the form of weeds the genera of *Santalaceæ* are found in Europe and North America; in Australia, the East Indies, and the South Sea Islands, they exist as large shrubs or small trees.

Osyris belongs to this order, although it differs in having dioecious flowers and a trifid calyx. This is however a different plant from the *Osyris* of Pliny, which possessed in former times a reputation for curing every disease. The modern genus possesses no sensible properties as a medicine, and is principally employed for the manufacture of besoms, for which its long slender branches well fit it. The Ogeehee Lime, which is used on the Mississippi instead of olives, is the fruit of *Nyssa candicans*. The *Nyssæ* form trees of great beauty, and their wood is white, soft, compact, and light. The most valuable genus in this order is its type, the *Santalum*, of which the species *S. album* forms the true sandal-wood of commerce.

d *c* *a* *b*

White Sandal-Wood (*Santalum album*).

a, branch with leaves, flowers, and fruit; *b*, flower with the calyx open, showing the perigynous stamens and their appendages, the inferior ovary, simple style, and lobed stigma; *c*, transverse section of fruit, with one seed; *d*, longitudinal section of fruit, with solitary pendulous seed.

SA'NTALUM, a genus of Plants which gives its name to the natural order *Santalaceæ*, to which it belongs. It has hermaphrodite flowers, the perianth united at the base with the ovary, the limb superior, tubular, and ventricose, quadrifid, deciduous; glands four, compressed, inserted into the throat, alternating with the lobes of the limb. Stamens 4, inserted into the throat opposite to the lobes of the limb; filaments awl-shaped, loaded with a pencil of hairs behind; anthers 2-celled; ovary half inferior, 1-celled; ovules 2-anatropous pendulous from the apex of a free central placenta; style filiform, simple; stigma obscurely 2-3-lobed; drupe berried, 1-seeded; margined at the apex. Seed inverse. Embryo straight at the apex of a fleshy albumen. Radicle above.

S. album, or the White Sandal-Wood, is a native of the mountainous parts of the coast of Malabar, and also of Timor and the islands of the Indian Archipelago, as it is probable that the same species extends to great distances. It forms a tree of moderate or rather of small size, but much branched, and in general appearance has been often compared to the myrtle, and in inflorescence to the privet. The leaves are opposite, with short petioles, oblong, entire, smooth, glaucous underneath; length from one and a half to three inches. The inflorescence is in axillary and terminal thyrsi. Flowers numerous, small, straw-coloured when they first expand, but change to a deep ferruginous purple; they are inodorous, as are all the exterior parts of the growing plant even when bruised. The tree when felled is about nine inches or a foot in diameter; it is then barked, cut into billets, and said to be buried in a dry place for about a couple of months. The deeper the colour and the nearer the root, the more fragrant it is. As seen in commerce it is in compact pieces of a white colour and agreeable odour, but with little taste. It is usually described as being the young and outer wood, and that the inner parts, as they become older, become coloured towards the centre, and that this is the source of the yellow, while the white sandal-wood consists of the outer and younger wood of the same tree.

This is the general opinion respecting the origin of yellow sandal-wood, but Garcias thought it in his time to be the produce of a different tree. M. Gaudichaud is of the same opinion; and has moreover figured the plant in plate 45 of the botanical part of the 'Voyage de l'Uranie.' This he saw in the Sandwich Islands, and has named it *S. freycinetianum*; stating it to produce the sandal-wood which is so much valued by the Chinese, which they also obtain from the Feejee and Marquesa Islands, Moluccas, &c. They manufacture various articles with the yellow sandal-wood, which is the most fragrant. They also burn it both in their temples and private houses as an incense, and especially in the form of long slender candles, which are formed by covering the ends of sticks with the sawdust of sandal-wood mixed with rice paste.

S. myrtifolium is another species, or a strongly marked variety of *S. album*, found by Dr. Roxburgh in the mountains of the Rajamundry Circar, and which was figured by him in plate 2 of his 'Coromandel Plants:' it is distinguished by its opposite lanceolate leaves. The wood is of little value, according to Dr. Roxburgh, but Dr. Wallich says it is 'certe odoratissimum.'

About 200 tons are annually imported into Calcutta from the Malabar coast, and about twice as much into Canton from the islands of the Indian Archipelago.

SAP, in vegetable physiology, is the fluid which plants imbibe from the soil in which they are placed, and is the great source from which they are nourished, and their various peculiar secretions produced. One of the most important conditions of the growth of plants is, that they may be placed in circumstances to absorb from the soil those constituents of which their sap is composed. The constituents of sap may be divided into those which are essential, or necessary for the growth of all plants, and those which are special, or necessary only for the growth of particular plants or families of plants. The elementary bodies which form the essential constituents of sap are carbon, oxygen, hydrogen, and nitrogen. These bodies are capable of uniting with each other and forming a great number of secondary combinations, and are seldom, if ever, absorbed in a pure state by plants. The forms in which they enter the plant and constitute its essential ingredients are those of water, carbonic acid, and ammonia. Water is one of the most universally necessary constituents of organic beings, and exercises a double function in relation to their nutrition. In the first place it enters largely into their composition, and in the second place it is the medium by which the various compounds are carried into the system of both plants and animals.

Many water-plants are almost entirely composed of water, and there are none that do not contain this substance, in large quantities, as is seen in the diminution of their weight by drying. Plants however throw off larger quantities of water than they retain, and this is necessary to the supply of the organic and inorganic elements of which they are composed, and which are found present in the sap. In a series of experiments performed by Mr. Lawes, in which he carefully weighed the quantity of water supplied to certain plants, and afterwards the quantity of organic and inorganic matters they possessed, he found that for every 200 grains of water absorbed and exhaled, one grain of organic matter was appropriated by the plant, and for every 2000 grains of water consumed, one grain of inorganic matter was appropriated. Water is supplied to plants both in the form of rain and vapour, but Schleiden has pointed out in opposition to the commonly received views on this subject, that by far the largest quantity of water supplied to plants is due to the latter source.

"The complete independence of vegetation of the atmospheric precipitation of rain in a liquid form is seen in the vegetation of the Oases, and of the cloudless coasts of Chili and Peru (see Darwin and Loudon), and in a small way in the experiments of Ward. The sand of the Sahara produces no vegetation, not because no rain falls upon it, but because it has not the power of condensing aqueous vapour. Of the water which falls as rain, very little is used directly by the plant; the greatest part runs off or is evaporated into the atmosphere whilst another part sinks into the earth and feeds the

springs. There are but few observations upon the quantity of water needed by plants, but the facts supplied by Hales and Schübler show that rain, after making allowances for that which flows away and is evaporated, does not supply more than a tenth part of what is necessary. It is unaccountable and inexcusable that not a single botanist, since the time of Hales, should have taken up and carried on his experiments. If we take the previous calculations of the quantity of water required by plants in England, which is deduced from Hales's experiments, and which agree with those of Schübler on *Poa annua*, we shall obtain the following approximative results:—According to Schübler, there falls in England upon the acre of 40,000 square feet, at the utmost 1,600,000 lbs. of water during 120 days of summer. According to the researches of Dalton, Müller, Berghaus, and Dausse, at least a third part of this water flows away into the rivers, but it is probably more than this, as the great rapidity of the flow of the water in steep, hilly, and mountainous regions is not sufficiently taken into consideration. A considerable but not accurately to be estimated quantity of water evaporates immediately after the fall of rain, as the vaporous state of the atmosphere indicates. From this it would appear that at the most there is left disposable for plants and future evaporation 800,000 lbs. of water on the acre. Now this quantity of water, according to the preceding experiments, would not cover more than two-thirds of the demand of an acre of cabbages, half of the demand of an acre of sunflowers, or of the Jerusalem Artichoke (*Helianthus tuberosus*), the fourth of a fruit garden, the fifth of a hop garden, and about the seventh or eighth of a meadow. It must be recollected that here only the water is taken into calculation which is given out from the plants and weeds growing in a meadow, but that which is afforded by the evaporation of the soil itself cannot amount to less than 2,000,000 lbs. for an acre. Thus much is very evident from these calculations, that the quantity of rain that falls upon the earth is no more a measure of the quantity needed or consumed by the plant, than is the quantity of humus, an index to the fertility of the soil. We may learn from this that the quantity of rain which falls in a given region is not a measure of its fruitfulness, but the quantity of moisture, the absolute and relative quantity of vapour, which yearly, and especially during those months which are most important for vegetation, is contained in the atmosphere." (Schleiden, 'Principles of Scientific Botany.')

Carbonic acid gas supplies plants with the carbon of their tissues. At one time it was supposed that the carbon of plants was supplied directly from the soil, by the agency of a substance called Humus. There are many facts in nature which show that this is impossible, for there are districts of the earth's surface which are constantly yielding carbon in the vegetable and animal products which they supply, and to which no humus is added to keep up the loss of carbon. This is the case with the produce of Switzerland, which for centuries has been sent into Europe, and yet no system of manuring is carried on in the agriculture of the Alps. Many districts of England and France are now covered with a fertile vegetation which a few centuries ago were barren sands. Such facts prove that the supply of carbonic acid is from the air and not from the soil. The sources of carbonic acid gas on the surface of the earth are very numerous and constantly operative, and yet this gas does not accumulate in the atmosphere. The only conclusion that can be come to with regard to its disappearance is, that it has been taken up by plants. It has also been proved by direct experiment that plants will not live without a supply of carbonic acid gas, and that they flourish where this gas is present.

The following are the sources of this gas:—

1. The respiration of man and animals. In one year it is calculated that a single human being throws 225 lbs. of carbon into the atmosphere. If this is multiplied by 1,000,000,000, it will give the enormous amount of carbon thrown into the atmosphere every year by man alone, which must at least be doubled for the rest of the animal creation. [Respiration.]

2. Combustion is a vast source of carbonic acid gas. Man needs heat to maintain his own temperature, to cook his food, and to manufacture and move about with. The quantities of carbonic acid thus thrown into the atmosphere must be even greater than that produced by respiration, and at the present day must constitute a very prominent source of supply of food to the vegetable kingdom.

3. All sugar in decomposing ferments, and a large natural supply of carbonic acid is probably thus afforded, but in the manufacture of alcohol by man, the quantity of carbonic acid thus formed must be very considerable. In all vegetable and animal decay carbonic acid is formed, and thus animals and plants are converted into an inorganic substance before their elements are again used in the nutrition of organic beings.

4. Another source of carbonic acid is the interior of the earth. In all volcanic districts the springs come up charged with carbonic acid gas, and this gas is found constantly present in lake, river, and spring water. It is also found that the gases which are discharged from active volcanoes consist principally of carbonic acid gas. This accounts for the destructive effects of the vapours of a volcano, where persons are exposed to their direct action. This purely mineral source of carbonic acid is interesting, as proving that a constant supply of carbon is kept up, not only for sustaining, but for allowing an increase in the vegetable and animal kingdoms from the mineral kingdom alone. Unless this source was known, it would be difficult to explain from whence the original supplies of carbon came, as we have every reason to believe that plants and animals have been created as individuals or pairs. To take the human race alone there must be 500,000,000 times as much carbon existing in it at the present moment as existed in the bodies of our first parents. Whence the source of this supply, if not from the mineral kingdom?

The sources of the supply of ammonia are the same as those of carbonic acid. The excretions of animals, the combustion of wood and coal, the decomposition of nitrogenous matters, the gases of volcanoes, are all sources of this gas.

The constituents of the sap which are not necessary for the growth of all plants are principally the metallic oxides, which it is well known enter very largely into the composition of some plants. The most common of these are the oxides of potassium, sodium, calcium, and magnesium. These occur in combination with various acids, but the acid is not found to exercise so much influence on the plant as the base. Although any of these oxides when presented in solution would be absorbed by plants, it would be only those adapted to the peculiar habit of the plant that would be appropriated. Thus plants which grow naturally on the sea-shore, and require soda for their growth, will take up potassa when presented to them in combination with soda, but they would reject the potassa by excretion and retain the soda. [Root.] The sap therefore which is found in plants varies in composition both from the nature of the soil and the nature of the plant.

From the soil the sap is conveyed by the roots into the plant, and is not long before it undergoes certain changes in its composition, but the nature of these changes, and the period at which they take place, are not well known. It is however a fact that the nearer a tree is tapped to its root, the more fluid is the sap which exudes. The channels through which the sap passes in its upward course are also a subject of difficulty. Various observers have contended for each of the different tissues being the sole conveyor of this fluid, but it is most probable that, with the exception of the spiral vessels, which seem appropriated to the conveyance of air, all the tissues of a plant are engaged in conveying sap. There are some parts which seem to convey more than others, and the younger tissues are always more filled with fluid than the older. Thus, when the trunk of a tree is cut through in spring, sap will be seen to exude from all parts of the cut surface, but in greatest quantities from the alburnum or sapwood, the most recently formed portion of the timber.

By whatever channels the sap pursues its upward course, we find that it undergoes great changes between the period of its absorption from the soil and its ultimate disposition in the secretions of the plant. The most important of these changes is the loss of a large portion of that water which it possessed when first absorbed. This water is got rid of by the process of exhalation, which takes place under the influence of external heat and light. In this way it has been ascertained that a common sunflower, three feet in height, will lose one pound four ounces of water every day; and a common cabbage one pound three ounces. Hales contrived to measure the force with which plants exhaled during the summer, and computed that in some plants it was five times as great as that which impels the blood in the crural artery of a horse. The part of the plant in which this process goes on most rapidly is the leaf, which, from its extensive surface and delicate structure, is well adapted for the performance of the function. For this purpose however the leaf is endowed with especial organs called stomates. The stomates are small openings in the cuticle of the leaf, the number of which varies exceedingly in different leaves, and the process of exhalation bears a direct proportion to their number. Exhalation goes on principally during the day, under the influence of the light of the sun, and almost completely ceases when the sun's rays are withdrawn. It is on this account that plants loose so rapidly their freshness on exposure to the light of the sun, when they have been plucked, or otherwise deprived of the means of obtaining a fresh supply of water. When the sap has arrived at the leaf and lost a certain quantity of water, it has been supposed that the peculiar secretions of the plant are there formed and sent down into the plant. This has been called the 'descent of the sap.' It is somewhat difficult to imagine how these secretions can pass back through so delicate an organ as the petiole, and pass down through bark or stem, even into the roots of the plant. The arguments which have been used for adopting this view are the facts that the peculiar secretions of the plant are not produced till the leaves are developed; that in ringing a tree the largest quantities of secretion is found in the upper and not the lower part of the wound, and that when the leaves are injured no secretions are found. It is answered that all the secretions of plants are formed in the interior of the cells where they are found, and that their formation depends on the leaves, not because formed in the leaves, but because the leaves by their function of exhalation produce a supply of nutritive materials, which is carried to every part of the plant, and thus there could be no secretions without the leaves. Again, when a plant is ringed or cut, the amount of effusion of sap or juices will depend on physical circumstances, and a greater supply of secreted matter is found in the upper part of a ring, because there is most liquid matter to be effused from the trunk and branches of the tree above, and because of its dependent position.

The cause of the progression of the sap in plants has been a fruitful

source of speculation. Malpighi supposed that it depended on the contraction and dilatation of the air inclosed in the air-vessels. Borelli attributed it to the condensation and rarefaction of the air and fluids of the plant. Du Hamel, who was also supported by Linnæus, accounted for it by the agency of heat. Hales demonstrated the insufficiency of this principle, but did not adopt one less objectionable. Capillary attraction has long been a favourite theory in explaining these motions, but it is liable to the same objections that all purely physical theories are, with regard to the movements of the fluids in plants and animals. Those botanists who have referred these movements to a vital agency have not been more happy. Brugmanns, Coulon, Saussure, and others adopted the theory of vegetable irritability. The vessels in which the sap was contained were supposed to be susceptible of the action of stimuli, and when the sap, which acted as a stimulus, was applied to them, the vessels contracted and the sap was propelled. Knight referred the propulsion of sap to contraction and dilatation not of the vessels, but of the medullary plates or rays. It appears really to depend on the physical relations existing between the substance of the cell-wall and the fluids which it has to absorb. [Absorption; Endosmosis.]

The movements observed in the sap are of two kinds, general and special. The general consist in the strong upward movements that take place in the spring, and which are called the 'ascent of the sap,' and in the diffusion of the secreted matters in a fluid state throughout the whole plant, the appearance of which, in dependent parts of the plant, have led to the notion of a 'descent of the sap.' The special movements are those which occur in the cells of plants, and which have been called cyclosis and rotation. [Cyclosis; Tissues of Plants; Secretions of Plants.]

SA'PAJOUS, the name generally given to a group of South American Monkeys, including in its larger sense the Ordinary Sapajous [Ateles; Lagothrix], and the other Sapajous (*Cebus*, Geoff.). These last, which are termed Sajous, have the head round, the thumbs distinct, but scarcely opposeable on the fore hands, and the tail entirely covered with hair, although still prehensile.

The whole of the Sapajous are very active, climb admirably, and are altogether well formed for an arboreal life. The fore-hands suffer by comparison with those of the Old World monkeys, and exhibit a less perfect organisation. The thumb is longer, but is more on a line with the other fingers. The palms both of the fore and hinder extremities are endowed with great sensibility. Small in size and playful in disposition, the Sapajous lead a gregarious merry life, feeding chiefly on fruits and insects. The facial angle is about 60°.

The species are very numerous, and Cuvier truly says, that they are nearly as difficult to characterise as those of the American Howlers. [Mycetes.]

One of the most common species is the Weeper (*Cebus Apella*); but why it should have obtained this dolorous title is not very clear, for when confined it is good tempered, playful, and hardy. The fur is rather rich, inclining to olive, with a golden tinge on the lighter parts; and the face is bordered with a paler circle, varying considerably in shading and breadth, being nearly wanting in some individuals. This species has been known to breed in confinement.

Humboldt describes another species, *C. albifrons*, the Ouavapavi des Catarractes, about the same size as the last, with a grayish-blue face, excepting the pure white orbits and forehead. The colour of the rest of the body is grayish-olive; but the hue is lightest on the back and belly.

It was found living in troops in the forests near the cataracts of the Orinoco. Mild and active, they are often kept by the Indians as playthings, and are very entertaining. Thus Humboldt saw one domesticated worthy at Maypures that caught a pig every morning, and rode him about while he was feeding in the savanna the whole day. Another in the house of a missionary bestrode a cat, which had been brought up with it, and patiently submitted to the rider.

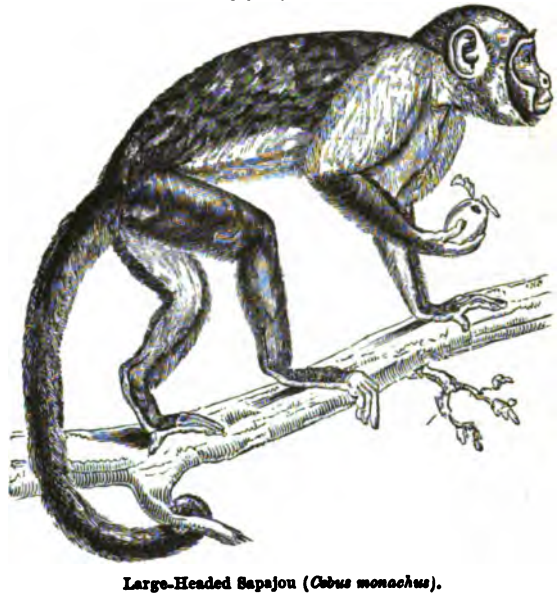
C. fatuellus, the Sajou Cornu of the French, Horned Sapajou of the English, *Simia fatuellus* of Linnæus, is a variety of the form marked by the extraordinary direction of the hair on the forehead. Colour, in some deep brownish or purplish black; in others, reddish-brown. The skin on the naked parts dark purple. The hair of the forehead stands up like a crescent, or a waterman's cap with the front elevated. When viewed in front it exhibits the appearance of two horns. The tips of these erect hairs and of those on the cheeks are paler. It is a native of French Guyana.

Cebus monachus, the Sai à Grosse Tête of the French, Large-Headed Sapajou of the English, has no frontal tuft like the last. On the contrary the head is covered with short whitish hairs of a shorn appearance. The breast and belly, sides of the cheeks, and all the front yellowish-white. Fore-arms, hinder extremities, and tail black. Irregular patches of black and brown cover the rest of the body.

Fifteen or sixteen species are recorded of this the most numerous group of the American monkeys. They may be considered as representing in that continent the *Guenons* of the Old World, which are also very numerous. [Guenons.]

The genus *Saguinus* is allied to *Cebus*, and is thus defined by M. Lesson:—Same character as in the Sapajous, excepting that the ears are very large and deformed, and that the tail is covered with short hairs. Body slender. Facial angle, 60 degrees.

Horned Sapajou (*Cebus fatuellus*).



Large-Headed Sapajou (*Cebus monachus*).

Dental Formula:—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6} = 36$.

M. Lesson arranges the following species under the genus:—*S. sciureus*, *S. personatus*, *S. lugens*, *S. amictus*, *S. torquatus*, *S. Moloch*, *S. melanocheir*, and *S. infulatus*.

S. sciureus is the *Simia sciurea*, Linn.; *Callithrix sciureus*, Geoff.; Sagoin Saïmiri, and Saïmiré, of the French; Saimiré of the natives of the Orinoco; and Titi of Humboldt.

Size about that of a squirrel, hardly more than 10 inches in length without the tail, which measures 13 or 14 inches. Body greenish-yellow above, becoming grayish on the thigh and arms; body beneath, nearly white. Feet, legs, and fore-arms reddish-chestnut. Muzzle dark; the rest of the face and ears flesh-coloured. Tail black at the tip. In both extremities the nails of the thumbs are broad; those of the fingers are more claw-like. It inhabits Brazil and Guyana.

This pretty species is often kept by the natives in confinement. One in the Paris Menagerie is described by F. Cuvier as very playful and good-humoured. The tail, when the animal was at rest, was wound round the body or limbs, a position in which it was kept when the little creature slept, which it did in a sitting posture, with the head bent down between the fore legs; but the tail was never used as a support. This is not an uncommon species.

Saïmiri (*Saguinus sciureus*).

Cuvier will not allow the Sagouins and Saïmiris to be classed together, and indeed he separates the Saïmiri above described and figured from the Sagouins, making the Sakis intervene between the forms. He says that in the Saïmiri the tail is depressed, and ceases to be prehensile, and that the head is very flat. He also observes that there is a membranous space in the interorbital partition in the skeleton.

Of the Sagouins (*Callithrix*, Geoff.), he says that they have the tail slender, and that their teeth do not project, remarking that they had for a long time been associated with the Saïmiris, but that the head of the Sagouins is higher, and that their canines are shorter. Such, he observes, are the Sagouin à Masque (*Callithrix personata*, Geoff.), and the Sagouin en Deuil or La Veuve (La Viduita, *Simia lugens*, Humb.).

The first of these, *Callithrix personata* (*Saguinus personatus*) is grayish-yellow, with the head and the four hands black, and a reddish tail. It is a native of Brazil, where it is found between 18° and 21° S. lat., on the banks of rivers.

The second, *Callithrix lugens* (*Saguinus lugens*), has the body of a shining black, with a purplish lustre on some parts: the hair soft and shining. The face has the appearance of a bluish-white square mask, which is surrounded by a narrow margin of a purer tinge, while two stripes of the same colour run from the eyes to the temples. The throat is marked with a band of white, of which colour are the anterior hands on the outsides, so that they there resemble a pair of white gloves, to which the natives compare them.

This species, which is the Macava Cahou of the natives, appears to be extremely rare. Humboldt saw only one specimen, and that in the forests bordering the rivers Cassiquiare and Guaviare. It was said to live in pairs; and this opinion was confirmed by the fear and dislike shown by the captive when placed near even some of the most diminutive species of the genus. It was very shy, and was active only when alone. When in the vicinity of persons, though they were occupied in general business, it would remain immoveably attentive to all that passed, refusing food even, notwithstanding a long fast. When alone its behaviour was very different. If a bird was introduced, the monkey was instantly roused at the sight of it, darted upon it like a cat, and swallowed it instantly, its whole habit at such moments being that of a carnivorous animal.

SAPAN-WOOD. [CÆSALPINIA.]

SAPHIRINE, a Mineral occurring granular disseminated in *Anthophyllite*. The colour is pale-blue or greenish; streak white. Fracture uneven, conchoidal. Hardness 7·0 to 8·0. Lustre vitreous. Translucent. Specific gravity 3·42. It is found at Akudlek in Greenland. Its analysis by Stromeyer, gives—

Silica	14·50
Alumina	73·11
Magnesia	16·85
Lime	0·38
Oxide of Iron	3·92
Oxide of Manganese	0·53
Water	0·49

SAPINDA'CEÆ, *Soap-Worts*, a natural order of Plants belonging to the calycose group of Polypetalous Exogens. It consists of trees or shrubs, rarely herbaceous plants, with erect or climbing stems, with alternate often compound leaves, rarely simple, with or without stipules, and often marked with lines or pellucid dots. Their inflorescence is racemose or paniculate, with small white or rose-coloured rarely yellow flowers, which are seldom barren or hermaphrodite. The calyx consists of 4-5 sepals, slightly cohering at the base. The petals are the same in number as the sepals, one being occasionally abortive. They are in general furnished with a petal-like scale, but are sometimes naked. They have a fleshy glandular disc occasionally occupying the base of the calyx. The stamens are definite, about twice the number of the sepals. The filaments are free or slightly connate, the anthers 2-celled. The ovary 3-celled, rarely 2-4 celled, the cells containing 1-2-3 ovules. Style undivided, or more or less deeply 2- or 3-cleft. The seeds have usually an aril, are without albumen, and have a curved or spirally twisted embryo. They are inhabitants of most parts of the tropics, more especially of South America and India. They are not found in Europe or the United States of America. One genus is found in Australia, *Dodonea*.

This order is closely allied to *Aceraceæ*, from which they only differ in their alternate leaves and petals. The number of their stamens 8, with 5 unequal sepals, point out a relation with *Polygalaceæ*. Their climbing habit and tendency to produce tendrils give them a remote relation to *Vitaceæ*. In this order, although the leaves, branches, and other organs act in a deleterious manner, yet their fruit and seeds are eatable and wholesome. The Litchi and Longan, favourite fruits in China, are produced by the genus *Euphoria*. These fruits are sweet, with a sub-acid flavour, and when dried are sometimes brought to this country. They are considered a great luxury in China, and are sent at a great expense from the provinces of Fokien and Quan-Tong, where they grow, to Peking, for the consumption of the emperor. Several other genera bear fruits which are very delicious, and are eaten in Japan and Brazil. *Sapindus* is remarkable for bearing a pulpy fruit, the outer part of which has been used, on account of its detergent properties, as a soap. [SAPINDUS.] Some of the species of this genus also produce eatable fruits. *Paulinia* is another genus which has poisonous properties residing in the leaves and other parts of the plant, whilst the fruits are eatable. The whole of the order partakes more or less of these properties.

d *a* *c* *b*

Euphoria longana.

a, branch with racemose flowers and alternate leaves; *b*, flower, showing the disc, stamens, petals, &c.; *c*, transverse section of ovary; *d*, longitudinal section of flower and fruit, showing divided stigma, erect ovules, disc, petals, and calyx.

SAPINDUS (contracted from *Sapo Indicus*, or Indian Soap), a genus of Plants belonging to the natural order *Sapindaceæ*, which has been so called in consequence of the berries of many of the species being employed for the same purposes as soap. The genus is tropical, containing between 20 and 30 species, which are found in the tropical parts both of the Old and New World. It is characterised by having the calyx 4-5-partite; petals as many as the sepals, a little longer, naked or hairy, or with a scale above the claw; torus or disc occupying the bottom of the calyx; stamens 8 to 10, inserted between the margin of the disc and ovary; ovary 3-, rarely 2-celled; ovule 1, erect at the base of each cell; style with a 3-, rarely 2-lobed stigma; fruit fleshy, 1-2-, rarely 3-lobed, each lobe 1-2-, rarely 3-seeded, with the seeds furnished with an aril.

The species consist of trees having leaves without stipules, with the inflorescence in racemes or terminal panicles. Flowers small, white, or greenish-white. Berries all red and saponaceous, on which account they have been employed for washing woollens and cloths of various kinds in different countries. For instance, in the West Indies and the continent of America, *S. saponaria* yields the so-called soap-berries, and in Java, *S. Rarak;* so in India several species, as *S. acuminatus*, *S. laurifolius*, *S. emarginatus*, and *S. detergens*, yield berries which are called Reetha, and in their dried state may be bought

in every bazaar, as they are everywhere employed as a substitute for soap. The fleshy part of these berries is viscid, and in drying assumes a shining semi-transparent appearance; when rubbed with water they form a lather like soap. The bark and root have similar properties, and have been employed for the same purpose, as well as medicinally, in the countries where they are indigenous. The berries, which are about the size of cherries, inclose black shining nuts, which used formerly to be much imported and employed as buttons for waistcoats, after having been tipped with gold, silver, or other metal. The kernel of these nuts contains an edible oil, which is sometimes employed for burning. The fruits of *S. Senegalensis* and of *S. esculentus* are eaten, and the wood of some species, as of *S. rubiginosus*, is close-grained and hard, and forms valuable timber.

SA'PIUM, a genus of Plants belonging to the natural order *Euphorbiaceæ*. The flowers are monœcious, the calyx bifid and 3-toothed, the style trifid, and the capsule 3-cooccous.

S. aucuparium is a tree 30 feet high, with oblong lanceolate acute serrate leaves, with an intermixture of larger and rounder teeth, coriaceous, shining, and about 6 inches long; the spikes are terminal, lax, thick, green, and about 6 inches long; the male above, the female below; the calyx of both of a dark purple. It is a native of the woods of Carthagena.

S. Indicum has alternate stalked leaves somewhat pendulous, broad, lanceolate, serrate, smooth, and of a deep shining green, from 2 to 4 inches long, and broad in proportion; the stipules small and deciduous; the calyx is 3-parted, the divisions somewhat cordate and expanding; the filaments longer than the calyx, the anthers ovate; the female flowers at the base of the catkins often solitary; the capsule or nut is globular, of the size of a nutmeg, 3-celled, 6-valved, thick, and exceedingly hard; the seed is solitary, affixed by the apex, oval, and smooth. The juice of this species, like the former, is highly poisonous.

(Lindley, *Flora Medica;* Burnett, *Outlines of Botany.*)

SAPODILLA. [SAPOTACEÆ.]

SAPODILLA PLUM. [SAPOTACEÆ; ACHRAS.]

SAPONA'RIA (from the Latin 'sapo,' soap, so called because the bruised leaves are said to produce a lather like soap when agitated in water), a genus of Plants belonging to the natural order *Caryophyllaceæ*. It has a 5-toothed calyx naked at the base, 5 clawed petals, 10 stamens, and 2 styles; the capsules are 1-celled, opening at the top with 4 valves; the seeds are globular or reniform.

S. officinalis, Soap-Wort, has fasciculate corymbose flowers, a cylindrical slightly-downy calyx, retuse crowned petals, elliptic lanceolate-ribbed leaves, and an erect stem. It is a native of many parts of Europe by the road-side, and in Britain in meadows by river-sides and under hedges. The flowers are either single or double, of a rose or pink colour, seldom white. The double variety of this plant is esteemed as an ornament to the flower-border, but is found inconvenient, unless planted in pots, from the spreading nature of the roots, which extend under-ground like those of couch.

S. vaccaria has panicled flowers, pyramidal smooth fine-angled calyxes; membranaceous acute bracteas; ovate lanceolate sessile leaves. It is a native among corn in many parts of Europe, particularly Germany, Switzerland, and the Levant. It derives its specific name from the idea that it increases the lacteal secretion in cows.

All the species of this genus are very ornamental. *S. ocymoides* is one of the most elegant plants we have in our gardens, and is well adapted for rock-work.

(Don, *Dichlamydeous Plants;* Babington, *Manual of British Botany;* Burnett, *Outlines of Botany.*)

SAPONITE, a Mineral consisting of silica, magnesia, alumina, iron, and potash. It is found at Lizard's Point, Cornwall. When first extracted it may be kneaded like dough. It becomes brittle on drying, and is of a white, yellow, blue, or red colour.

SAPOTA'CEÆ, or SAPO'TEÆ, *Sapotads*, a natural order of Plants belonging to the polycarpous group of Monopetalous Exogens. It consists of trees and shrubs, which abound with a milky juice; the branches are round; the leaves alternate, simple, entire, coriaceous, destitute of stipules, their under sides being covered by a silky or downy pubescence. The flowers are axillary, regular, and united; the calyx is 4-8-cleft, imbricate in æstivation; the corolla is hypogynous, regular, and cleft; the lobes are equal in number to the sepals and alternate with them; the stamens are definite and distinct, some are barren and some fertile, the former being alternate with the sepals, the latter opposite; the ovary is superior, with several cells, in each of which is one erect ovule; style simple; stigma undivided; seeds nut-like, sometimes cohering into a several-celled putamen; embryo large, erect, and inclosed in fleshy albumen.

This family of plants is most nearly allied to that of *Ebenaceæ*, with which it agrees in habit, its monopetalous regular hypogynous corolla, the absence of a hypogynous disc, its several-celled ovary, and definite ovules and stamens. It differs however in the possession of milky juice, soft wood, hermaphrodite flowers, undivided stigma, and 1-seeded ovary with erect ovules. The plants of this family are chiefly natives of India, Africa, and America. Some of the species produce fruits which are much prized as articles of diet. Amongst these is the Sapodilla Plum, or Naseberry, which is the produce of *Achras sapota*. The Star-Apple (*Chrysophyllum*), Marmalade (*Achras mammosa*), the Medlar of Surinam, and other eatable fruits, are derived from plants belonging to this order. Most of the species yield large quantities of a milky juice, which, unlike the secretions of most lactescent families of plants, may be used for alimentary purposes. The fruit and seeds abound in oil, which is solid like butter, and has a mild pleasant flavour. [BASSIA.] The bark of some species of *Achras* is astringent and tonic, and has been recommended as a substitute for quinine. [ACHRAS.]

Sapodilla Plant (*Achras sapota*).

a, branch with axillary flowers; *b*, flower, showing the imbricate calyx; *c*, pistil, with style and simple stigma; *d*, fruit (sapodilla plum); *e*, seed; *f*, embryo.

SAPPARE, a corruption of Sapphire. [KYANITE.]

SAPPHIRE. [ADAMANTINE SPAR; CORUNDUM.]

SAPWOOD. [ALBURNUM.]

SAPY'GIDÆ, a family of Hymenopterous Insects of the section *Fossores*, the species of which are chiefly distinguished by the feet in both sexes being slender, and little or not at all spinose; the antennæ are at least as long as the head and thorax together, and generally increase in thickness towards the extremity.

In the genus *Sapyga* the eyes are deeply emarginate; the antennæ are subclavate, slightly curved outwards at the apex in the males, straight in the females, and inserted in a cavity at the base of the clypeus, with an elevated ridge between them; the superior wings have one marginal cell, which passes beyond the third submarginal, and is acuminate; and four submarginal cells, the second the smallest and receiving the first recurrent nervure, the third receiving the second, and the fourth apical.

The species of this genus are usually of moderate size. The females are said to form holes in the mortar of walls, or in putrescent wood, in which they deposit their eggs with food to supply the larvæ. Latreille supposes them to be parasitic upon some of the wild bees; and Mr. Shuckard observes that he has caught the *S. punctata* (a species found in this country) entering the cells of *Osmia bicornis*. The species just mentioned is from 4¼ to 5¼ lines in length, and of a black colour, excepting the abdomen, which is red, and has a transverse white spot on each side of the fourth, fifth, and sixth segments —such is the colouring of the female; the male has the body black, with a white spot on each side of the second, third, fourth, and fifth segments.

A second species of this genus, the *S. clavicornis*, is also found in England. Both sexes are black, and have interrupted yellow bands on the abdomen.

The genus *Thynnus*, according to Latreille, also belongs to the present family, and the species are readily distinguished by the antennæ being filiform and the eyes entire, that is, not emarginate, as in *Sapyga*.

Polochrum.—This genus, like *Thynnus*, has the antennæ filiform, but the eyes are emarginate, as in *Sapyga;* the mandibles are tridentate.

SARCINA, a genus of Plants belonging to the family of *Algæ*. This microscopic *Alga* was first detected by Professor Goodsir of Edinburgh in 1842, in the matter vomited by a patient under his care. It was subsequently observed by Mr. Busk and Mr. Edwin Quekett, and many other observers. It consists of masses of cells which are arranged in a square form. Each of the cells is nucleated, and vary in number from 4 to 64 on each frond.

The species most commonly found is that discovered by Goodsir,

and which he called *S. ventriculi*. This species has been referred by Robin, in his 'Histoire Naturelle des Végétaux Parasites,' to a genus which he calls *Merismopœdia*.

Although this plant is found most frequently in matters vomited from the stomach of human beings, it is not at all confined to this spot. It has been found in the urine several times, although it may be doubted as to whether it could have been originated in this fluid before it was excreted. A case is recorded by Virchow, in which it was found in human lungs which were in a state of carcinomatous disease. It has also been observed in the stomachs of the lower animals.

In the cases where this plant has been detected in vomited matters, they have always been in a state of fermentation, and the fluid in most instances presents an acid reaction. The *Sarcina* becomes paler by the action of acids and alkalies, but they are not destroyed by these re-agents. They become slightly brown on the addition of iodine.

It does not appear that the presence of *Sarcinæ* is the cause of disordered states of the system, but they may rather be regarded as the results of disease. *Sarcinæ* have been detected under circumstances which render it probable that they are not uncommon tenants of the human stomach, and that they may exist in considerable numbers without inconvenience. The treatment of diseases with which they are found associated should therefore be rather directed to the removal of the diseased condition than to the destruction of the *Sarcina*. [ENTOPHYTA.]

(Robin, *Histoire Naturelle des Végétaux Parasites qui croissent sur l'Homme et sur les Animaux Vivants;* Beale, *The Microscope, and its Application to Clinical Medicine.*)

SARCINULA. [MADREPHYLLIÆA.]

SARCOÏDEA, a group of *Polypiaria*, of which the type is the old Linnæan genus *Alcyonium*. [ALCYONIDÆ.]

SARCOLITE. [ANALCIME.]

SARCO'PHILUS (F. Cuvier), a genus of *Marsupiata*, founded on *Dasyurus ursinus*, Auct., *Didelphys ursina*, Harris.

F. Cuvier states that *Sarcophilus* approaches nearer to the *Thylacini* than to the *Dasyuri*, but that it is very different from either. These differences are well pointed out in the last part of his 'Histoire Naturelle des Mammifères,' where a very good figure of the animal is given, and of which the subjoined cuts are copies. [MARSUPIATA.]

Head of *Sarcophilus ursinus*. (F. Cuvier.)

Sarcophilus ursinus. (F. Cuvier.)

SARCORAMPHUS. [CONDOR; VULTURIDÆ.]

SARCOSTE'MMA (from σάρξ, flesh, and στέμμα, a crown, in reference to the leaflets of the inner corolla being fleshy), a genus of Plants belonging to the natural order *Asclepiadaceæ*. It has a rotate corolla, a coronet of double stamens; the outer one cup-shaped or annular crenated, the inner one 5-leaved, higher than the outer one, with fleshy segments; the stigma is nearly blunt; the follicles slender and smooth, and the seeds comose. The species of the genus are natives of Australia and the East Indies, as well as of South America.

S. glaucum, Glaucous-Leaved Sarcostemma, is a lactescent smooth twining herbaceous plant. The leaves are lanceolate, short-stalked, slightly revolute, membranous, being with the midrib prominent on the under side, which is glaucous; the umbels are many-flowered between the petioles, on very long peduncles; the segments of the calyx lanceolate, ciliated, and acuminate; the corolla white, with a large fleshy annular wavy coronet; the segments of the corolla fringed and spreading.

S. Brownii is a twining glabrous plant, with lanceolate acuminated glabrous leaves, and interpetiolar umbels; the pedicels, calyxes, and corolla downy; the segments of the corolla ovate, bluntish, concave, and glabrous inside; the outer corona an entire narrow ring; the leaflets of the inner corona ovate, bluntish, and glabrous a little higher than the gynostegium; the lower leaves are large and ovate-oblong, the upper ones becoming gradually narrower with revolute edges, painted with white on the nerves, and greenish-blue on the veins; the calyx is small; the pollen-masses oblong, a little curved, hairy, hanging by short pedicels rising from blackish glands. These plants thrive best in a mixture of peat, sand, and vegetable mould; cuttings of them root readily in sand, if placed in heat without any hand-gass over them. They should have little or no water when in a dormant state, particularly the tuberous-rooted kind.

(Don, *Dichlamydeous Plants;* Lindley, *Flora Medica.*)

SA'RDONYX. [AGATE.]

SARGASSUM. [FUCACEÆ.]

SARGUS. [SPARIDÆ.]

SARIGUE. [MARSUPIATA.]

SAROTHAMNUS, a genus of Plants belonging to the natural order *Leguminosæ*. It has a 2-lipped calyx, the upper lip with 2, the lower with 3 teeth; the style is long, curved, thickened upwards, and channelled within; the stigma terminal, capitate, and small; the pod is flat.

S. scoparius, the Common Broom. The only British species is a well-known plant, with a stem 2 or 3 feet high, angular, and glabrous. The leaves are ternate or simple; the leaflets obovate. The flowers are axillary, solitary, or in pairs, shortly stalked, large, and of a bright yellow. The pods are dark brown, hairy at the edges, and have numerous seeds. It is found on dry hills and heaths.

(Babington, *Manual of British Botany.*)

SARRACENIA'CEÆ, *Sarraceniads*, the Water-Pitcher order, a natural order of Plants, placed by Lindley in the Albuminous group of Polypetalous Exogens. It consists of herbaceous perennial plants inhabiting bogs, with fibrous roots and radical leaves, with a hollow urn-shaped or pitcher-shaped petiole, at the point of which is articulated the lamina, or blade of the leaf, which covers the petiole like a lid. The flowers are solitary or on scapes, and the petals and sepals are herbaceous; the calyx is composed of 5 persistent sepals, often having a 3-leaved involucre without, imbricate in æstivation; corolla of 5 petals, unguiculate and concave; the stamens are hypogynous and indefinite, filaments short; anthers 2-celled, bursting longitudinally; ovary superior, 5-celled, with a central many-seeded placenta; style single; stigma much dilated, peltate, with 5 angles. Fruit a globose capsule, with 5 lobes, 5 cells, and 5 valves. Seeds very numerous; albumen abundant. The affinities of this order are not very obvious. It is usually placed near *Papaveraceæ*, on account of its dilated stigma, indefinite stamens, and embryo in the midst of a copious albumen. Lindley considers it to be related to *Dionæa* [DIONÆA], wherever that genus may be ultimately placed. In the remarkable structure of the leaves this order agrees with *Nepenthaceæ* and *Cephalotaceæ*.

Sarracenia purpurea.

a, entire plant with leaves and flowers; 1, the dilated stigma; *b*, ovary with columnar style; *c*, transverse section of fruit, showing seeds attached to parietal placentæ; *d*, seed; *e*, section of seed, showing the minute embryo and abundant albumen.

There are but 2 genera belonging to this order, of which there are about 6 species, all of them inhabitants of the bogs and swamps of

North America. Of their properties we know but little; they are chiefly interesting on account of their pitcher-like leaves, which are capable of holding water, and are thus said to furnish drink to wild animals in their native forests during periods of drought. The pitchers frequently contain the dead bodies of flies and other insects, which become putrid and produce an unpleasant smell around the plant, but are said to afford to the plant a source of nutrition.

SARSAPARILLA. [SMILAX.]

SASSAFRAS, a genus of Plants belonging to the natural order *Lauraceæ*. This is one of the genera into which the old genus *Laurus* of Linnæus has been divided by Nees von Esenbeck and other botanists. It is known by its dioecious flowers, 6-parted membranous calyx, with equal segments permanent at the base. The barren flowers have 9 stamens in 3 rows, the 3 inner with double-stalked glands at the base; the anthers linear, 4-celled, with their faces turned inwards. The fertile flowers have sterile stamens, which are fewer than or as many as in the barren flowers. The fruit is succulent, placed on the thick fleshy apex of the peduncle, and seated in the torn unchanged calyx. The leaves are deciduous. Flowers yellow. The species of this genus most known is the *S. officinale*, the Sassafras Laurel, on account of its medicinal virtues. It is an inhabitant of the woods of North America, from Canada to Florida. It is mostly a small tree or bush, but sometimes attains the height of 40 or 50 feet. Its flowers are arranged in naked downy racemes, which open before the leaves appear, and are furnished with subulate deciduous bracts. The leaves are membranous, bright green, smooth above, finely downy beneath, very variable in form, and tapering in a wedge-like manner into the petiole. The fruit is of a bright blue colour, as large as a small cherry, and seated upon red clavate peduncles. In America the Sassafras is divided into two varieties, the red and white. Its great use is for medicinal purposes. It is however employed in America for making bedsteads and other articles of furniture, which are not liable to the attacks of insects, and give out a very agreeable odour.

S. Parthenoxylon is a lofty timber-tree growing in the forests of Sumatra. The bark is rough and brown. Leaves alternate, rather long, petioled, ovate, acute, often acuminate and varying in breadth, about 3 inches long, entire, with somewhat revolute edges, smooth, glaucous beneath; nerves lateral and irregularly alternate. The fruit has a strong balsamic smell, and yields an oil, considered useful in rheumatic affections. An infusion of the root is used in medicine.

SASSOLIN. [BORON.]

SATIN-BIRD. [CORVIDÆ.]

SATURNIA, a genus of Insects belonging to the order *Lepidoptera* and the family *Bombycidæ*. The antennæ are fringed in the male; the head is small; the wings are very broad and entire; the palpi and trunk are wanting.

S. Pavonia minor, the Emperor Moth, is one of the handsomest of the British species of Moths. It is about 3 inches wide. The colour is grayish-brown, faintly tinged with purple; the hinder margin of all the wings has a band of pale brown and purple, the hinder band being much waved. The centre of each wing has a large spot or ocellus, which is placed on a light ground; it consists of a black pupil, with a yellow or gray iris, and partly surrounded by a light blue crescent. The larva is of a green colour, having a black band on each segment adorned with pink tubercles, bearing a whorl of six hairs diverging like a star. It constructs a curious cocoon, the extremity not being close, but terminated by a converging circle of very stiff hairs, which enables the insect to make its escape from within, but completely prevents all ingress.

To the genus *Saturnia* some of the largest of the *Lepidoptera* belong. *S. Atlas*, the Giant Atlas Moth, has wings measuring 7 or 8 inches across. This species also, with *S. Cecropia* and *S. Luna*, have their wings produced into a tail. The cocoons of *S. Cynthia* and *S. Mylitta* are used in India for the production of silk. Latreille states that these are the wild species of silk-worm of China. *S. Cynthia* is the Arrindi Silk-Worm of India. (Roxburgh, 'Linn. Trans.,' vol. vii.) *S. Prometheus*, a North American species, forms its cocoon within the leaf of a sassafras-tree, having previously fastened the stalk of the leaf to the stem by a strong silken web, whereby it is prevented from falling with the other leaves. (Westwood.)

SAUCE-ALONE. [ERYSIMUM.]

SAURIA (*σαῦρος*, or *σαύρα*, a lizard), the term by which the great family of Lizards is generally designated. The animal forms more strictly included under it are those comprised under the genera *Lacerta* (after deducting the Crocodilians and the Salamanders) and *Draco* of Linnæus.

To these, Cuvier observes, the family *Anguis* might even be joined, because their osteology, especially that of the head, resembles the osseous structure of many of the Lizards.

In the large acceptation of the term Saurians, the Pterodactyles, Enaliosaurians, and Crocodiles are included.

The general relations of this order will be found under the article REPTILES. We shall here refer to their general structure and organisation, and to their classification.

If we take the living forms collected under the above-mentioned genera of Linnæus, after eliminating from the genus *Lacerta* the groups above excepted, we shall find that all the animals have a similar structure of the skull, of the shoulder-blade, and of the os hyoides, or that they exhibit but slight variations in the composition and proportion of the parts, whilst they differ considerably from the Crocodiles and Tortoises, and still more from the Salamanders, as Cuvier, with his usual acuteness, has observed.

With regard to the structure of the os hyoides, Cuvier remarks, that it becomes important in proportion as we approach the Fishes; and he observes that in man it is composed of five parts: namely, a body in the form of a flattened transversal arch; two anterior and very long horns, which proceed to attach themselves to the temporal bone below the meatus auditorius, and of which the upper part is there soldered at a very early period, and takes the name of the styloid process of the temporal bone; whilst the lower part, for a long time simply ligamentous, has below, at the point of junction with the body, an osseous grain (cornu minus); and, finally, two posterior bony cornua (cornua majora) supporting the larynx by means of a ligament which attaches to them the thyroid cartilage.

The numerous variations which this bone of the tongue presents in the class *Mammalia*, depend on the form of its body, on the more or less prompt soldering which takes place with the posterior cornua, and on the form and the proportion of the pieces of the anterior cornua. Very often in the Ruminants, the Solipedes, and the Cetaceans, the body takes, in becoming soldered to the posterior cornua, the shape of a crescent; and it often happens also, especially in the two first families, that it produces anteriorly a more or less long apophysis; but the anterior horns are always suspended to the cranium, and nearly without exception to a small apophysis of the os petrosum and to the neighbouring part of the tympanic cavity.

This suspension does not take place in those birds in which the anterior horns run round the back of the cranium [PICIDÆ; TROCHILIDÆ], and are only there attached by muscles and cellular substance.

The body of the tongue-bone is most frequently of a rhomboidal form. To its posterior part is articulated or soldered a slender unequal bone on which the larynx reposes, and which singly represents the two posterior cornua; and to its anterior part another bone, sometimes double, which penetrates into the tongue, and which Cuvier names the lingual bone. The anterior horns consist generally of only two pieces.

With regard to the diversities of this bone in the different families, he remarks that in the Saurians it continues with little change to the *Ophisauri*, the Orvets (*Anguis*), and the *Amphisbænæ*. In the two former the anterior horn is nearly reduced to a membranous state; but the posterior one is well ossified. In the *Amphisbænæ* the second articulation of the anterior horn is reduced to a simple vestige. There is none in the third horn. The os hyoides in the true serpents is reduced to two long cartilaginous filaments, which only sustain forwards, as the sole vestige of the body, a species of membrane, hardly discernible in those which are not very large.

The teeth in the true Saurians are not placed in sockets, nor are those which are to replace the teeth which are lost or shed produced in the cavities of the old teeth; but the gelatinous germs of the teeth adhere to the internal surface of the dental bone without having any bony partitions between them, and sometimes without being guarded on the internal side by a lamina of that bone: in the latter case their bases are only separated from the cavity of the mouth by the gum. The base is not divided into roots; but when the tooth grows the same phenomenon is manifested as is seen in fishes. The gelatinous nucleus becomes ossified; it unites itself intimately on one side to the bone of the jaw, whilst it contracts on the other an intimate adherence with the tooth which it has exuded; the tooth then appears like a prominence, an apophysis of the jaw, only it is covered with enamel, whilst its base is naked and purely osseous, and around this base are to be seen striæ and little pores by which the vessels have penetrated or still penetrate into its internal cavity, and which also mark the spot where the rupture will take place when this tooth must yield up its place. The new teeth spring not in the cavity of the old ones, as in the crocodile, but near the internal surface of their base, or in certain species in the thickness of the bone above or below the base according to the jaw.

Professor Owen, in his valuable chapter on the 'Teeth of Saurians' ('Odontography,' pt. ii., p. 234, et seq.), commences his inquiry with the Ophisaurians, observing that there are several genera of reptiles, which, like the true snakes, are externally devoid of locomotive extremities, or have them indicated only by minute rudiments, but are covered by small uniform scales, and resemble the Saurians much more than the Ophidians in their anatomical structure, especially in the fixed condition of the jaws, which cannot be divaricated laterally, or rotated backwards and forwards upon a moveable tympanic pedicle. These Snake-Lizards, he observes, have always intermaxillary as well as maxillary teeth.

In the Amphisbænians, Professor Owen remarks that there are both pleurodont and acrodont species, as in the true Saurians; but the pleurodonts are the most numerous, and have their teeth applied against the internal surface of an external alveolar wall. In *Trogonophis* however the teeth are blended by their whole base with the alveolar ridge, are so closely approximated that they cohere, and are unequal, conical, subcompressed, and obtuse. The intermaxillary

teeth are in unequal number, the middle azygos tooth being longer than the rest.

In *Chirotes* Professor Owen found the teeth slightly curved, simple, and nearly equal, with the exception of the azygos intermaxillary tooth, which is longer than the rest. They are small at first, but increase as they are placed backwards. [CHIROTES.]

The typical Blind-Worms, or Anguians, have, according to the Professor, only maxillary teeth; the palatine teeth being absent. In *Anguis fragilis* [BLIND-WORM] the first five of the upper teeth on each side are small, with cutting edges, and are placed on the intermaxillaries; the next eight are much larger, pointed, and recurved, and are separated by intervals. In general form therefore, Mr. Owen observes, the teeth of the true *Anguis* adhere to the Ophidian type; but in the *Ophiomerus*, or Miliary Blind-Worm, and in the Acontias, they are conical, obtuse, and straight. In the sub-genera *Lerista*, *Ablepharus*, *Hysteropus*, *Dibamus*, *Typhlinus*, and the rest of the family of Blind-Worms, the teeth are likewise simple and conical.

The Scincoidians, or Smooth-Scaled Lizards, have small mouths and slender sharp teeth, fitted apparently, observes Professor Owen, for insect food. [SCINCIDÆ.]

The teeth in *Tropidophorus* are described as straight, cylindrical, simple, slightly compressed at the summit, and confined to the jaws. In the true Skinks (*Scincus*, Dum. et Bibr.), of which the *Scincus officinalis* is the type, the palate also is furnished, four or five small obtuse teeth being situated on each pterygoid bone. The maxillary teeth of *Scincus* are conical, obtuse, and sometimes slightly incurved.

In the Chameleons, the same author states that the teeth are conical, compressed, trenchant, with the summit simple, or terminating in three points, arranged in the same longitudinal line; and that, in most species, the teeth gradually increase in size, and become wider apart as they are situated farther back upon the jaws. Professor Owen further observes that the teeth are so completely confluent with the alveolar plate, as to appear, externally, when in place, to be mere processes of that border of the jaw; but, he remarks, their true nature is evident when viewed from the inner side of the jaw. The number of teeth vary in the species. [CHAMELEONS.]

In the Agamanians, or Agamoid Lizards, forming the genus *Uromastyx*, the dentition, which at first sight seems to consist of a merely notched or dentated margin of the jaw, resembles that of the Chameleons. These notches, or processes, are however true teeth, originally developed as independent parts, and afterwards becoming confluent, by their base and a great part of the outer side, with the alveolar parapet of bone.

The canines of the Dragons [DRACONINA] are proportionally longer than those of *Stellio*, but otherwise the dentition is the same.

There is a resemblance between the mutable *Agamæ* (*Trapelus*) and the *Stelliones*, inasmuch as the former have two conical teeth longer than the rest, beginning the series in the lower jaw and superior maxillary bones; but the *Agamæ* have four small conical intermaxillary teeth, without corresponding teeth below. Seventeen triangular teeth were found to succeed the canines in the lower jaw, and fifteen in the upper jaw, in *Trapelus ater*. *Agama orbicularis* resembles the *Trapeli* in its dentition, with the exception that the molar teeth behind the canines are more conical.

In the Geckotians [GECKOTIDÆ] the teeth are more pointed, more slender, more equable, and more numerous than in the preceding group. The Professor remarks that the summit of the tooth is always simple, and that the base is obliquely soldered to the internal surface of an outer alveolar parapet. The number of the teeth varies very much in the different sub-genera; but none of the *Geckotidæ* have teeth on the roof of the mouth.

The Iguanians [IGUANIDÆ] are characterised, like the preceding groups, by a short contractile tongue, slightly notched at its extremity, but, as he remarks, they are distinguished for the most part by having teeth on the pterygoid bone, and also by the complicated form of the crown of the maxillary teeth in the typical genera, the species of which subsist chiefly on vegetable substances. In most of the family the teeth are set in a common shallow oblique alveolar groove, and are soldered to excavations on the inner surface of the outer wall of the groove.

The following genera are enumerated by MM. Duméril and Bibron as showing the pleurodont type of dentition, and as being also furnished with pterygoid teeth, namely:—*Polychrus*, *Urostrophus*, *Anolis*, *Corythophanes*, *Basiliscus*, *Aploponotus*, *Amblyrhynchus*, *Iguana*, *Metopoceros*, *Cyclurus*, *Brachylophus*, *Leiosaurus*, *Hypsibates*, *Proctotretes*, *Ecphymotes*, *Stenocercus*, and *Oplurus*. But the following pleurodonts, *Hyperanodon*, *Tropidolepis*, *Rhynosoma*, and *Callisaurus*, have no pterygoid teeth.

In the genera *Istiurus*, *Calotes*, *Lophyrus*, *Otocryptis*, and *Chlamydosaurus* among the Acrodonts, the maxillary teeth may, Professor Owen observes, be divided into anterior, laniary, and posterior teeth; and he states that no Iguanian lizard has teeth on the palatine bones.

"The most strictly vegetable-feeding reptiles," says the Professor, "are the true *Iguanæ* and the *Amblyrhynchi*; yet the size of the teeth, their mode of implantation, and the limited motions of the jaws permit only an imperfect comminution of the food by these instruments; and their summits are rather chipped off than ground down by use. The appearance of abrasion is greatest in the posterior teeth; especially in the *Iguana cornuta*, in which the crowns of the teeth are thicker than in the *Iguana tuberculata*, and make a nearer approach to the very remarkable form of tooth that characterises the gigantic *Iguanodon*." [IGUANODON.]

Professor Owen describes the fang of the tooth of Hylæosaurus as sub-cylindrical, sub-elongate, and smooth; the crown as expanded, compressed, slightly incurved, and with the narrow sides straight and converging at a slightly acute angle to the apex. In all the teeth which the Professor had seen, these sloping sides showed the effects of attrition, the enamel being worn away and the dentine exposed. The tooth is described as consisting of a body of dentine covered by a thick coating of clear structureless enamel, and surrounding a small central column of true bone, consisting of the ossified remains of the pulp, which presents the usual characters of the texture of the bone in the higher reptiles. The dentine differs, like that of existing Lacertians, from the dentine of the *Iguanodon* in the entire absence of the numerous medullary canals which form so striking a characteristic of the latter reptile. The main calcigerous tubes are described as characterised by the slight degree of their primary inflections, and as continued in an unusually direct course from the pulp-cavity to the outer surface of the dentine at nearly right angles with that surface, but slightly inclined towards the expanded summit of the tooth. They are stated to be chiefly remarkable for the large relative size of their secondary branches, which diverge from the trunks in irregular and broken curves, the concavity being always turned to the pulp-cavity. In most parts of the tooth the Professor found the numbers of these branches obscuring even the thinnest sections. The ossified pulp exhibited the parallel concentric layers of the ossified matter surrounding slender medullary canals, interspersed with irregular, elliptical, radiated cells. [HYLÆOSAURUS.]

Professor Owen observes that one gigantic extinct species of Saurian Reptile [MOSASAURUS] has been found to agree with many of the existing species in the Lacertian, Iguanian, Anolian, and Scincoid families, in having the pterygoid bones armed with teeth; but, he remarks, the maxillary teeth combine the pleurodont with the acrodont characters; and the skeleton indicates a special adaptation for swimming and marine life.

The teeth of *Geosaurus*, which appears not to be happily named, inasmuch as the large eyes defended by broad sclerotic plates indicate, as Professor Owen observes, that the sea was its dwelling-place, resemble those of the large Varanians in their compressed subrecurved crown, with a trenchant anterior and posterior edge, which likewise presents a fine and close dentition. A very fine fragment, we believe, the best known, is in the British Museum. Sömmering's conjecture that *Geosaurus* might be a young Mosasaur is no longer held good, and Cuvier's observations on the difference of their teeth are acknowledged to be just. Professor Owen remarks that the form of the vertebræ of *Geosaurus* indicates its near affinity to the crocodilian group, and that the Argenton fossil crocodile presents the same subcompressed teeth with dentated margins as *Geosaurus*.

The Varanians form a family of scaled Saurians, including the Monitors of the Old World: some of the species come nearest in size to the crocodiles. This family, Professor Owen remarks, manifests its affinity to that group in the absence of pterygoid teeth, and in the number of successive tooth-germs which may be observed at the same time behind the fixed and functional teeth. Independently of these characters, the Varanians must excite our interest from exhibiting in some species a form of tooth which most nearly resembles that which characterises *Megalosaurus* and other very remarkable extinct terrestrial species of gigantic squamate Saurians.

In a small extinct species of Lizard from the gault and chalk formations, and for which Professor Owen proposes the name of *Raphiosaurus*, the teeth are awl-shaped, about three lines in length above the alveolar border, close-set, and equal-sized. Their rounded base was anchylosed to the alveolar groove, and their outer side attached to a well-developed external alveolar wall.

For the varieties in the form of the teeth presented by the existing Varanians we must refer to the work itself, observing only that Professor Owen points out the *Heloderm*, *Varanus Niloticus*, *V. arenarius*, *V. Timoriensis*, *V. Bengalensis*, *V. bivittatus*, *V. variegatus*, and *V. crocodilinus* as the principal species which exhibit such varieties.

Professor Owen commences the family of the Thecodonts, extinct Saurians which exhibit a mode of fixation of the teeth different from the Acrodonts and Pleurodonts, with the genus *Thecodontosaurus*, observing that these Thecodonts, which in other parts of their organisation adhere to the squamate or Lacertine division of the order, have their teeth implanted in sockets, either loosely, or confluent with the bony walls of the cavity; and to this group the most ancient Saurians belong.

The *Thecodontosaurus* discovered by Dr. Riley and Mr. Stutchbury in the Dolomitic Conglomerate at Redland near Bristol, is, as well as their *Palæosaurus*, also there found by them, allied in the form of the teeth to the typical Varanian Monitors, but they differ in having the teeth imbedded in distinct sockets: to this condition however the *Varani* make an approach in the shallow cavities containing the base of the teeth along the bottom of the alveolar groove.

One of the two teeth of *Palæosaurus* found by Dr. Riley and Mr. Stutchbury is compressed and pointed, with opposite trenchant and

serrated margins; but its breadth is much greater than its length; this they ascribe to a species which they name *P. platyodon;* the other they refer to a species designated by them *P. cylindrodon.*

The genus *Cladeiodon* (Owen) derives great interest from having been found in the same quarries of New Red-Sandstone (Keuper?) at Warwick and Leamington as contained the remains of *Labyrinthodon.* "In their compressed form," says Professor Owen, "anterior and posterior serrated edges, sharp points, and microscopic structure, these teeth agree with those of the Saurian reptiles of the Bristol conglomerate. In their breadth, as compared with their length and thickness, they are intermediate between the *Thecodontosaurus* and the *Palæosaurus platyodon;* they are also larger and more recurved, and thus more nearly approach the form characteristic of the teeth of the *Megalosaurus.* From these teeth however they differ in their greater degree of compression, and in a slight contraction of the base of the crown. I propose therefore to indicate the genus, of which, as yet, only the teeth are known, by the name of *Cladeiodon,* and for the species from the Warwickshire sandstone the name of *C. Lloydii,* in testimony of the friendly aid of Dr. Lloyd of Leamington, to whose exertions I owe the materials for the description of the teeth of the present genus, and the still more remarkable ones of the British species of *Labyrinthodon,* with which the teeth of the *Cladeiodon* are associated."

Professor Owen retains the name of *Protorosaurus* for the small species of Saurian found in the pyritic schists of Thuringia, which, he observes, like the dolomitic breccia near Bristol, rank as the oldest member of the new red-sandstone. He adds in a note, that besides the Thecodont type of dentition the *Protorosaurus* differs from all recent Saurians, and resembles the Pterodactyle in the great relative size of the cervical vertebræ and the ossified tendons of the muscles of that region of the spine; it differs from all reptiles, except the extinct *Rachæosaurus,* in the bifurcate superior spines of the caudal vertebræ.

In the extinct Saurian from the Oolitic Formation at Neuffen in Würtemberg (*Thaumatosaurus oolithicus,* Meyer), Professor Owen found the teeth conical, slightly curved, straighter on the inner side of the crown, and implanted by a long and strong root, rather obliquely, in a deep socket. The base and basal portion of the crown presented a nearly circular transverse section, and the wide pulp-cavity in this part of the tooth exhibited an elliptical transverse contour; the tooth becomes slightly compressed towards the apex. Its implanted base is stated to be the broadest part of the tooth; the breadth of the crown to its height is as one to three; the crown is described as invested with a thin layer of enamel, the basal half of which is marked by longitudinal striæ; these striæ seemed to consist of folds of the enamel, which do not extend into the dentine. The successional teeth are noticed as penetrating into the interior of the fixed teeth in the progress of their development.

The teeth of *Ischyrodon,* a gigantic reptile from the Jura Limestone of the Canton of Aargau, are described as somewhat resembling those of the *Thaumatosaurus,* but the external longitudinal striæ of the crown of the tooth as being sharper and more elevated, and the enamel between the striæ as roughened by irregular linear risings; whilst the teeth of the *Pœciloplcuron,* an extinct reptile, also of gigantic dimensions, from the Oolitic Beds at Caen, has, according to the single tooth referred to that species, a more compressed crown than the teeth of *Thaumatosaurus;* the striæ are also described as wider apart, and the two diametral ones as developed into ridges which extend to the apex of the tooth.

In noticing the teeth of the Enaliosaurians, Professor Owen observes that those of the *Ichthyosauri* [ICHTHYOSAURUS] have a simple, more or less acutely conical form, with a long and usually expanded or ventricose base or implanted fang, and that they are confined to the intermaxillary, maxillary, and premandibular bones, in which they are arranged in a pretty close and uninterrupted series, and are nearly of equal size. They consist, he informs us, of a body of unvascular dentine, invested at the base by a thick layer of cement, and at the crown by a layer of enamel, which is itself covered by a very thin coat of cement; the pulp-cavity is more or less occupied, in fully-formed teeth, by a coarse bone. He observes that the external surface of the tooth is marked by longitudinal impressions and ridges, but the teeth vary both as to outward sculpture and general form in the different species.

"The chief peculiarity," he says, "of the dental system of the *Ichthyosauri* is the mode of implantation of the teeth. Instead of being anchylosed to the bottom and side of a continuous shallow groove, as in most Lacertians, or implanted in distinct sockets, as in the Thecodon, Megalosaur, or Pterodactyle, they are lodged loosely in a long and deep continuous furrow, and retained by slight ridges, extending between the teeth, along the sides and bottom of the furrow, and by the gum and the organised membranes continued into the groove and upon the base of the teeth. The germs of the new teeth are developed at the inner side of the base of the old ones."

The chief distinction offered by the dental system between the *Ichthyosauri* and *Plesiosauri* is pointed out by Professor Owen as existing in the loose implantation of the teeth of the latter in separate alveoli. In this deviation from those of the Ichthyosaur, the Plesiosaur, observes the Professor, approximates to the crocodilian type, and this affinity, he adds, is likewise manifested in the unequal size of the teeth, and the development of some of the anterior ones into large tusks. They are described as being composed, like those of the Ichthyosaur, of a body of hard and simple dentine, covered at the crown by a coat of enamel, and at the base by a coat of cement; but the latter is relatively thinner than in *Ichthyosaurus,* and is not inflected into the substance of the dentine.

Professor Owen proposes the subgeneric name of *Pleiosaurus* for a gigantic extinct reptile whose remains have been found in the Kimmeridge Clay. The teeth are described as differing from those of *Plesiosaurus* in their greater relative thickness as compared with their length, and in the subtrihedral shape of their crown. The outer side is slightly convex, sometimes nearly flat; it is separated from the two other facets by two sharp ridges; these are more convex, and the angle dividing them is often so rounded off, that they form a demi-cone, and the shape of the tooth thus approximates very closely to that of *Mosasaurus,* with which it is equal in size, but from which it is readily distinguished even when the crown only is preserved, by the ridges which traverse the inner or convex sides; the outer flattened surface alone being smooth. The long fang of the perfect tooth at once removes it from the Acrodonts, and allies it with the Thecodonts, among which it approaches nearest, in the superficial markings of the crown, to *Plesiosaurus.* The vertebræ of the neck are so modified that the peculiarly elongated proportion of this part of the spine, which characterises the typical *Plesiosauri,* is exchanged for one that much more nearly approaches the opposite condition of the cervical region in the *Ichthyosauri;* thus presenting an abrogation of the main characteristic of the *Plesiosauri* combined with the more crocodilian proportions of the teeth of this *Pleiosaurus,* of which a fine specimen (*Plesiosaurus brachydeirus,* Owen) from Market-Raisin is preserved in Dr. Buckland's collection at Oxford, consisting of considerable portions of the upper and lower jaws.

We now have to examine the other parts of the skeleton of the Saurians. That of the Enaliosaurians is noticed in the articles ICHTHYOSAURUS and PLESIOSAURUS; that of the Crocodilians, under the article CROCODILIDÆ. Among these animals there is a wonderful adaptation of the structure to their modes of progression and habits of life. In the extinct Pterodactyle, we have, more especially in the anterior extremities, a modification in the development of the bones, to enable the animal to move through the air with a true flight. [PTERODACTYLE.] In the great mass of the terrestrial Saurians, the bones of the extremities are elongated, to facilitate progression on the earth, on trees, or even, as in the case of the Geckos, on smooth walls and ceilings. When we come to the aquatic groups, we have in the Crocodilians a more compact form of the bones of the hand and foot, but still adapted to occasional progression on land, till at last, in the Enaliosaurians, the short, compact, and compressed bones of the extremities become mere paddles to row the body through the water, like those of the tortoises among the reptiles, and of the seals and whales (in the latter as far as the anterior extremities are concerned) among the mammiferous animals

Cuvier remarks that the study of the vertebræ of the living Saurians is highly necessary, in order to a recognition of the numerous fossil bones belonging to this family, and he thus proceeds to describe those of the former: — The atlas of the Monitor is a ring composed of three pieces—two upper ones, united to each other at the dorsal part, notched in front and behind for the nerves, and one lower piece. The anterior surface of the axis (dentata), or rather of that portion of it which is analogous to the odontoid, penetrates in the ring of the atlas and fills nearly half its width, leaving always in front a concavity for the condyle of the head. Below, on the junction of the atlas, of the odontoid, and of the body of the axis, is a triangular piece which gives off a pointed hook directed backwards. The axis is compressed; its annular part takes, above, the form of a longitudinal pointed crest; its anterior articular facets have their plane turned outwards; the posterior ones have them downwards; the body terminates in a transverse convexity of a kidney shape; on each of its lateral surfaces is a small and but slightly projecting crest, which has, towards its anterior third, a small point; below, there is a crest, under the posterior part, which is enlarged backwards. The sutures which distinguish the annular part of the body are soon effaced; but for a long period a small epiphysis may be seen at the posterior point of each of the two crests. The five succeeding vertebræ resemble the axis, excepting that they are without an odontoid; but their anterior surface has a concavity proportione to the convexity of the preceding vertebræ, their dorsal or spinous crest or process is elevated and shorter, and their transverse processes enlarge slightly, and present a convex facet for the support of the cervical rib. The lower crest exists; and this is what distinguishes the cervical from the dorsal vertebræ, the body of which last is even below, with the exception of the three first, which have each a tubercle becoming gradually less and less. At the point of these crests is an epiphysis, which in the other sub-genera forms the crest by itself. The dorsal vertebræ after the twelfth have always a squared spinous process, an anterior concave and a posterior surface, both of a kidney-shape, horizontal articular apophyses, the posterior looking downwards, the anterior upwards; and on each side under the anterior apophysis, by way of a transverse apophysis, a vertical oval-shaped tubercle for supporting the rib. The number of

these vertebræ is 22, there being no lumbar vertebræ; for there are ribs from the neck to the pelvis amounting to 27 pairs, including the 5 cervical, but the first and the last of these ribs are very small. The first pair of ribs is attached to the third cervical vertebra. The first five pairs are not united by means of cartilages to the sternum, and on this circumstance Cuvier relies to distinguish the cervical vertebræ, which, adding the atlas and dentata (these last having no ribs), makes their number 7, as in the Crocodiles and Mammals generally. The first three dorsal ribs only are attached to the sternum; the 17 succeeding ones are false ribs. Cuvier remarks that the total absence of lumbar vertebræ appears to him a general rule in the family of Saurians.

There are two sacral vertebræ in the Monitor. The first has, in lieu of a small tubercle, a large apophysis, convex externally, and presenting to the ossa ilii an articular surface notched behind, and of a horse-shoe shape. The second has also a large apophysis, but simply widened and flattened horizontally. The caudal vertebræ after the eighth are very numerous (70, 80, and more); they may be easily recognised by their spinous and transverse apophyses or processes, which are long and narrow, and their articular apophyses or processes, which are nearly vertical, the anterior looking inwards, the posterior outwards; and also by having on their lower surface, towards the hinder part, two small tubercles for supporting the chevron bone, which occupies the place of a lower spinous process. These two small tubercles are placed more forward in the Monitors than in the other sub-genera; for in the latter they touch the posterior articulation, so that the chevron bone appears to be attached to the vertebræ. All the caudal vertebræ of the Monitor have, like the preceding, the anterior surface concave and the posterior convex, and they go on diminishing in proportion as they approach the extremity of the tail, their prominences finishing by being reduced almost to nothing.

The cervical vertebræ, determined by the anterior false ribs, are eight in number, that is to say, there are six pairs of these false ribs, and this number is found in many other sub-genera, particularly in the *Iguanæ*, the Basilisks, the Lizards, the Geckos, the Anolides, the *Agamæ*, and the Stelliones. The last two, and sometimes the last three ribs, though they do not reach to the sternum, yet are placed under the shoulder, and concur in the formation of the thorax, so that the vertebræ which support them may be placed among the dorsal, which would reduce to five the number of vertebræ really belonging to the neck. In the ordinary Lizards, the Skinks, and slightly in the Anolides and the Geckos, the cervical ribs attached to the fourth, fifth, and sixth vertebræ are singularly compressed and widened at their free extremity. The differences which characterise the vertebræ of the different sub-genera, independently of what Cuvier had already remarked as to the position of the tubercles of the caudal vertebræ for the chevron bones, especially consist, he informs us, in the respective length and stoutness of their bodies, and the respective length and width of their apophyses. The *Iguana* has the spinous processes of its dorsal vertebræ less lofty, and, cut, as it were, more obliquely. The bodies of its caudal vertebræ are more elongated, so that with a less number they form a greater length. Their spinous processes decrease more rapidly. The Basilisks have very nearly the characters of the *Iguanæ*, but their dorsal spinous processes are high and narrow, as well as those of a part of their tail. The *Agamæ* have also the dorsal spinous processes high, straight, and narrow; but the Stellios have them low. In the Lizards they are tolerably high, but directed somewhat obliquely backwards.

The ribs of the Saurians are slender, round, and the anterior ones only have the costal head slightly enlarged and compressed. Cuvier had never seen any of them with a division at their upper extremity into a head and tubercle. The anterior ribs of the Monitors are a little more widened in the upper parts than those of other Saurians. Instead of those simply ventral ribs which are seen in the Crocodile, many sub-genera, especially in the *Polychri*, Anolises, and Chameleons, after the ribs which are united to the sternum, have others which unite mutually with their corresponding rib, and thus surround the abdomen with entire circles.

The sternum of the Saurians, taken together with their shoulder, forms, says Cuvier, a kind of cuirass for the heart and large blood-vessels. It is more complicated than in the Crocodiles, and formed upon a plan very different from that of the Tortoises. It consists essentially of a long narrow depressed bone, which gives off anteriorly two branches directed to each side, more or less recurrent, according to the species, and between which its point passes sometimes to advance more forward under the neck. This bone penetrates with its posterior part into a cartilaginous plate of a rhomboidal shape, which has two sides forward and two backward, and which often shows traces of a longitudinal division into two portions. Its interior sides are continued with the edges of the anterior part of the bone, but in divaricating to the right and left. They are sometimes ossified, particularly their edge, which has a groove, in order to give support, like a mortise, to the sternal edge of the clavicular bone. The posterior sides of the rhomboidal cartilage serve for the insertion of the false ribs. So far there is no great difference in this part of the organisation from that of the Crocodile, except in the anterior branches of the elongated bone, which give it the form of a T, of an arrow, or of a cross, according to the species; but a more considerable difference is apparent in the development of the coracoid bone, and in the constant presence of a clavicle more or less large. The coracoid bone, as in the Crocodiles, the Tortoises, and all the animals which have a true arm, concurs in the formation of the glenoid cavity, and in the true Saurians affords nearly half of it. Widening more than the bony plate of the shoulder-blade, it proceeds to articulate itself to the sternal rhomboid by a wide edge, which takes the form of the blade of an axe; but its peculiarity consists in the giving off one or two apophyses, by means of which it supports a great cartilaginous arch which passes on the slender and advanced bone of the sternum, and lies across that of the coracoid bone of the other side.

The scapula, or shoulder-blade, produces the other part of the glenoid facet; it goes on, as ordinarily, enlarging on the side of the thorax and towards the back; and at about a third or the middle of its length stops short, but is continued in a single portion, which is generally cartilaginous, or which, when it is ossified, which frequently happens, becomes so in a different manner, and with another texture, like the cartilage adhering to the coracoid bone. In the case of ossification, the scapula is always divided into two bones.

The clavicle rests on one side against the slender bone of the sternum, or against its lateral branch, and often also it reaches to the opposite clavicle; on the other side it proceeds to rest against the anterior edge of the scapula, either against the osseous portion or that which remains longer cartilaginous, and which often presents a tubercle or small crest for its reception. Sometimes the bony scapula gives off an apophysis which goes to sustain the body of the clavicle, but this is all that it presents as a slight resemblance to an acromion: the tubercle of the cartilaginous part resembles that process much more.

The pelvis of the Saurians (Cuvier takes the Monitor as the example) is composed of three bones, which concur, as in the viviparous quadrupeds, to compose the cotyloid fossa. Its upper part is formed by the ossa ilii; its neck is wide and short; its spinal part, instead of being directed forwards, as in the viviparous quadrupeds, or of being rounded as in the Crocodile, runs obliquely backwards in the form of a narrow band, and has only a small point in front. The pubis and the ischium are each united to its opposite in the median inferior line; but the pubis is not joined to the ischium, and the two oval holes are only separated by a ligament. Their neck is wide, short, and flat. That of the pubis is pierced with a rather large hole, and its anterior border produces a point which is recurved downwards and outwards. Cuvier adds that the pelvis in the different sub-genera is especially distinguished by the symphysis of the pubis, which is formed by a rather wide truncature in the Monitors, and even slightly in the Sauvegardes; but only by a narrow point in the majority of others. The Chameleon differs from all the others in its narrow ossa ilii, which proceed perpendicularly in widening slightly to attach themselves to the spine. These ossa ilii are still further distinguished by a triangular cartilage, analogous to that of the shoulder-blade. The symphysis of its pubis is formed by a truncature, and there is no lateral point.

The cylindrical bones of the Saurians exhibit the following characters:—The humerus agrees very much in form with that of Birds. Its upper head is compressed, to answer to the hollow fosset which the shoulder-blade and coracoid bone together present to it. Its lower pulley is formed of two projecting rotatory portions, entirely rounded, the external of which is the least developed. The internal condyle also projects more than the external, the deltoid crest produces an angle more projecting forwards, and its posterior tuberosity is less hooked. In these two last respects it more resembles that of the Crocodile; but it has in general all its articular surfaces much better defined. But the humerus of a lizard may always be distinguished from that of a bird, because the former is not hollow, nor pierced with holes for the admission of air into its interior. The ulna of the Saurians is compressed and trenchant on its radial edge. Its sigmoid facet is oval, and its olecranon projects but little; its carpian head is also oval and uniformly convex. The radius is delicate; its upper head is oval and concave; its lower, which is slightly convex, presents to the first bone of the carpus a rounded tubercle and a fosset of a crescent-shape. The femur in its upper part resembles that of the Crocodile much more than that of birds, and this has reference to the direction of the foot in reptiles. Its upper head is compressed and curved in front, and has its trochanter on the tibial side placed nearer to the head of the bone than in the Crocodile, much more projecting, and of a compressed form. The lower head of the femur, on the contrary, much resembles that of birds, especially in the small hollow on the peroneal side for the head of the fibula. The patella is very small, often hardly visible. The leg is always composed of two bones, of which the tibia is the largest. Its upper head is triangular, as ordinarily; its lower is transversely oblong and flat. The fibula of the Monitors is flattened and widened below, where it unites to the tarsus by a narrow line. In the Iguanas and the greater part of the other genera it is nearly of a size throughout, slender, with its upper head compressed, and its lower demi-oval and slightly oblique.

The bones of the fore and hind feet in the Saurians consist of a carpus composed of nine bones, like that of the Tortoises, and Cuvier remarks that its composition may equally be compared to the *Simiadæ*. In the first row are a radial bone, a cubital bone (rather large), and a

pisiform bone fitted against the lower part of the ulna. In the lower row are five small bones, disposed in a curve and answering to the five metatarsal bones, and a ninth, placed between the two large bones of the first row, and the first, second, third, and fourth of the second row. The metacarpals of the thumb and little finger are rather shorter than those of the other three fingers. The number of phalanges amounts to two for the thumb, three for the fore finger, four for the middle finger, five for the ring finger, and three for the little finger. The tarsus, like that of the crocodile, has only four bones. In the first row are two: 1, a tibial bone, which extends also partially under the fibula, and presents a facet to it; it is irregularly rectangular, wider than it is long, thick on its internal border, and presenting in its profile some relationship to the astragalus of a Ruminant; 2, a fibular bone, smaller and soon uniting itself into a single piece with the preceding, on the same plane with which it is. In the second row are also two; one larger, triangular on its anterior surface, and stouter backwards, where it articulates with the two of the first row, and supports the metatarsals of the fourth and fifth toes; the second, smaller, placed between the preceding and the metatarsals of the third and second toes. This last also slightly touches upon the astragalus, which only supports the metatarsal of the great toe. The first four metatarsals are slender and nearly straight; they go on elongating to the fourth; the fifth is short, widened, and recurved on its upper head towards the great bone of the second row, to which it is articulated by the side. The great toe has two phalanges; the second toe, three; the third, four; the fourth, five. It is this, which is the longest, that gives to the foot that elongated and unequal form which characterises it in the lizards. The fifth, which is nearly as short as the great toe, has, like the third, four phalanges. Cuvier remarks that in the ordinary position of the hind feet of the Saurians, that is, with the toes directed backwards, the tibia and great toe are at the external border of the foot, and the little toe is at the internal border. The ungueal phalanges of all the feet are trenchant, arched, and pointed. This description, observes Cuvier, allowing for some differences in proportion, answers for all the sub-genera which have well-developed feet, with the exception of the Chameleons alone and some peculiarities relative to the toes in certain Geckos; and even in the Chameleon it is in the proportion of the bones of the carpus and tarsus, rather than in their number and arrangement, that the difference appears. The mode in which the bones of the feet are grouped in the chameleon is in an inverse manner, that is, the great and little toes of all the feet together and directed inwards, and the three others also together and directed outwards. [CHAMELEONS.]

The other parts of the organisation of the Saurians will be found in detail, where necessary, under REPTILES and the different articles relating to families and genera. We shall here only observe that their heart, like that of the Tortoises, is composed of two auricles and one ventricle, which is sometimes divided by imperfect partitions. Their ribs are moveable, and can be raised or depressed for the purposes of respiration. Their lung extends more or less towards the hind part of the body, and often penetrates into the abdomen, whose transverse muscles glide under the ribs and even towards the neck to embrace it. Their generation, with few exceptions (*Zootoca*, for instance), is oviparous, and the eggs have a more or less hard shell. In some (Chameleon, for instance) it is a mere tough calcareous skin, and this is its general condition. The coitus is complete, and effected sometimes by means of two intromittent organs and sometimes by means of one only. The young come into existence in the same form which they retain through life. The toes are armed with nails, with very few exceptions, and the skin is either covered with scales more or less serrated, or at least with small scaly grains. All have a tail more or less long, nearly always thick at the base. The greatest number have four feet, some two only, and a few mere rudiments not apparent externally.

The following is a synopsis of the families of the *Sauria*, adopted by Dr. J. E. Gray in his 'Catalogue of the Specimens of Lizards in the British Museum.' The genera and species of the *Lacertinidæ* are given, the other large families are described under their proper names:—

Order I. LIZARDS. *Saura.*

Mouth not dilatable, jaws toothed, the lower jaw-bones being united by a bony suture in front. Eye generally with distinct eyelids; drum of the ear generally distinct. Limbs four, distinct, rarely in such a rudimentary state as to be hidden under the skin. Toes clawed. Body elongate, rounded, covered with imbricated or granular scales; ribs distinct, mobile, and with a distinct sternum. Tail elongate, tapering, rarely prehensile, generally covered with whorls of scales. Egg with hard skin. The young not undergoing any metamorphosis.

Sub-Order I. *Leptoglossæ.*

Tongue flat, elongate, and bifid.

Tribe I. *Cyclosaura.*

Scales of the belly square, in cross bands, of the back and tail rhombic and imbricate, or circular and subgranular. Tongue elongate, flattened, free, nicked, or with two elongate cylindrical horny tipa. Eyes diurnal, with two valvular lids. Feet for walking; toes unequal, compressed.

a. Head with small many-sided shields. Tongue sheathed at the base.

1 *Monitoridæ.*—Head-shields flattish, scales small. Inhabit the Old World and Australia. [MONITORIDÆ.]

2. *Helodermidæ.*—Head-shields and scales of body convex, tubercular. Teeth with a groove behind. Inhabit the New World.

b. Head with large regular shields. Tongue mostly free at the base.

* Sides flattish, covered with small often granular scales.

3. *Teidæ.*—Supra-orbital plate horny. Teeth solid, rooted. Scales small, granular, often with large plates. Inhabit the New World. [TEIDÆ.]

4. *Lacertinidæ.*—Head pyramidal, covered with regular many-sided shields; supra-orbital plate rigid. Throat scaly, often with a cross fold in front, and a collar of larger scales behind. Tongue elongate, flat, free at the base, exsertile, long-forked. Teeth hollow, rooted. Scales granular or rhombic, keeled. Sides flat, covered with small granular scales. The species inhabit the Old or Eastern World and Australasia.

Synopsis of the Genera.

I. Nostril erect, in the lower hinder angle of the nasal shield, just above the labial shield, with one or two shields behind it. Eyelid distinct.

A. Toes simple, compressed, not keeled nor fringed. Collar distinct.

a. Scales granular or 6-sided, elongate. Posterior nasal shield single. Collar distinct.

Zootoca.—Lower eyelid scaly, opaque.

Z. vivipara, the Scaly Lizard, Common Lizard, and Nimble Lizard. It is the *Lacerta vivipara* of Jacquin; *Lacerta agilis*, Pennant; *Zootoca muralis*, Gray. It has the ventral shields 8-rowed, the temple covered with many-aided shields, with a large central shield; its colour olive; back with a white-edged blackish streak on each side, and a central black streak; belly orange (in summer), black-spotted.

This little lizard is a common inhabitant of heaths and banks in most of the districts of England, extending even to Scotland. It is also one of the few reptiles found in Ireland. Its range is very limited on the Continent, and is not found in Italy or France. Its movements are graceful and rapid, it comes out of its hiding place during the warm parts of the day, from the early spring till autumn. It lives upon insects, which it seizes with its mouth. In this species the eggs are retained in the oviduct until the young are ready to be hatched, and they are thus produced alive. The young when brought forth are fully-formed, and capable of running about and taking their own food. The usual length of this lizard when full grown is from 5½ to 6½ inches.

Z. muralis, the Tiliquesta, is a native of the south of Europe.

Z. oxycephala, the Long-Headed Lizard, is a species brought by Mr. Webb from either Spain or Madeira.

Z. Taurica, a native of the Crimea, Morea, Corfu, and Sicily.

Z. tæniotata, the Striped Lizard, a native of South Africa.

Z. Derbiana, a native of Australia.

Z. Galloti, Madeira.

b. Scales granular or 6-sided, elongate. Posterior nasal shields 2, small, one above the other. Collar distinct.

Lacerta.—Lower eyelid opaque. Chin-fold distinct. Abdominal shields narrowed behind.

L. agilis, the Sand-Lizard. It is the *L. stirpium* of Milne-Edwards and others. The upper hinder nasal small, rather in front of the larger lower one; scales of the temple small, unequal, irregularly many-sided, often with a larger central one; throat-fold indistinct, brown, spotted or eyed with black; sides green, brown-eyed, beneath white. This species is a native of Great Britain, and is especially abundant in the neighbourhood of Poole in Dorsetshire. Its general abode is on sandy heaths, where, from the rapidity of its movements, it is often mistaken for some form of snake. On account of the rapid locomotion it is not often caught. It does not bear confinement, but pines away and dies. When caught it often bites, but no ill-consequences are the result. The female lays her eggs to the number of 12 or 14 in hollows in the sand, which she excavates for the purpose. They are subsequently hatched by the heat of the sun. The eggs appear to be laid a considerable time before they are hatched. In this respect this species differs very much from the common lizard, which always brings forth her young alive. This lizard is larger than the *Zootoca vivipara*, as those of average size measure about 7 inches in length.

L. viridis, the Green Lizard, has the scales of the temple inequilateral, many-sided, with a central larger one; back granular, oblong, with shelving sides; throat-fold distinct. This species is a native of Guernsey and Jersey, and also of the south of Europe. It is much more readily caught than the last species, and never attempts to bite. It may be readily tamed and taught to come to the hand for food. It will lie coiled in the two hands, and never attempt to escape.

L. ocellata and *L. lævis*, both natives of the south of Europe, are the only other species of the typical genus *Lacerta*.

Thetia.—Lower eyelid transparent. The only species is *T. perspicillata*, a native of Algiers.

Teira.—Lower eyelid opaque. Chin-fold distinct. Abdominal folds and shields square. *T. punctata*, a native of Madeira, is the only species.

Nucras.—Lower eyelid opaque. Chin-fold indistinct. Abdominal shield narrow behind. Preanal shields one before the other.

N. Lalandii, is a native of the Cape of Good Hope.

N. teselata, is a native of South Africa.

N. exigua and *N. chalybdea*, the Small Lizard and Steel-Black Lizard, are natives of the Caucasus.

c. Scales rhombic, keeled. Posterior nasal shields 2, small, one above the other.

Notopholis.—Collar and throat-fold distinct.

N. Fitzingeri is a native of Sardinia.

N. Capensis is a native of South Africa.

N. Moresticus inhabits the Morea.

N. nigropunctata, a native of the Island of Corfu.

Tropidosaurus.—Collar and throat-fold indistinct. *T. montana*, a native of Java, is the only species.

d. Scales rhombic, keeled. Posterior nasal shields single. Collar indistinct.

Algira.—Ventral shields roundish, thin.

A. barbarica, the Zermoumeah, is a native of Algiers.

A. Capensis and *A. Dumerilii* are natives of the South of Africa.

B. Toes keeled beneath, and sometimes fringed on the sides. Scales keeled. Posterior nasal single.

Acanthodactylus.—Toes fringed on the sides.

A. velox. A native of North Africa.

A. Bellii. Found in Algiers.

A. Capensis. South Africa.

A. Savignii. Algiers.

A. lineato-maculatus. Marocco.

A. Boskianus. North Africa.

A. inornatus. Tripoli.

Psammodromus.—Toes not fringed on the sides. Collar indistinct.

P. Hispanicus, the Garriques, is a native of Spain.

P. cinereus inhabits the South of France.

II. Nostril horizontal on the ridge, between three swollen scales, one between the nostril and labial. Toes keeled beneath or fringed on the side.

a. Eyelid distinct.

Scrapteira.—Toes depressed, fringed on the edge, not keeled beneath. Collar indistinct. *S. graminea*, a native of Nubia, is the only species.

Eremias.—Toes compressed, keeled beneath, not toothed on the edge. Collar distinct. Preanal shields small, in several series, in central series one behind the other.

E. arguta. The Arguta is a native of Tartary.

E. velox. The Crimea.

E. Knoxii. South Africa.

E. Capensis; E. Burchellii; E. dorsalis; E. Namaquensis; E. lugubris, are also described by Dr. Smith as natives of South Africa.

E. guttulata. North Africa.

E. lineo-ocellata. South Africa.

E. pulchella. South Africa.

Mesalina.—Toes compressed, keeled beneath, not toothed on the edge. Collar distinct. Preanal shield single, semicircular, with 1 or 2 arched series of smaller ones round it.

M. Pardalis. North Africa.

M. rubro-punctata. North Africa.

Cabrita.—Toes rather compressed, keeled beneath, not fringed on the sides. Collar none.

C. Leschenaultii, a native of India, is the only species.

b. Eyelid rudimentary. Eye circular, exposed.

Ophiops.

O. elegans is found on the shores of the Mediterranean.

O. macrodactylus is a native of Asia Minor.

** Sides with a distinct longitudinal fold, covered with small granular scales.

5. *Zonuridæ.*—Ears distinct. Limbs distinct, or rarely quite hidden. [ZONURIDÆ.]

6. *Chalcidæ.*—Ears hidden under the skin. Limbs very short; femoral pores none. Lateral fold indistinct. [CHALCIDEA.]

*** Sides rounded, covered with scales like those on the back.

7. *Anadiadæ.*—Scales of the back and sides thin, imbedded, smooth, in alternating cross series; of the tail elongate, smooth, in longitudinal series. Ears distinct. Femoral pores distinct.

8. *Chirocolidæ.*—Scales of the back imbricate, 6-sided, lanceolate, keeled, narrow, in cross series; of the tail in rings, alternating with each other. Ears hidden. Femoral pores distinct.

9. *Cercosauridæ.*—Scales of the back, sides, and upper part of the tail keeled, in longitudinal series. Limbs 4: feet for walking.

10. *Chamæsauridæ.*—Scales imbricate, all elongate, rhombic, keeled in longitudinal series, the keels forming longitudinal ridges. Limbs simple, undivided. Temple scaly.

Tribe II. *Geissosaura.*

Scales of the belly and (almost always) of the back and sides quincuncial, rounded, imbricate. Sides rounded. Tongue narrow, short, flat, end slightly nicked. Head with regular shields.

a. Eyes distinct, exposed, eyelid rudimentary. Head conical.

11. *Gymnophthalmidæ.*—Head-shields normal. Nostrils lateral, in a nasal shield. Limbs 4 or 2. Body fusiform.

12. *Pygopidæ.*—Head-shields normal. Nostrils over the upper edge of the first labial. Pupil round or oblong. Abdominal shields 6-sided, in 2 or 3 series. Tail with a central series of larger shields. Limbs 2, posterior. Australasia.

13. *Aprasiadæ.*—Head-shields normal. Nostrils in a suture between the nasal and first labial (sometimes united ?). Limbs none. Ventral and dorsal scales nearly similar. Australasia.

14. *Lialisidæ.*—Head-shields subimbricate, scale-like. Cheeks scaly. Nostrils in a small single nasal on ridge of the face.

b. Eyes distinct, eyelids distinct, connivent. Head conical.

15. *Scincidæ.*—Rostral shield moderate, triangular. Nostrils in a plate between the frontal and labial shields. [SCINCIDÆ.]

16. *Ophiomoridæ.*—Rostral moderate, triangular. Nostrils in a notch on edge of nasal and the supranasal shields.

17. *Sepsidæ.*—Rostral rather large, square. Nostrils in a notch in the hinder edge or the rostral. [SEPSIDÆ.]

18. *Acontiadæ.*—Rostral large, cup-like. Nostrils in the rostral, with a narrow slit to its hinder edge.

c. Eyes hidden under the skin.

19. *Typhlinidæ.*—Head conical. Rostral shield cup-like. Nostrils in the rostral shield, with a slit to its hinder edge.

20. *Typhlopsidæ.*—Head short, depressed. Rostral shield elongated, extended up the forehead. Nostrils in an elongated nasal shield. [TYPHLOPS.]

Sub-Order II. *Pachyglossæ.*

Tongue thick, convex, attached to the gullet at the base.

Tribe III. *Nyctisaura.*

Scales of the belly small, rhombic, imbricated; of the back and sides granular. Tongue thick, short, convex, end slightly nicked. Eyes nocturnal; eyelids circular, not connivent, pupil linear, erect. Feet for walking; toes subequal, scaly beneath, and generally dilated.

21. *Geckotidæ.*—The Old and New World. [GECKOTIDÆ.]

Tribe IV. *Strobilosaura.*

Scales of the belly small, rhombic, imbricate; of the back and sides imbricata. Tongue thick, short, convex, end slightly nicked. Eyes diurnal, with valvular eyelids; pupil round. Feet for walking; toes unequal, compressed.

22. *Iguanidæ.*—Teeth on the inner side of the jaw-bone. New World. [IGUANIDÆ.]

23. *Agamidæ.*—Teeth on the edge of the jaw-bones. Old World and Australasia. [DRACONINA.]

Tribe V. *Dendrosaura.*

Scales of the belly, sides, and back, granular. Tongue elongate, subcylindrical, worm-like, very exsertile. Eyes globular, very mobile, with a small, central, round opening. Toes equal, united into two opposing groups.

24. *Chameleonidæ.*—Teeth on the edge of the jaw-bone. Old World. [CHAMELEONA.]

SAURI'CHTHYS, a genus of Fossil Fishes. [FISH.]

SAUROCE'PHALUS, a genus of Fossil Fishes. [FISH.]

SAU'RODON, a genus of Fossil Fishes. [FISH.]

SAURO'PHAGUS. [LANIADÆ.]

SAUROPHIS. [ZONURIDÆ.]

SAURO'PSIS, a genus of Fossil Fishes. [FISH.]

SAUROTHERA. [CUCULIDÆ.]

SAURURA'CEÆ, *Lizards'-Tails*, a natural order of Plants belonging to the Achlamydose group of Incomplete Exogens. It consists of only a few genera, which are aquatic or marshy herbs or herbaceous plants, with perennial root-stocks, knotted stems, and simple entire alternate leaves, with vaginal stipules. The flowers are naked, and seated upon a scale. The stamens are 6 in number, hypogynous; filament slender; anthers continuous with the filament, having 2 lobes bursting longitudinally; the ovaries are 4, containing one or more ovules; style short; stigma simple; the seeds are few, with an abundant albumen, in the midst of which lies a small embryo, which is inclosed in a persistent vitellus.

These plants are very near *Piperaceæ*, from which they mostly differ in the compound nature of their ovary. This order connects Dicotyledons with Monocotyledons. Its foliage, stipules, and seeds connect it with the former; but the floating habit of some of the species, and their general character, ally them with some of the families of the latter class. They are natives of North America, China, the north of India, and the Cape of Good Hope, where they are found growing in marshes and pools of water. Their properties are not

well known, but they seem to be the representatives of the peppers in colder climates; and on account of their less exposure to light, their secretions are not so strong, and their properties not so active, as their allies in the tropics.

Saururus cernuus.

a, branch, with leaves and spikes of flowers; *b*, a naked flower seated on its bract; *c*, transverse section of fruit; *d*, section of fruit, showing the seed, with large albumen and the embryo in its permanent sac; *e*, the seed.

SAURY. [Esox.]

SAUSSUREA, a genus of Composite Plants belonging to the sub-order *Cynarocephaleæ*. The florets are all hermaphrodite and tubular; the anthers with ciliated setæ at the base; the involucre is imbricated and unarmed, the receptacle scaly; the pappus in 2 rows, the outer one consisting of short rough bristles, the inner one feathery.

S. alpina has a stem from 3 to 12 inches high, erect, downy, and simple, terminating in a small corymb of heads with pinkish florets and purple anthers; the leaves are nearly glabrous above, cottony beneath, the lower ones ovate-lanceolate, the upper ones sessile-lanceolate, all distantly-toothed, the heads in a dense corymb, the involucre subcylindrical, with depressed hairy scales. This is the only British species. It is found in alpine situations.

(Babington, *Manual of British Botany.*)

SAUSSURITE, a Mineral, also called *Axe-Stone, Jade.* It occurs massive. Cleavage parallel to the faces of a rhombic prism. Fracture splintery. Hardness 5·5. Extremely tough. Colour greenish and grayish-white. Streak white. Lustre pearly, inclining to vitreous on the faces of cleavage. Nearly opaque, but translucent on the edges. Specific gravity 3·2 to 3·4. Before the blow-pipe it fuses with difficulty into a white glass. It was discovered on the edge of the Lake of Geneva by Saussure in rounded masses. It has also been found in Styria, Corsica, and at Madras. Its analysis by Saussure gives:—

Silica	44
Alumina	30
Soda	6
Lime	4
Oxide of Iron	12·5
	——96·5

SAUVAGE'SIACEÆ, *Sauvageads*, a natural order of Plants formed by Bartling, and consisting only of the genus *Sauvagesia*, of which there are six or seven species. Another genus, *Luxemburgia*, was referred to this order by Bartling, but this has been placed by De Candolle in *Frankeniaceæ*. Lindley, in his 'Natural System,' makes *Sauvagesiæ* a sub-order of *Violaceæ*, from which, he observes, it is principally distinguished "by the stamens being opposite the petals, by the anthers not having a membranous termination, by the presence of five hypogynous scales, and by their fruit having a septicidal dehiscence, so that the seeds adhere to the edges and not the centre of the valves, and by the strongly-ribbed and imbricated calyx." This last character gives them a relation to *Hypericaceæ*, but from this order they differ in their parietal placentæ and the presence of stipules. They are natives of the tropical parts of South America, growing in moist meadows and the vicinity of streams. The genus *Sauvagesia*, named after the celebrated physician Sauvages, is characterised by possessing 3 rows of petals; the outer petals 5, ovate or oblong, spreading, deciduous; the intermediate ones filiform, variable in number; the interior 5 opposite the outer, erect, converging into a tube much smaller; calyx deeply 5-parted, and a capsule inclosed in the permanent floral organs, more or less deeply 3-valved and many-seeded. One of the species, *S. erecta*, Upright Sauvagesia, is held in great repute as a medicine in South America. It is very mucilaginous, and has a bitter taste. It is used in Brazil in diseases of the eye, and in Peru and the West Indies it is employed in slight inflammatory affections of the mucous membranes of the bladder and intestines.

SAUVEGARDE, or SAFEGUARD. [Teidæ.]

SA'VACOU. [Boat-Bill.]

SAVI'GNYA, a genus of *Cruciferæ*.

SAVIN. [Juniperus.]

SAW-FISH. [Squalidæ.]

SAWWORT. [Serratula.]

SAXI'CAVA. [Lithophagidæ.]

SAXICOLA, a genus of Insessorial Dentirostral Birds belonging to the family *Sylviadæ*. Three British species belong to this genus as now constituted, the Stonechat, the Wheatear, and the Whinchat. This genus has the following characters:—Beak straight, slender, the base rather broader than high, surrounded with a few stiff hairs; the superior ridge of the upper mandible prominent, the sides towards the point compressed; the point itself curved and indented. Nostrils basal, lateral, oval, half closed by a membrane. Wings: the first quill-feather about half as long as the second; the second shorter than the third or fourth, which are the longest in the wing. Feet: the tarsus rather long, three toes in front, one behind; the outer toe connected by a membrane to the middle toe; claw of the hind toe short, strong, and curved. (Yarrell.)

S. rubicola, the Stonechat. This is the Traquet Rubicole and Moteux Traquet of the French; Saltabastone, Zompa-cardi, and Saltinpalo of the Italians; Schwarzkehliger Steinschmatzer of the Germans; Clochder y Cerrig of the Welsh; and Stonechatter, Stonesmith, Stonesmich, Stoneclink, and Moor-Titling of the English.

The old male in summer plumage has the head, throat, back, and small coverts of the wings perfect black; but each feather very finely bordered with ruddy brown; a great white spot on the sides of the neck, on the upper part of the wings, and on the rump. Breast deep ruddy, lower parts very bright ruddy; wings brown bordered with brighter brown; base of all the tail-feathers white, the rest of a blackish brown. Length 4 inches 4 or 5 lines.

Male after the Autumnal Moult.—Wider ruddy borders at the end of the feathers on the throat; those of the nape and the back fringed with large borders of that colour; breast bright ruddy, the rest of the lower part of the body clear Isabella colour; wider borders on the quills, and the end of the tail ruddyish.

Stonechat (*Saxicola rubicola*).
Lower figure, male; upper figure, female, in perfect plumage.

Female.—Upper parts blackish brown with borders of yellowish ruddy; wings and tail-feathers brown bordered with yellowish ruddy; throat black, with small whitish and ruddyish spots; the white space on the sides of the neck and of the upper part of the wing less extended; ruddy colour of the breast less vivid.

Young males before their second moult like the old female.

Young at their Departure from the Nest.—Feathers of the upper parts grayish brown; all terminated by a small whitish spot.

After the autumnal moult all the individuals have brown ash-colour on the head and the back; this colour occupying solely the fine points of the barbs, they by exposure and friction cause in the spring the black colour of the middle of the feathers to appear. (Temm.)

It is found in Russia, Germany, France, Provence, Italy, Smyrna, Japan, the Deccan, the banks of the Ganges, the mountain-chain of Upper Hindustan, Senegal, and South Africa (Cape). England, Ireland, and Scotland.

Though several of this species remain through the winter months, the general body quit the British Islands in autumn, nor do they return till the spring is forward, seldom appearing on our heaths and commons, dappled with furze and bushes, before the end of March: but March is often bleak; and when the winds blow roughly, they quit these open spots for the shelter of the snug lanes and groves. Still however the open tracts are their favourite haunts, and, wind and weather permitting, there they are to be seen almost ever in motion, now on a stone, now on a bush, from which they dart to seize the passing insect and then return. Although their song, which is given on the wing, is short, it is pleasing; and they are in a degree mocking-birds, being no bad imitators of the song of others. Besides insects, worms are acceptable food to them; and for these they may be frequently seen foraging on the ground.

The nest, which is of considerable size in proportion to the bird, is framed in the beginning of April on the ground or some dwarf bush. Externally it is fabricated of moss and grass; and a few fine bents, hairs, and feathers form the lining. The eggs, which are laid from the middle of April to the third week in that month, are pale-blue with somewhat of a grayish tint, finely dotted with obscure reddish-brown at the large end.

When the young are hatched—that is, about the middle of May—the old Stonechats become very bold. They make a constant clamour, and put in practice many a ruse to deceive the schoolboy and draw him from their nest.

S. œnanthe, the Wheatear (*Motacilla œnanthe*, Linn.; *Vitiflora* of Belon and Brisson). It is the Moteux, Vitrec, and Cul-blanc, of the French; Codo-Bianco, Culo-Bianco, Fornarola, Petragnola, Culbiano, and Codetta d'Estate, of the Italians; Steinschwatzer, Steinschnapperl, Graurückiger, Steinschmatzer, and Weisschwanz, of the Germans; Tapuit of the Netherlanders; Stensquetta of the Swedes; Steendolp, Steensquette, and Steengylpe, of the Norwegians; Fallowfinch, Fallow-Chat, Fallow-Smith, Whitetail, Fallow-Smiter, Horsematch, Snorter, Stone Chacker, Chickell, and Chack-Bird, of the English; and Tinwyn y Cerrig of the Welsh.

The old male has the upper parts of the body ashy-gray; forehead, band above the eyes, and throat, white; black passing from the root of the bill below the eye and covering the orifice of the ears; wings black; rump and tail white for two-thirds of the length of the latter; the rest, towards the end, black, excepting the two middle feathers, which are entirely black; front of the neck and breast buff-colour; the rest of the lower parts pale buffy-white. Total length 6½ inches.

Female.—Upper parts ashy-brown; forehead rusty-gray; deep brown above the eye and covering the orifice of the ears; wings blackish-brown, bordered with bright brown; white at the origin of the tail, less extended; neck and breast rusty; the rest rusty-white.

Young of the Year.—At their departure from the nest, with the upper parts variegated with rusty and ash-colour, and spotted with brown; feathers of the rump white; throat and lower part of the body ruddy, dotted and finely striped with blackish-brown; wing-coverts bordered with rusty; quills and tail-feather bordered with ruddy.

The geographical distribution of this bird is very wide. Lapland, Denmark, Sweden and Norway, Iceland, and Faroe Islands.

In Europe it is abundant, particularly on the northern shores of the Mediterranean. It is found in Dalmatia and the Morea. Belon saw it flying above the bushes in Crete; Mr. Strickland noticed it at Smyrna in April; and Mr. Keith Abbott procured it at Trebizond (40° 45′ N. lat., 40° 25′ E. long.)

In these islands, where it is generally diffused, the Wheatear arrives about the middle of March, and the great body have left us about the end of September, though some stragglers stay later, and have been seen as late as past the middle of November. The Hebrides, Orkneys, and Shetland are visited by them.

Insects generally, which are captured on the wing, *Coleoptera* and their larvæ, and worms, form the food of the Wheatear, which generally sits on the watch upon an elevated clod or stone.

The nest is framed of dried roots and feathers, rabbit's-down, &c.; and the eggs, generally six in number, are pale-blue. The bird manifests sometimes great precaution in selecting a place for it not easily detected. Various curious positions are recorded by naturalists. Mr. Salmon states that in Suffolk and Norfolk a deserted rabbit-burrow is usually selected for the nest, which is placed near the entrance. In such situations, he adds, the nest is sure to be discovered by the accumulation of a number of small pieces of the withered stalks of *Pteris aquilina* which the old birds amass outside the entrance. Mr. Yarrell found the nest in a fallow field under a large clod, to which his attention was drawn by a portion of its materials appearing outside the hole through which the bird passed to the hollow space within.

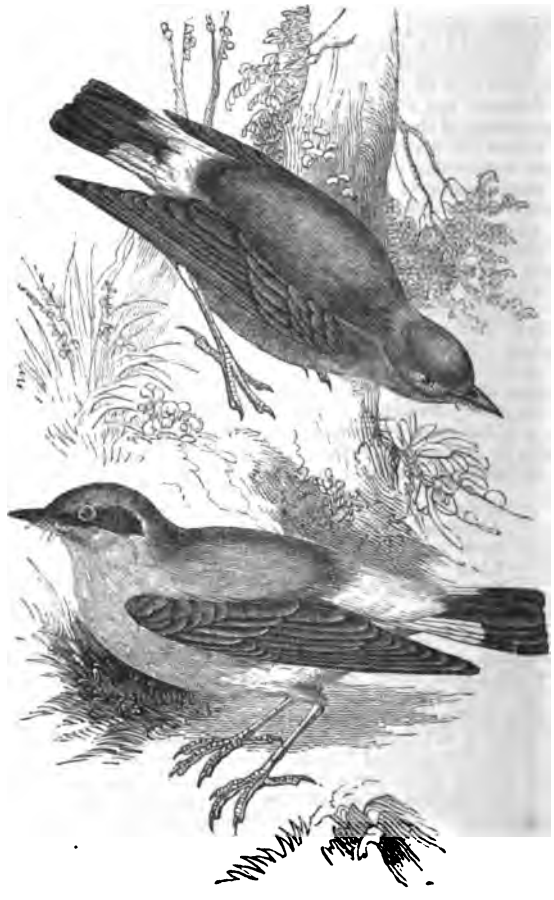
When the Wheatears begin to draw towards our southern counties previous to their departure, they soon fall victims to the eagerness with which they are sought as delicacies for the table. They are caught by the shepherds in traps. The numbers thus taken in the season, which commences on St. James's Day (25th July), when the traps are first opened, appear to be almost incredible. A shepherd has been known to capture 84 dozen in a day. Pennant declares that about Eastbourne about 1840 dozen were annually caught in his time. They are roasted wrapped up in vine-leaves, on account of the great tenderness of the flesh. The flavour is delicious, and it has been termed, not inaptly, the English Ortolan.

The flight of the Wheatear is smooth and rapid, but low. Its song, though heard with difficulty in the open air, is soft and sweet, often uttered while on the wing in the season of love, as the male hovers over the female, expanding the feathers of his tail.

The following quatrain appears under the figure of this species in the 'Portraits d'Oyseaux, Animaux, Serpens, etc., observez par P. Bélon du Mans:'—

> "L'oyseau petit, que l'on nomme Culblanc,
> Cherche à se paistre et vivre de vermine
> Qu'il trouve en herbe, ou que dans terre il mine:
> Et a tel nomme, pour avoir le cul blanc."

Besides the Wheatear here noticed, Mr. Gould describes and figures the following as European:—The Black Wheatear (*S. cachinnans*, Temm.); the Pied Wheatear (*S. leucomela*, Temm.); the Russet Wheatear (*S. stapazina*, Temm.); and the Black-Eared Wheatear (*S. aurita* Temm.).



Wheatear (*Saxicola œnanthe*). Lower figure, male.

S. rubetra, the Whinchat, Auct., *Motacilla rubetra*, Linn. This is the Grand Traquet, Traquet, Groulard, Tarier, Thyon, Semel (in Lorraine), of the French; Grosser Fliegenfanger, Gestettenschlager, and Braunkehliger Steinschmätzer, of the Germans; Saltabastone con

la Gola Bianca and Stiaccino of the Italians; Furzechat and Blackberry Eater of the English; and Clochder yr Eithin of the Welsh.

The old male has the top of the head, sides of the neck, and upper parts of the body, blackish-brown; each feather with a wide border of rusty-yellow; above the eyes an elongated streak of white, reaching to the occiput; throat and longitudinal streak on each side of the neck pure white; front of the neck and breast fine bright rusty; a great spot on the wings and tail of pure white; extremity of tail, as well as the two middle quills, and all the shafts, blackish-brown. Length nearly five inches.

Female.—With yellowish-white wherever the male has pure white; the white space on the wing less, and all the feathers with a small brown spot; the rust of the breast is less pure, and the lower parts, as well as the upper part of the tail, are rusty white.

The young have white and grayish spots all over their plumage.

It is found in Norway, Sweden, temperate Russia, but not Siberia: all southern Europe to the Mediterranean shore: common in Smyrna in winter. (Strickland.) In the British Islands they are generally, but not numerously, diffused in the summer; have been seen in the Hebrides, but are not recorded as having visited Orkney or Shetland. They arrive here about the middle of April, but, as a general rule, depart in autumn.

The flight of the Whinchat is undulating, and it flits from bush to bush, perching on one of the topmost twigs. Furze commons are its favourite haunts. Worms, insects, small shell-mollusca, and slugs, form its principal food, but it also eats berries. The nest resembles that of the Stonechat, and is formed of dry grass stalks and a little moss, the lining being finer bents or stalks. It is usually placed on the ground.

The song is very pleasing, and resembles, according to Bechstein, that of the Goldfinch; and the bird will sing not only during the day, but in the evening, and sometimes at night.

Whinchats become, like the Wheatear, very fat in August, and, though smaller, are equally delicate for the table.

In the 'Portraits d'Oyseaux' the following quatrain is printed under the figure of this species:—

"Es summites des buissons hoche l'aelle
Incessamment le Traquet ou Tarier;
Et le voyant sans cesse varier,
Comme un traquet de moulin on l'appelle."

Whinchat (*Saxicola rubetra*).
Upper figure, female; lower figure, male.

SAX'IFRAGA (from 'saxum' and 'frango,' in allusion to their supposed medical virtues), a genus of Plants, the type of the natural order *Saxifragaceæ*. It is characterised by possessing a calyx, either free or partly united to the ovary, and divided into 5 segments; a corolla consisting of 5 petals; 10 stamens, with awl-shaped filaments and roundish anthers; pistils having two styles with obtuse stigmas; a capsule with 2 beaks, 2-celled, many-seeded, opening between the beaks; the seeds upon a receptacle attached to the dissepiment.

Of the species 24 are British. They are mostly inhabitants of alpine and subalpine regions of the colder and temperate parts of the northern zone. They are most of them true rock plants, and send forth their roots between the crevices of the rocks on which they grow.

S. umbrosa, London-Pride, or None-so-Pretty. Calyx reflexed; leaves undivided, obovate, with sharp cartilaginous teeth, tapering gradually into a broad foot-stalk which varies in length; scape from 9 to 18 inches high, erect, panicled, red and hairy, with a few small scattered entire bracts; flowers numerous, with obtuse petals, white or flesh-coloured, beautifully spotted with yellow near the base, and dark red towards the extremity; capsule superior, purplish. This plant was found by Tournefort on the hills of Spain, and is a native of Great Britain and Ireland. It is one of the most popular of garden flowers, blossoming in April and June, and attaining perfection even amidst the smoke of London. In Ireland it is known by the name of St. Patrick's Cabbage.

S. Geum, Kidney-Leaved Saxifrage. Calyx reflexed; leaves undivided, roundish, kidney-shaped, sharply toothed, more or less hairy; foot-stalks linear, channelled; scape panicled, capsules superior. This species is found on mountains in the south of Ireland, and is considered by some botanists as only a variety of the former.

S. granulata, White or Granulated Meadow Saxifrage. Calyx spreading; radical leaves, kidney-shaped, on long footstalks, obtusely lobed; those of the upper part of the stem nearly sessile, acutely lobed; stem panicled, root consisting of numerous small clustered tubers. This plant is found in Great Britain, and, though not common, is abundant on gravelly soils. The roots of this species, forming as they do little granular masses, were at one time sold in the shops under the name of Saxifrage Seed.

SAXIFRAGA'CEÆ, *Saxifrages*, a natural order of Plants belonging to the apocarpous group of Polypetalous Exogens. It consists of shrubs and herbaceous plants with single alternate leaves without stipules. The calyx consists of five sepals more or less united at the base; the petals are equal in number to the lobes of the calyx, and alternate with them. The stamens are perigynous, 5-10 in number; anthers 5-celled; they have an hypogynous or perigynous disc; the ovary is inferior, or nearly superior, consisting of two carpels, which cohere more or less by their face at the base, but diverge at the apex; 1- or 2-celled, with a parietal or central placenta. They have no styles, and the stigma is sessile on the tops of the lobes of the ovary. The seeds are numerous, very minute; the embryo is taper, lying in the axis of fleshy albumen. The genus *Parnassia* belonging to this order differs in having four parietal placentæ, which are opposite the lobes of the stigma. [PARNASSIA.] The genus *Heuchera* has irregular flowers and stipules.

Saxifraga granulata.

a, entire plant; *b*, calyx cohering to the carpels, with perigynous stamens; *c*, longitudinal section of flower, showing the half superior ovary and ovules attached to central placentæ, with the relation of the stamens to the petals.

This order is most nearly allied to *Rosaceæ*, but it differs in its many-seeded partially-united carpels, its albuminous seeds, and in its not possessing stipules. The habit of *Saxifragaceæ* allies them to *Caryophyllaceæ*, but they differ in the character of their placentæ, the situation of the embryo, and other points. This order also approaches

Crassulaceæ, but *Saxifragaceæ* are distinguished by possessing a less number of carpels, and by the absence of glands at the base of the carpels. They are for the most part mountain plants, chiefly remarkable for the delicacy and beauty of their flowers, which are usually white. They inhabit the mountainous districts of Europe and the northern parts of the world, and constitute the chief beauty of the vegetation in high alpine stations.

The whole order is represented by De Candolle as possessing astringent properties. The *Heuchera Americana* is remarkable for its powerful astringency, and is used in medicine under the name of the North American Alum-Root. [HEUCHERA.] *Chrysoplenium* is reputed to possess both aperient and diuretic properties; but these cannot be very powerful, as it is used in the Vosges as a salad, under the name of Cresson de Roché. [CHRYSOPLENIUM.]

SAXIFRAGE. [SAXIFRAGA.]

SAXIFRAGE, GOLDEN. [CHRYSOPLENIUM.]

SCABBARD-FISH. [TÆNIOIDES.]

SCABIO'SA (from 'scabies,' the Latin word for scab or itch, which disorder the common sort is said to cure), a genus of Plants belonging to the natural order *Dipsaceæ*. The inner calyx consists of 5 bristles, the outer one is membranous and plaited; the receptacles scaly. The fruit nearly cylindrical, with 8 excavations; the corollas 4-5-cleft, with 4 stamens. The species are perennial or suffruticose herbs with variable leaves.

S. succisa, the Devil's-Bit, has an abrupt root appearing as if it were bitten off at the end, the heads of the flower and fruit nearly globose; the outer calyx hairy, 4-cleft; the lobes ovate acute; the inner calyx consisting of 5 bristles. The corolla is 4-cleft; the lower leaves toothed, the upper ones entire; the stem and both sides of the leaves hairy or glabrous. The flowers are dark violet or purple, varying to flesh-colour and white. It is a native of Europe to the Caucasus, and is very plentiful in Great Britain. In cultivation the plant becomes much more branched than in a wild state. In days of superstition it was fabled that the devil, envying the good this plant might do mankind, bit away part of the root, and hence its common specific name. According to Bergen, the root is astringent, and an infusion of it is bitter, but not unpleasant. A strong decoction of it was formerly an empirical secret for gonorrhœa. Linnæus says the dried leaves are used to dye wool yellow or green. It is usually regarded as the Πυκνόκομον of Dioscorides (4, 173), but Fraas thinks the plant of Dioscorides is the *S. Ambrosioides*.

S. Columbaria has the outer calyx membranous, plaited, and notched, the inner one of 5 nerveless bristles; the corolla 5-cleft, the radical leaves oblong, stalked, crenate, entire, or lyrate; the upper leaves pinnatifid, with linear segments. The flowers are purplish, the involucres narrow. It is a native of Europe, the Caucasus, and Siberia, and is very common on chalky soil in Great Britain. It is a very polymorphous plant.

S. grandiflora has a branched downy stem, with rather villous leaves, the radical ones oblong crenated, the cauline ones pinnatifid, with lanceolate linear spreading segments; the corollas amply radiant, of a cream-colour or white, with reddish tubes; the calyx consists of 5 reddish-brown bristles. It is a native of Barbary, Italy, and Sicily, in fields, and is worth cultivation.

(Don, *Dichlamydeous Plants;* Lindley, *Vegetable Kingdom;* Babington, *Manual of British Botany.*)

SCABIOUS. [SCABIOSA.]

SCAD. [SCOMBERIDÆ; CARANX.]

SCALARIA, a genus of *Mollusca*, the species of which are called Wentletraps.

Lamarck arranges *Scalaria* between *Vermetus* and *Delphinula*.

Cuvier observes that the *Scalariæ*, which he places between *Turritella* and *Cyclostoma*, have, like the *Turritellæ*, the spire elongated into a point; and, like the *Delphinulæ*, the mouth completely formed by the last whorl; this mouth is moreover surrounded by a bourrelet, which the animal repeats at intervals, so as to form a succession of step-like elevations.

M. De Blainville gives *Scalaria* its position between *Proto* and *Vermetus*.

M. Rang makes it come between *Pleurotomaria* and *Melanopsis*.

Mr. Swainson has arranged it as the first genus of his sub-family *Turbinæ*, the fourth of his family *Turbidæ*. [TURBINIDÆ.]

The animal is very spiral, furnished with a proboscis, two tentacles provided with a filament, and carrying the eyes upon an external convexity. Foot short and oval. Male organ very slender.

Shell subturriculate, with the spiral whorls more or less close, furnished with elevated longitudinal ribs, which are interrupted and nearly trenchant; aperture round, rather small, the borders united and forming a delicate and recurved bourrelet.

Operculum horny, delicate, rather large, and pauci-spiral. (Rang.)

M. De Blainville divides the genus into the following sections:—

A. Species, the whorls of whose spire are contiguous. Ex. *S. communis*.

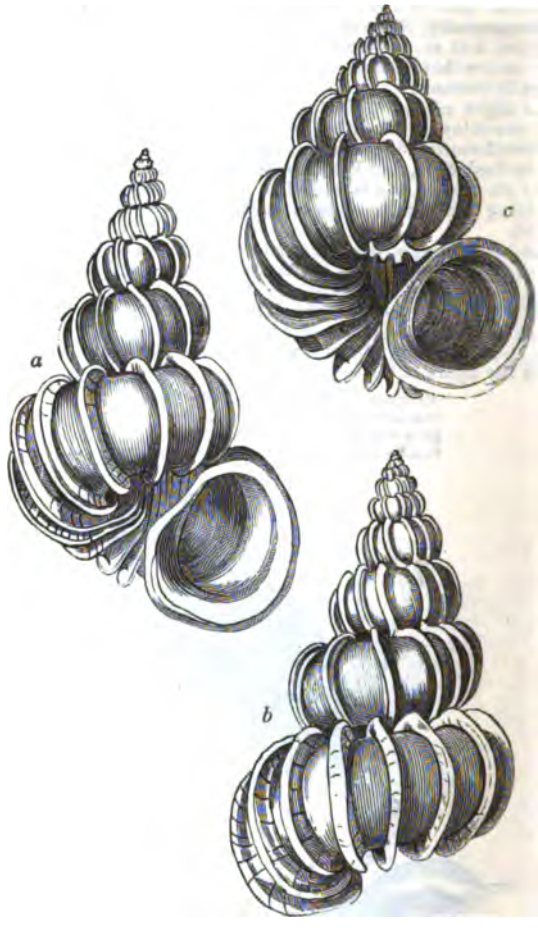
B. Species, the whorls of whose spire do not touch each other in any direction, or which are disjointed. Genus *Aciona*, Leach.

The first of these sections comprises the False Wentletraps of collectors, and the second those designated by them as True Wentletraps.

There are about 100 recent species of *Scalaria* known.

Species of this genus, which is marine, have been found at depths ranging from 7 to 80 fathoms in sandy mud. The True Wentletraps are found in the seas of warm climates: some of the false (*Scalaria communis*, for example) occur in the European seas and upon our own coasts. The animal exudes a purple fluid when molested. The species are found in Greenland, Norway, Great Britain, the Mediterranean, the West Indies, China, Australia, the Pacific, and the seas of Western America.

S. pretiosa (*Turbo scalaris*, Linn.; *Aciona scalaris*, Leach).—The shell conic, umbilicated, contorted into a loose spire, pale-yellow, with white ribs, the whorls disjointed and smooth, the last ventricose. It is found in the East Indian seas; China.

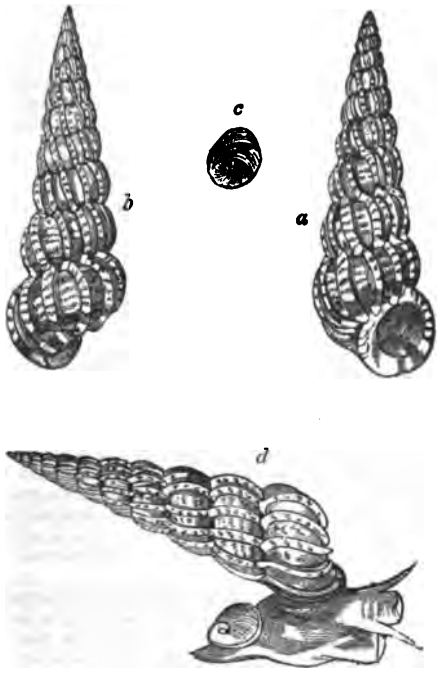


Precious Wentletrap (*Scalaria pretiosa*).

a, front, showing the mouth; *b*, back; *c*, view showing that the whorls are disconnected.

This elegant shell, so much sought after by collectors, was known among the French as the Scalata, La Vraie Scalata, and Le Véritable Escalier; among the Germans as the Rechte Wendeltreppe, among the Dutch as the Oprechte Wendeltrap; among the Belgians as the Wendeltrap, and to the English as the Wentletrap, Wendeltrap, and Royal Staircase. The specific name given to it by Lamarck was at one time well deserved on account of its rarity and the great price which a fine specimen would bring in the market, especially when it exceeded two inches in height: such a specimen has been sold in former days for 2400 livres, or 100 louis! But those times are gone by; the shell is no longer rare, and good specimens only fetch shillings where they once brought pounds. A very fine example however still commands a considerable sum. That in Mr. Bullock's museum, supposed to be the largest known, brought 27*l.* at his sale, and was, in 1815, estimated at double that value.

S. communis (*Turbo clathrus*, Linn., the Common Wentletrap) has the shell turreted, imperforate, white or pale fulvous; the ribs rather thick, smooth, and suboblique. There is a variety of this species with the shell rather longer, rosy-violaceous, and with purple-spotted ribs. Length of the common variety about 16 lines, of the rosy-violaceous variety 17½ lines. (Lam.)



Common Wentletrap (*Scalaria communis*).
a, front; *b*, back; *c*, operculum; *d*, shell and animal.

The number of fossil species of *Scalaria* is also about 100. They are found from the Coral Rag upwards.

SCALD-FISH. [PLEURONECTIDÆ.]

SCALE MOSSES. [JUNGERMANNIACEÆ.]

SCALOPS. [SORECIDÆ.]

SCALPELLUM. [CIRRIPEDIA.]

SCAMMONY. [CONVOLVULUS.]

SCANDIX, a genus of Plants belonging to the natural order *Umbelliferæ*. It is known by the margin of its calyx being obsolete or obscurely 5-toothed; petals obovate, emarginate, and mostly furnished with an inflexed point; fruit with a very long beak, separable into two parts, each with 5 blunt equal ribs, the furrows without vittæ; seed squarely convex, with a deep furrow in front. This genus is composed of annual herbs, with square rather striated stems, bi-pinnate leaves, the leaflets divided into linear lobes. The umbels have few rays. The involucra are wanting or composed of one leaf.

S. Pecten Veneris, the Common Shepherd's Needle, or Needle Chervil, is a native of Europe and the North of Africa, and is very plentiful in the cultivated fields of Britain. It is known by its involucels possessing jagged leaves, and its nearly smooth fruit with a bristly-edged beak. It possesses slightly acrid and aromatic qualities, and is supposed to be the Σκάνδιξ of Dioscorides, which was used as a potherb by the Greeks.

One of the species of this genus, *S. cerefolium*, the Garden Chervil, is now referred to the genus *Anthriscus*. [ANTHRISCUS.] It was formerly much cultivated in gardens. It is known by its twice-pinnate leaves, with channelled footstalks, stem slightly hairy at the joints, umbels sessile, either axillary or opposite the leaves; fruit somewhat furrowed, not ribbed, smooth. It is a native of the South of Europe.

SCANSO'RES, Mr. Vigors's name for an order of Birds comprising the families *Ramphastidæ*, *Psittacidæ*, *Picidæ*, *Certhiadæ*, and *Cuculidæ*. [RAMPHASTIDÆ; PSITTACIDÆ; PICIDÆ; CERTHIADÆ; CUCULIDÆ.]

SCAPHIDURI'NÆ. [STURNIDÆ.]

SCAPHI'TES. [CEPHALOPODA.]

SCA'PHODUS, a genus of Fossil Fishes.

SCAPOLITE, a Mineral, also called *Chelmsfordite*, *Paranthine*, and *Wernerite*. It occurs crystallised and massive. Its primary form is a square prism. Cleavage parallel to the lateral faces and the diagonal planes of the primary form. Fracture uneven, conchoidal. Hardness, easily scratches fluor-spar and sometimes apatite. Colour white, gray, green, reddish, violet. Lustre vitreous; translucent, opaque. Specific gravity from 2·612 to 2·724. When strongly heated by the blow-pipe it swells up and fuses into a brilliant white enamel. *Scapolite* occurs in Sweden, Norway, Finland, and North America.

The analysis of the mineral from Pargas by Nordenskiold, gives—

Silica	43·83
Alumina	35·43
Lime	18·96
Water	1·03
	——99·25

Nuttalite, *Meionite*, *Dipyre*, *Gehlenite*, *Somervillite*, and *Mellilite* are varieties.

SCAPTEIRA, Fitzinger's name for a genus of Pristidactyle Cœlodont Saurians (Lacertian or Autosaur Lizards) of Duméril and Bibron.

SCARABÆIDÆ, a very extensive group of Coleopterous Insects, forming the chief part of the section *Lamellicornes*. The Scarabæides of Latreille were regarded by Linnæus as a genus, but this great naturalist being acquainted with 87 species only, whilst the various collections at the present time contain together about 3000, it is natural that entomologists should have sought for characters among the species of this immense group by which they might be divided into sections; hence we find in the works of Fabricius (Linnæus's pupil) the present group raised to the rank of a family, and subdivided into several genera. These genera are however but few in number compared with those instituted by modern entomologists, which amount to nearly 200.

The Scarabæides (or *Scarabæidæ*) are distinguished from the other section of Lamellicorn Beetles (the *Lucanidæ*) chiefly by the structure of their antennæ, which are proportionately shorter; the basal joint being of moderate size, that is, but little longer than those which follow it [COLEOPTERA, vol. ii., col. 64, *fig.* 9]; whereas, in the *Lucanidæ*, the basal joint is usually very long, and often nearly as long as all the other joints taken together [COLEOPTERA, *fig.* 13], the latter forming in their natural position an angle with the first joint. The club with which the antennæ terminates also generally differs considerably in form. In the *Scarabæidæ* it is most usually composed of three leaf-like joints, but sometimes the number is increased to seven, as in the Common Cockchafer (*Melolontha vulgaris*); and these joints, when the insect is at rest, are closely applied together, and form either an elongated or rounded knob, which is bent at an angle with the basal joints. In those species which have the club rounded the two outer joints are stouter than the others, and have the external surface convex and the internal concave. In the *Lucanidæ* the terminal joints are produced in front at an angle with the axis, but are less expanded, and generally more distinctly separated and shorter than in the *Scarabæidæ*. The more typical species of the *Lucanidæ* moreover are remarkable for the great development of the mandibles in the male sex. The Common Stag-Beetle (*Lucanus Cervus*) affords a familiar example of this family.

Latreille divides the *Scarabæidæ* into six sections, to which he applies the following names:—*Coprophagi*, *Arenicoli*, *Xilophili*, *Phyllophagi*, *Anthobii*, and *Melitophili*.

The *Coprophagi* have the antennæ generally composed of eight or nine joints, the three last of which form the club; the labrum and the mandibles are membranous and hidden, and the lobe with which the maxillæ are terminated is also of the same texture; it is broad and curved inwards. The terminal joint of the maxillary palpi is always the largest, and either approaches to an oval form, or is nearly cylindrical; but the terminal joint of the labial palpi is almost always more slender than the preceding joints, and often very small. Behind the last-mentioned palpi is a small membranous protuberance. The mentum is emarginated, and the claws of the tarsi are always simple.

To this group belong the Dung-Feeding *Scarabæi*, and these are for the most part of a black colour, or black and brown. Some few species however are adorned with brilliant metallic colours. They are usually of a short and broad form; in some the body is somewhat depressed, and approaches to a square form; the head is large, broad, and flattish, and has numerous notches in front; the fore legs are very broad and deeply notched on the outer side, and are moreover remarkable for the want of tarsi to the anterior pair of legs, and the absence of a scutellum. To this section belongs the Sacred Beetle of the Egyptians, the *Scarabæus sacer* of Linnæus. It is about one inch long, or rather more, and of a black colour. This species is not only found in Egypt, but is met with in the south of France, Spain, and Italy, and, as well as other species of the group to which it belongs, incloses its eggs in a ball of excrement, which it forms by rolling the substance by means of its hind legs. The size of the ball, when completed, is much larger than that of the insect, being sometimes as much as one inch and a half in diameter.

In other species of the *Coprophagi* the body is convex, and although short, slightly inclining to a cylindrical form. A great portion of these have the head armed with an erect horn in the male sex, and the fore part of the thorax truncated or slightly concave, elevated in the middle, and not unfrequently produced at the sides into short stout pointed horns, as in the genus *Copris*. In a closely-allied genus (*Phanæus*), the species are usually adorned with brilliant colours. These insects have often a very long horn on the head, or this is sometimes replaced by two short horns; the thorax has a concavity in front, and usually has an angular protuberance on each side of the disc. These insects are usually of moderate size, and sometimes large, but there are two extensive groups of *Coprophagi* the species of which are small; they constitute the genera *Onthophagus* and *Aphodius*. In the former the body is short and subdepressed; the thorax is nearly as large as the elytra, and has a concavity in front, and a protuberance in the middle of the posterior boundary of this cavity; the head is usually armed with a small horn, which is directed backwards and upwards. In the *Aphodii* the body approaches to a cylindrical form, and the head and thorax are destitute of horns.

Of the genera mentioned, we possess no British examples of the first, or *Scarabæus* proper (or *Ateuchus*, according to some authors). The species of this group are confined to the warmer parts of the Old World. The species of the genus *Copris*, *Onthophagus*, and *Amphodius*, are of universal distribution, if we except Australia, where we are not aware that the first of these genera occurs. The species of *Phanæus* are almost entirely confined to the warm parts of South America, the only exceptions occurring in North America.

The species of the second great section of the *Scarabæidæ* (the *Arenicoli*) are distinguished by their having the mandibles horny and usually projecting; the lobe of the maxillæ is straight; the terminal joint of the labial palpi is always distinct, and nearly as long as the preceding: the antennæ have ten or eleven joints; they are moreover distinguishable from other *Scarabæi* (the species of *Aphodius* excepted) by their elytra being extended over the apex of the abdomen. The three principal genera in this section are *Geotrupes*, *Bolbocerus*, and *Trox*. The species of *Geotrupes* are usually of moderate size, of a black colour, often tinted with blue or green, and usually brilliant beneath. The body is convex, and the head and thorax are rarely furnished with protuberances. They are almost entirely confined to Europe, North Asia, and North America. They feed upon the excrement of cattle, under which they construct their burrows. Several species are found in England, and some are seen in great abundance flying about the roads towards the evening.

In *Bolbocerus* the body is nearly hemispherical; the males are often provided with an erect horn on the head, and protuberances on the fore part of the thorax. The species are usually of moderate size, and appear to be found in all the temperate and warm parts of the globe. Only one species is found in this country.

The species of the genus *Trox* are also usually of moderate size, and are found in all parts of the globe. In these insects the body is convex, and remarkable for the roughness of the upper parts; they are always of a dull brown or grayish colour, and appear as if covered with a coating of dried earth. Their food (according to Latreille) consists of the roots of vegetables, but they will also eat decayed animal substances, and in this respect differ from other *Scarabæi* the habits of which we are acquainted with.

The *Xylophili* have the antennæ 10-jointed, the mandibles laterally exposed; the maxillæ are various. It embraces the larger forms of the genus *Scarabæus*, as the *S. Hercules*, which is the largest insect known. The genus *Dynastes* also belongs here. [DYNASTES.]

The *Phyllophagi* have the antennæ 8-10-jointed; mandibles hidden by the clypeus and maxillæ; club of antennæ sometimes 7-5-jointed. This division embraces the *Anoplagnathidæ* and *Melolonthidæ*. [MELOLONTHIDÆ.]

The *Anthobii* have their labium produced, the mandibles corneous, the maxillary lobe membranous. The species live upon flowers or leaves. They embrace the genera *Glaphyrus*, *Amphicoma*, *Anthipna*, *Chasmatopterus*, *Chasme*, and *Dichelus*. None of them are found in Great Britain. They inhabit the southern parts of Europe, and the warm parts of both hemispheres.

The *Melitophili* are distinguished by their mandibles being membranous. They embrace three families, the *Trichiidæ*, the *Goliathidæ*, and the *Cetoniadæ*. The species of the first family are rare in England. The *Goliathidæ* embrace the gigantic beetles belonging to the genus *Goliathus*, and commonly called Goliath Beetles. The *Cetoniadæ* are perhaps the most important insects of the group. [CETONIADÆ.]

SCARBROITE, a Mineral—a Hydrated Silicate of Alumina. It occurs massive. Its fracture is conchoidal. Hardness about 2·0. It is easily scratched by the knife, and polished by the nail. Adheres to the tongue, and has a strong earthy smell when breathed upon. Colour white. Opaque. Dull. Streak shining. When put into water it does not become transparent, nor fall to pieces, but increases in weight. Specific gravity 1·48. It occurs in veins in the beds of sandstone covering the calcareous rock near Scarborough, between septæ of oxide of iron. Its analysis by Vernon gives—

Silica	7·90
Alumina	42·75
Water	48·55
Oxide of Iron	0·80
	——100·

SCARI'TIDÆ, a family of Coleopterous Insects belonging to the section *Geodephaga*, which section corresponds to the genera *Carabus* and *Cicindela* of Linnæus. The *Scaritidæ* have the prothorax separated from the elytra by a narrow cylindrical neck; the mandibles are usually large, and armed with strong teeth on the inner side; the labrum is small; the mentum is furnished with a tooth; the antennæ are usually short, and have the basal joint long; the legs are short; the anterior tibiæ are broad, and strongly notched on the outer side, and fitted for burrowing; and the anterior tarsi in the males are not dilated. The body is usually elongated, and straight at the sides; the head, thorax, and elytra, are nearly equal in width. The principal genera contained in this family are *Scarites*, *Pasimachus*, *Camptodontus*, *Acanthoceles*, *Clivina*, and *Dischirius*.

In *Scarites* (Fabricius) the mandibles are strongly toothed on the inner side, the second and third joints of the antennæ are obconic, and the following joints are shorter, compressed, and subquadrate. The species of this genus are very numerous, and are found in nearly all the temperate and warmer portions of the globe.

The species of the genus *Pasimachus* differ chiefly from *Scarites* in being proportionately broader, and of a somewhat depressed form; in having the thorax produced on each side behind, and forming distinct angles; the mandibles are shorter and more arched, and the maxillæ have no terminal acute hook. The species of this genus are peculiar to North America, and are of a tolerably large size, averaging about one inch in length.

Dejean separates from *Scarites*, under the generic name *Oxygnathus*, the *S. elongatus* of Wiedemann, which differs in having the mandibles more slender and elongated, and destitute of teeth on the inner side. The only known species is found in the East Indies; it is of a very narrow form.

Camptodontus is another genus founded by Dejean upon a single species. In this insect the labial palpi are decidedly shorter than the external maxillary palpi; and, like them, are terminated by a spindle-formed joint; the basal joint of the antennæ is scarcely longer than either of the following joints. It inhabits Guyana.

The genus *Acanthoceles* is established by Latreille upon a singular insect found at the Cape of Good Hope; it is of a short and broad form, and has the anterior tibiæ still more strongly notched than in the species of *Scarites*; the tibiæ of the middle and hinder pair of legs are stout, curved, and concave on the inner side, and very rough and covered with short spines on the outer side. The thorax is broader than long, and the elytra are almost equal in length and width, distinctly striated, and rounded at the apex. This insect is of a black colour (as are almost all the *Scaritidæ*), and about three-quarters of an inch in length.

The species of *Clivina* are of small size, averaging about a quarter of an inch in length, and nearly cylindrical form. The basal joint of the antennæ in these insects is scarcely longer than the others, the mandibles are comparatively short, and the terminal joint of the palpi is pointed. They are found nearly all over the world; they live under stones, and frequent damp situations.

In the genus *Dischirius* the species also have a wide geographical range, and are of small size; indeed the smallest of the present family: they are very nearly allied to *Clivina*, but are almost invariably adorned with metallic colours, usually brassy-green. The terminal joint of the labial palpi is proportionately stouter than in *Clivina*; the thorax usually approaches to a spherical form, and the tibiæ are less strongly notched. Numerous species of this genus are found in England, the largest of which is less than a quarter of an inch in length. They are always found on the wet mud on the margins of ponds and such places.

SCARUS. [LABRIDÆ.]

SCAUP-DUCK. [DUCKS.]

SCELIDOSAURUS. [*See* SUPPLEMENT.]

SCELIDOTHE'RIUM. [MEGATHERIDÆ.]

SCELO'TES. [SCINCIDÆ.]

SCEPA'CEÆ, a small natural order of Plants belonging to the rectembryose group of Incomplete Exogens. The plants of this order are trees having alternate coriaceous leaves, with membranous stipules, which form the scales of the bud. The flowers are diœcious; the males are arranged in catkins, the females in short axillary racemes. The calyx is inferior, 4-, 5-, 6-leaved, in one or two whorls; stamens 2-5, with 2-celled anthers; ovary with 2 cells, in each of which there are 2 ovules; no style; stigma with 2 short emarginate lobes or 4-fringed ones; seeds single or two, enveloped in a succulent aril; embryo green, in the axis of albumen. These plants are allied to *Cupuliferæ* and *Betulaceæ* in their amentaceous flowers, but their arillate albuminous seeds and dehiscent 2-celled pericarp distinguish them from these as well as any other orders to which they may seem to have relation. They are natives of the tropical parts of India. The wood of one of the species, *Lepidostachys Roxburghi*, or Kokra, is used in India for various economical purposes on account of its hardness.

SCHEELITE. [TUNGSTEN.]

SCHELLY, a local name for Gwyniad, the *Coregonus fera*.

SCHELTOPUSIK. [ZONURIDÆ.]

SCHERERITE, or SCHEERERITE, a Mineral occurring in acicular crystals and small translucent layers. Colour white or yellowish-white. Lustre pearly. Devoid of taste or smell; is very friable. It melts at 112° Fahrenheit, and distils at 194°. It is insoluble in water and alkaline solutions, and in alcohol unless it be heated, but it dissolves in ether and oil of turpentine. When exposed to fire it inflames, and is entirely dissipated, with a somewhat aromatic smell.

It occurs in beds of lignite at Uznach, near St. Gall in Switzerland and also at Bagh in the same country.

According to Macaire Prinsep it contains—

Hydrogen	24·0
Carbon	73·0
	——97·0

SCHEUCHZER'S MAN. [AMPHIBIA.]

SCHEUCHZERIA, a genus of Plants belonging to the natural order *Alismaceæ* and the sub-order *Juncagineæ*. The perianth is composed of 6 leaves; it has 6 stamens with slender filaments. The ovaries

with 2 ovules. The stigma adnate to the ovary and downy. The capsules compressed and inflated, 1-2 seeded.

S. palustris is the only known species of this genus. It has a stem from 6 to 8 inches high, the leaves are distichous, few, alternate, semi-cylindrical, obtuse, and with a minute pore on the upper side at the apex. The raceme is terminal, and consists of about five greenish flowers. The capsules about three, and much inflated. It is found in England and Scotland in bogs.

(Babington, *Manual of British Botany.*)

SCHIEFER SPAR, Slate Spar, Foliated Carbonate of Lime, a Mineral occurring massive. Its structure is laminar, the laminæ being thin and generally curved, wavy or undulating. It yields easily to the knife. Its colour is white, reddish, yellowish, or greenish. Streak white. Lustre pearly on the surface of the laminæ, and vitreous on the edges. Translucent. Specific gravity 2·740. It is almost entirely soluble in acids with effervescence. It occurs in Cornwall, Scotland, and Ireland. It has the following composition: —

	Suersee.	R. Phillips.
Carbonate of Lime	95·33	93·118
Silica	1·66	00.050
Oxide of Iron	1·00	00·800
Water	2·00 Water and loss	1·032
	99·99	100·00

SCHILLER SPAR, a Mineral occurring crystallised. Its primary form an oblique rhombic prism. Cleavage parallel to the lateral planes and both the diagonals. Fracture uneven. Hardness, scratches calcareous spar, is scratched by quartz. Colour olive, blackish, grayish, yellowish-green. Lustre metallic. Nearly opaque; translucent on the edges. Specific gravity 2·692.

When exposed to a strong heat it becomes hard, and forms a mass resembling porcelain.

Found at Baste in the Harz, at Zöbletz in Saxony, in Piedmont, Cornwall, &c. It occurs generally in Serpentine.

An analysis of the mineral from Baste by Vauquelin gives—

Silica	62·00
Alumina	13·00
Magnesia	10·00
Lime	0·00
Oxide of Iron	13·00
	98·00

SCHIST, an Argillaceous Rock of a coarse laminated structure. [Slate.]

SCHIZANDRA (from σχίζω and ἀνὴρ), a genus of Plants belonging to the natural order *Schizandraceæ*. The flowers are monœcious; sepals 9; no petals; the male flowers having 5 anthers, which are joined at the apex; female ones with an indefinite number of ovaries; berries arranged in spikes along an elongated receptacle.

S. coccinea, the Scarlet Schizandra, is one of our most beautiful greenhouse climbers. It has alternate oval-lanceolate leaves, pointed at both ends, rarely toothed, of a beautiful green, smooth above, and pale beneath; scarlet flowers disposed in spikes in the axils of the leaves. It is a North American plant, and is found in woods in Georgia, Florida, and Carolina.

SCHIZANDRACEÆ, a natural order of Exogenous Plants, consisting of trailing shrubs, with alternate exstipulate leaves, allied to *Anonaceæ*, but differing in their habit, their unisexual flowers, their imbricate æstivation, and their homogeneous albumen. The stamens are often monadelphous, and the fruit consists of numerous baccate carpels. There are twelve known species, which occur in India, Japan, and the hotter parts of North America. They abound in an insipid mucus, and the fruit of some is edible. (Balfour, *Class-Book of Botany.*)

SCHIZOCARP. [Fruit.]

SCHIZODESMA (Gray), a genus of *Mollusca* belonging to the family *Mactridæ*.

SCHIZODON. [Hystricidæ.]

SCHI'ZODUS (Sowerby), a genus of Fossil *Conchifera*.

SCHIZO'PODA. [Stomapoda.]

SCHIZO'PTERIS. [Coal-Plants.]

SCHIZO'STOMA (Brown), a genus of Fossil *Gasteropoda*.

SCHLEICHE'RA, a genus of Plants belonging to the natural order *Sapindaceæ*. It has a 5-toothed calyx. Petals absent; the disc occupying the bottom of the calyx. The stamens 6-10, inserted between the margin of the disc and the ovary. The ovary is 3-celled, with one erect ovule in each cell. The stigma 3-cleft. The fruit is an indehiscent drupe, with 1, 2, or rarely 3 cells. The seeds are solitary in each cell, and covered with a pulpy arillus; the embryo much curved. The species are trees; the leaves abruptly pinnate, the leaflets nearly opposite. The flowers are small, disposed in spike-like racemes.

S. trijuga has abruptly pinnate leaves from 8 to 16 inches long, the leaflets 2-4, opposite, sessile, broad, lanceolate, or oblong-entire, rather smooth on both sides the lower pairs, the smallest from 3 to 8 inches long. The petioles are a little downy, the stipules wanting. The racemes are axillary, or below the leaves round the base of the young shoots, solitary, in the male simple, in the hermaphrodite often compound, from 2 to 4 inches long. In the male flowers the calyx is cup-like, and 5-toothed. The corolla wanting, the filaments 6-10, erect, and many times longer than the calyx. The anthers oval and erect; the pistil a mere rudiment. The hermaphrodite flowers on a separate tree. The calyx, corolla, and stamens as in the male flower. The disc a fleshy yellow ring, surrounding the insertions of the filaments. The ovary superior, ovate, 3-celled, with one ascending ovule in each cell. The style short, stigma 3-cleft, recurved, slender, and downy. The drupe about the size of a nutmeg, a little pointed, covered with a tender gray dry pericarp. The seeds are oblong, and surrounded with a whitish pulpy aril, which is of a pleasant acid taste, and most grateful during dry weather. It is a native of insular and continental India, where the astringent bark, mixed with oil, is used as a remedy for the itch.

(Lindley, *Flora Medica;* Lindley, *Vegetable Kingdom.*)

SCHMIEDELIA (in honour of Casimer Christopher Schmiedel, once a professor at Erlangen), a genus of Plants belonging to the natural order *Sapindaceæ*. It has a 4-parted unequal calyx, 4 petals, the 5th or superior one wanting. The disc incomplete, with 4 glands opposite the petals, 8 stamens inserted in the receptacle, and connate around the ovary at the base. The fruit is indehiscent, 1-, 2-, or rarely 3-lobed. The lobes roundish, fleshy, or dry, and 1-seeded. The seeds with or without an arillus. The species are trees or shrubs, usually with trifoliate, rarely with simple exstipulate leaves, and racemose white flowers. The racemes are axillary.

S. serrata has ternate leaves, the leaflets ovate, pointed, serrate, generally blistered, smooth on the back, and from 2 to 3 inches long. The racemes axillary, single, and erect. The flowers small, white, and polygamous. In the hermaphrodite flower the calyx is 4-leaved, and the petals 4, unilateral. The filaments very woolly near the base. The fruit is small, red, and succulent, and is eaten by the natives of Coromandel. The root is astringent, and is employed by the native practitioners in diarrhœa.

S. Cochinchinensis has its leaves on long petioles, with serrated leaflets, terminal racemes, pilose small petals. The flower is small and white. It is a native of Cochin China, on the banks of rivers. The leaves are used as cataplasms in contusions.

(Don, *Dichlamydeous Plants;* Lindley, *Flora Medica.*)

SCHOBE'RIA, a genus of Plants belonging to the natural order *Chenopodiaceæ*. It has a 5-parted perianth, without appendages, 5 stamens springing from the receptacle, and from 2 to 3 stigmas. The pericarp is membranous, the seed horizontal, the testa crustaceous.

S. fruticosa has an erect shrubby stem, with obtuse semi-cylindrical leaves, 3 styles, and smooth shining seeds. It is found on the south and east coasts of Great Britain.

S. maritima is found on the sea-shore in England. It has a procumbent stem, with numerous spreading branches, acute-semicylindrical leaves, 2 styles, with reticulate, striate shining seeds.

(Babington, *Manual of British Botany.*)

SCHŒNANTHUS. [Spikenard.]

SCHOENUS, a genus of Plants belonging to the natural order *Cyperaceæ*. The spikelets are 2-ranked, 2-4-flowered. The glume 6-9, the lower one small and empty. Bristles few or wanting.

SCHŒPFIA, a small genus of Plants belonging to the natural order *Loranthaceæ*, named after Schöpf, a German botanist, who described the plants in the neighbourhood of Ulm. The genus is characterised by having the flowers hermaphrodite, margin of the calyx entire, tube adnate to the ovary, very narrow, caliculate at the base. Corolla tubular, united into one piece; limb 5 rarely 4-6 cleft. Stamens equal in number to the lobes of the corolla, and inserted before them into the tube of the corolla. Anthers ovate or roundish, dehiscing laterally by a double chink; style erect; stigma capitate or 3-lobed; ovary 3-celled, with an ovule in each. Leaves alternate, petiolate, entire, feather-nerved. Peduncle axillary, usually many-flowered. The genus *Schœpfia* is found in the West Indies and in the Andes of Peru, also in the Pundua Mountains near Lower Assam, and in Nepaul, thus being common to both the Old and New World.

SCHORL. [Tourmaline.]

SCHORLOMITE. [*See* Supplement.]

SCHREIBERSITE. [Aerolites; Supplement.]

SCHRÖTTERITE, a Mineral resembling *Allophane*.

SCLÆNIDÆ, a family of Acanthopterygious Osseous Fishes, of which the genus *Sciæna* is the type. They are closely allied to the Perches, and resemble them in their general characters, but differ in having no teeth on the vomer and palatines. The preopercle is denticulated; the operele is armed with spines; the bones of the face and head are often cavernous, forming a protruding snout.

The *Sciænidæ* are divided into those having two dorsal fins and such as have only one. A single species of *Sciæna*, the Maigre (*S. aquila*), occasionally wanders from the seas of southern Europe into our own. *Umbina vulgaris* is common on the coasts of Italy, France, and Spain, but not on our own. *Hæmulon*, *Pristoma*, *Diagramma*, and *Amphiprion* are some of the many genera belonging to this family.

SCLÆNU'RUS. [Fish.]

SCILLA, or SQUILLA, a genus of Plants belonging to the natural order *Liliaceæ*. It has 3 sepals coloured and spreading; petals very like them, and scarcely broader; stamens 6, shorter than the perianth, filaments smooth, somewhat dilated at the base, acuminate, entire

ovary 3-parted, glandular, and melliferous at the apex; style smooth, simple; stigma obscurely 3-lobed, papillose; capsule rounded, 3-cornered, 3-celled; seeds numerous, in two rows, flattened with a membranous testa.

S. maritima, Squill, is found near the coast of the Mediterranean, in Portugal, and the Levant. It has a roundish ovate very large bulb, between globose and ovate, half above the ground, with the integuments either pale-green or red; leaves appearing long after the flowers, broad, lanceolate, channelled, spreading, recurved; scape about two feet high, terminated by a rather dense, long, ovate raceme; flowers about three-quarters of an inch across, spreading, pale yellowish-green, with a green stain along the middle of each segment; filaments shorter than the segments of the perianth. The bulbs contain *Scillitin*, a very active medicinal agent. They are very acrid, and capable of vesicating. Squills are used as an emetic and expectorant.

S. Pancrateon is found near Cadiz, at Malta, and probably other parts of the Mediterranean. The bulb is about half the size of the last species, pale-green or whitish-green, occasionally red. The leaves much shorter, more acute, erect, and narrower; stem more glaucous. Flowers smaller, more compactly arranged, with shorter bracts; flower-stalks shorter; flower-bud more blunt. In its effects this species is like the former, but milder.

S. Indica is found on the sandy shores of various parts of India. It has a round white perennial bulb, tunicated, about the size of a large apple; leaves numerous, radical, sub-bifarious, ensiform, nearly flat, smooth on both sides, from 6 to 18 inches long. When in blossom the plant is perfectly destitute of leaves; scape erect, round, smooth, naked, including the raceme from 2 to 3 feet long; raceme very long, erect; flowers remote, long, pedicelled, drooping. This species is supposed by Dr. Roxburgh to possess the same qualities as *S. maritima*.

(Lindley, *Flora Medica*.)

SCINCIDÆ, SCINCOIDIANS, or LEPIDOSAURS, the names given by Gray, Oppel, Fitzinger, and Messrs. Duméril and Bibron to a family of Saurians.

This family, observe Messrs. Duméril and Bibron, seems to establish a sort of connection with or transition to the great division of Serpents, by the intervention of certain species, such as those of *Anguis* and *Acontias*. It is, they remark, a group of Lizards, whose numerous races are found spread over the most arid regions of temperate climates, as well as those where the temperature is always very high.

They join to the general character of the Saurians many peculiarities which distinguish them from the other families of that order. Thus, their cranium is covered with great plates, joined together at their edges, most frequently angular, whose sutures or lines of junction always remain distinct. Their trunk is completely covered with scales, more or less large and solid, of variable form, but always disposed like a coat of mail, placed quincuncially, and overlapping each other like tiles or slates, nearly like those of the greater part of the osseous fishes. The *Scincidæ* have besides the tongue free, fleshy, not of much thickness, slightly notched at the point, and covered totally or partially with scaly papillæ. Their belly is cylindrical, without lateral folds, and covered with scales, having the same disposition, and, in general, the same form as those of the back.

All these characters suffice to distinguish the *Scincidæ* from the whole of the other families. The great angular plates which are applied on the bones of the head and face are never seen in the *Chameleonidæ*, the *Geckotidæ*, the *Crocodilidæ*, the *Varanidæ*, nor in the *Iguanidæ*. They are, it is true, found in the *Lacertidæ* and in the *Chalcididæ*, but the first have always the scales of the belly different from those of the upper part of the trunk, and in the others, besides the disposition of the horny lamellæ so as to form verticillations or transverse rings, there is most frequently a fold on their sides throughout their length, from the cranium to the origin of the tail.

The form and the mode of insertion of the tongue, which in one part is free, or not attached by its circumference to the concavity of the lower jaw, serve to distinguish the *Scincidæ* from the Crocodiles; on the other hand, as the tongue of the *Scincidæ* cannot be withdrawn into a sort of sheath, this conformation removes them from the Chameleons, which have the tongue very long, cylindrical, and terminated by a concave and viscous tubercle. The same conformation serves to separate the *Scincidæ* from the *Varanidæ*, which have this organ endowed with capability of re-entering into a sheath, at the same time that its free extremity is deeply divided into two points. Finally, the tongue of the *Scincidæ* is not free, or disengaged from adhesion at its point only, as in the *Geckotidæ* and the *Iguanidæ*. The lateral walls of the trunk are not hollowed with a longitudinal furrow, as in the *Chalcididæ*, and the skin of the belly below is not furnished with plates with four principal faces, or with quadrilateral scales more or less elongated, and larger than those of the back, as may be observed in the True Lizards.

Messrs. Duméril and Bibron thus sum up the essential characters of the Reptiles which compose this family:—

1. Head covered above by horny plates, which are delicate, angular, and opposed to each other (affrontées) by their faces (pans) in a singular manner.
2. Neck of the same form and size as the breast.
3. Trunk and limbs entirely clothed with imbricated scales, with many faces (pans), most frequently widened, and with the border slightly rounded, disposed quincuncially, back rounded, without crests or elevated spines, belly cylindrical, without any groove or lateral furrow.
4. Tongue free, flat, without a sheath, slightly notched in front, the surface covered entirely or partially with papillæ, ordinarily all in the form of scales, but occasionally some are squamiform and others filiform.

Cocteau presented in 1837 to the French Academy his great table of the classification of this extensive group. These 'Tabulæ Synopticæ Scincoideorum' formed the prodromus only of an extensive work undertaken for the classification of the species which belong to three of the tribes of the family which Cocteau named Cyprilepids, or those covered with scales after the manner of a carp.

Messrs. Duméril and Bibron give the following synoptical analysis of this great work:—

Tetradactylus, Seps, Siaphos, Heteromeles, Chelomeles.

- CYPRILEPIDS
  - Podotes
    - Tetrapodes
      - Sauropthalmes.
      - Ophiopthalmes.
      - Typhlophthalmes
    - Apodes
      - Dipodes
        - Popodes.
        - Hysteropodes.
- SAUROPHTHALMES
  - Saurotites
    - Teleodactyls
      - Scincoids — *Scincus.*
    - Ateleodactyls
      - Heterodactyls
        - *Hetreropus.*
        - *Champsodactylus.*
      - Omodactyls
        - *Tetradactylus.*
        - *Tridactylus.*
  - Ophiotites — *Acontias.*
- OPHIOPHTHALMES
  - Saurotites
    - Teleodactyls — *Ablepharis.*
    - Ateleodactyls
      - Heterodactyls
      - Omodactyls
        - *Gymnophthalmus.*
  - Ophiotites
    - Omodactyls
      - Heterodactyls — *Lerista.*
- TYPHLOPHTHALMES.

Messrs. Duméril and Bibron, like Cocteau, divide their Scincoidians or Lepidosaurs into three great divisions:—1, Sauropthalms; 2, Ophiophthalms; and 3, Typhlophthalms; with the following genera, which are subdivided according to the conformation of the feet, toes, tail, rostral plate, muzzle, teeth, nostrils, and tongue:—

1. Sauropthalms.—*Tropidophorus, Trachysaurus, Cyclodus, Scincus, Sphenops, Gongylus, Diploglossus, Amphiglossus, Heteropus, Champsodactylus, Tetradactylus, Hemiergis, Seps, Nessia, Heteromeles, Chelomeles, Brachymeles, Brachystopus, Evesia, Scelotes, Prapeditus, Ophiodes, Anguis, Ophiomorus, Acontias.*
2. Ophiophthalms.—*Ablepharus, Gymnophthalmus, Lerista, Hysteropus, Lialis.*
3. Typhlophthalms.—*Dibamus, Typhline.*

The following is Dr. J. E. Gray's arrangement of the genera of his family *Scincidæ*:—

I. Scales thin, smooth, not striated nor keeled. Nostrils in a single smooth plate, without any lunate groove behind. Tail round, tapering, unarmed.

A. Toes depressed, fringed on the sides. Head wedge-shaped. Rostral depressed, keeled in front. Nostril in the middle of the upper edge of the nasal, with a triangular supranasal above the rostral. *Scincina.*

1. *Scincus.*—Body fusiform, flat below. Toes 5-5.

B. Toes compressed, simple. Head subquadrangular. Rostral erect, triangular. Nostril in the middle of a shield.

a. Supranasal plate none.

* Body fusiform. Lower eyelid covered with scales; fronto-parietals, two.

2. *Hinulia.*—Head subquadrangular. Heel surrounded with granules.
3. *Keneuxia.*—Head depressed in front. Rostral and labials low. Heel with a flat oval plate behind.
4. *Elania.*—Head conical. Rostral rather produced. Heel surrounded with granules.

** Body fusiform. Lower eyelid with a transparent disc.

5. *Mocoa.*—Rostral erect, triangular. Palate toothless.
6. *Lepidopisma.*—Rostral erect, triangular. Palate toothed. Parietal plates 2, large, square.
7. *Lipinia.*—Rostral depressed, large. Head flattened. Nasa lateral, square.

*** Body and tail cylindrical, elongate. Limbs 4, weak, far apart. Rostral erect, rounded. Fronto-nasals distinct.

† Toes elongate, unequal.

8. *Lygosoma.*—Toes 5-5. Lower eyelid scaly.
9. *Rustella* (?).—Toes 4-5. Lower eyelid —— (?) Supranasal —— (?).
10. *Tetradactylus.*—Toes 4-4, the third longest, the fourth short. Lower eyelid transparent.
11. *Hemiergus.*—Toes 3-3, unequal, middle one rather longest. Lower eyelid transparent.

12. *Chelomeles.*—Toes 2-2, unequal. Lower eyelid transparent.

†† Toes short, thick, subequal.

13. *Omolepida.*—Toes 5-5, rather short, subequal. Lower eyelid scaly. Ear deep, simple in front.

14. *Podophis.*—Toes 5-5, short, subequal. Lower eyelid scaly. Frontoparietal single.

**** Body and tail cylindrical, elongate. Limbs rudimentary or wanting. Rostral rather produced; frontonasal very small, lateral. Head half conical.

15. *Siaphos.*—Legs 4. Toes 3-3, very short, the middle longest.

16. *Rhodona.*—Legs 4; fore legs rudimentary, undivided, clawless; hinder with 2 short, unequal, clawed toes.

17. *Soridia.*—Legs none.

b. Supranasal plates 2, rarely 4 or 6.

* Body fusiform. Tail tapering. Limbs strong. Supranasals 2.

18. *Plestiodon.*—Lower eyelid scaly. Scales large. Body fusiform. Palate toothed. Frontoparietal double.

19. *Eumeces.*—Lower eyelid scaly. Scales large. Body and tail elongate. Palate toothless. Frontoparietal double.

20. *Otosaurus.*—Lower eyelid scaly. Scales small. Body fusiform. Palate toothless. Frontoparietal double.

21. *Mabouya.*—Lower eyelid transparent.

** Body and tail elongate, subcylindrical. Legs 4, short. Toes compressed, unequal. Supranasal 1 pair.

22. *Riopa.*—Toes 5-5, unequal.

23. *Hagria.*—Toes 5-4, unequal.

24. *Chiamela.*—Toes 4-4, unequal.

*** Body and tail elongate, subcylindrical. Legs 4, very short. Toes very short, subequal or rudimentary. Supranasals 1 pair.

25. *Senira.*—Toes 5-5, rounded, thick, very short.

26. *Brachymeles.*—Fore feet very short, with two very short toes; hinder tapering, undivided.

**** Body and tail elongate, subcylindrical. Legs 2, posterior, or none. Supranasals 2 or 3 pair.

27. *Ophiodes.*—Legs 2, on side of vent, undivided.

28. *Anguis.*—Legs none external.

II. Scales thick, bony, rugose, striated, or 1 or more keeled. Rostral rounded in front. Body fusiform. Limbs 4, strong. Toes 5-5, compressed.

C. Tail compressed, keeled above. Scales of the tail keeled, spinose, of the body smooth. Head-shields rugose, closely applied to the skull. Temples shielded. Lower eyelid scaly. Preanal plates few, large.

29. *Tribolonotus.*—Tail with 4 spinose keels above, and spinose on the sides. Preanal plates 2, large.

30. *Tropidophorus.*—Tail with 4 spinose keels above, smooth on the sides. Preanal plates 3, large, central triangular.

31. *Norbea.*—Tail with 2 close rows of keeled scales above, smooth on the sides. Preanal plates single, square, very large.

D. Tail rounded, tapering, rarely spinose, not keeled above, thick, bony, rugose, or 3 or 5 keeled, rarely smoothish.

* Supranasal shields none.

† Lower eyelid scaly. Toes 5-5. Nostril with a curved groove behind it.

§ Toes short, thick, subequal. Scales rugose, unarmed. Orbit with a series of plates beneath.

32. *Trachydosaurus.*—Tail short, thick, depressed, truncated. Body fusiform. Scales very thick, rugose. Ears lobed in front.

33. *Cyclodus.*—Tail moderate, round, tapering. Body fusiform. Scales moderate, subequal. Ears lobed in front.

§§ Toes elongate, compressed, unequal. Scales 1-5-keeled. Orbits simple.

34. *Silubosaurus.*—Tail short, depressed, spinose. Scales 1-keeled.

35. *Egernia.*—Tail elongate, round, tapering, spinose. Scales 1-keeled. dagger-pointed.

36. *Tropidolepisma.*—Tail elongate, round, tapering, armed. Scales 3- or 5-keeled, slightly toothed behind. Frontal short.

37. *Lardella.*—Tail elongate, tapering, unarmed. Scales 2-keeled. Frontal very long.

†† Lower eyelid scaly. Toes 5-5. Nasal plate flat, without any groove behind it.

38. *Ateuchosaurus.*

††† Lower eyelid transparent. Toes 4-5. Nasals —— (?).

39. *Heteropus.*—Tail and body elongate, subcylindrical. Scales 3-keeled. Legs weak. Ears —— (?).

** Supranasals 1 pair. Scales moderate, 3-5-keeled. Palate toothed.

40. *Dasia.*—Lower eyelid scaly. Toes dilated at the base.

41. *Tiliqua.*—Lower eyelid scaly. Toes compressed the whole length.

42. *Euprepis.*—Lower eyelid transparent. Ears oblong, lobulated in front, or covered with the scales of the temple. Toes compressed the whole length.

E. Tail round, tapering, unarmed, not keeled above. Scales minutely striated, and sometimes 1-keeled. Supranasals 2 pair.

43. *Microlepis.*—Body fusiform. Head depressed. Tail elongate, compressed.

44. *Celestus.*—Body fusiform. Tail tapering. Head depressed. Internasal and frontonasal united into 1 shield. Claws short.

45. *Camalia.*—Body fusiform. Tail tapering. Head square. Internasal and frontonasal separate. Claws broad, blunt.

46. *Diploglossus.*—Body and tail cylindrical, elongate.

The species of this family are spread over nearly the whole world, but they are found in greatest abundance in Australia. The locality of certain *Scincidæ* is far from being limited to any particular country of the globe: *Gongylus ocellatus, Seps chalcides, Anguis fragilis,* and *Ophiomorus miliaris* live in the south of Europe and in the north of Africa. The *Plestiodon quinquelineatum,* which was believed to be peculiar to North America, is found also in Japan; the *Lygosoma Quoyi, L. Labillardieri,* and many species of *Eumeces* are races common to Oceania and Australia; and, what is still more worthy of the attention of naturalists, *Ablepharus Kitaibelii* exists in Hungary, Greece, and Australia, whilst *A. Peronii* is found in both the two last countries equally, and also in the Mauritius and South America.

Europe possesses *Gongylus ocellatus, Seps chalcides, Ablepharus Menestriesii, A. Kitaibelii,* and *A. Peronii, Anguis fragilis,* and *Ophiomorus miliaris.*

Africa, with all these species except *Ablepharus Menestriesii* and *A. Kitaibelii,* produces 18 others, among which *Amphiglossus Goudotii* is a native of Madagascar, and *Ablepharus Peronii* and *Leiolopisma Telfairi* are natives of the Mauritius.

Seventeen species are peculiar to Asia, and three others, one of which is also found in America and the other two in Polynesia.

Fourteen Scincoidians are natives of America, and of America only; and there are two others, one of which, *Plestiodon lineatum,* also inhabits Asia, and the other, *Ablepharus Peronii,* Europe, Africa, and Australia.

Polynesia possesses 36 species, peculiar to itself, and to these must be added *Ablepharus Kitaibelii,* which is found also in Europe and in Asia; *A. Peronii,* which occurs also in Asia, Africa, and America; and *Lygosomata Quoyi* and *L. Labillardieri,* which belong also to Asia.

There is not a single Scincoidian whose geographical range is confined to Europe.

The genera *Scincus, Sphenops, Amphiglossus, Leiolopisma, Brachystopus, Scelotes, Acontias,* and *Typhline,* are peculiar to Africa; and *Tropidophorus, Champsodactylus,* and *Brachymeles,* to Asia. The genera *Diploglossus, Ophiodes,* and *Gymnophthalmus,* are composed of American species exclusively; and *Tropidolopisma, Cyclodus, Trachysaurus, Heteropus, Tetradactylus, Hemiergis, Chelomeles, Nessia, Evesia, Præpeditus, Hysteropus, Lialis, Lerista,* and *Dibamus,* belong to Polynesia.

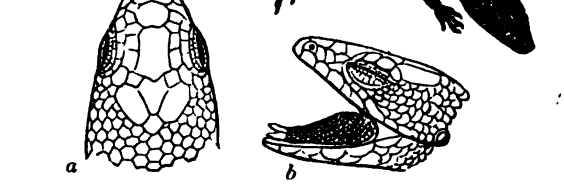
The sub-genus *Gongylus,* as well as the genera *Seps, Anguis,* and *Ophiomorus,* are common to Europe and Africa. *Eumeces* and *Lygosoma* are spread over Asia, America, and Polynesia. *Euprepes* is found in Africa, Asia, and Polynesia; *Plestiodon* in Africa, Asia, and America and *Ablepharus* in Europe, Asia, Africa, America, and Polynesia.

We now proceed to illustrate some of the forms of this numerous group, from the division of Saurophthalms.

Tropidophorus, Dum. and Bibr. (*Leposoma,* Cuv., not Spix).

T. Cocincinensis. Upper part of the body brown-yellow, or inclining to olive, banded on the neck and back with much deeper brown, disposed so as to represent great ⋈ placed one after the other. On the tail are spots, more or less large, of deep brown; and there is a row of whitish points along the lower region of the sides.

It is a native of Cochin China. (Dum. and Bibr.)



Tropidophorus Cocincinensis.

a, Head, seen from above; *b*, profile; mouth open to show the tongue.

Scincus. Fitzing.

S. officinalis, the Common Skink. Messrs. Duméril and Bibron remark that this species includes three varieties, which are very distinct in the colouring of their upper parts; for in all cases the lower and lateral regions, that is to say, the cheeks, the sides of the neck, those of the tail, as well as the sides, and very often the limbs, are of a silvery-white, more or less pure.

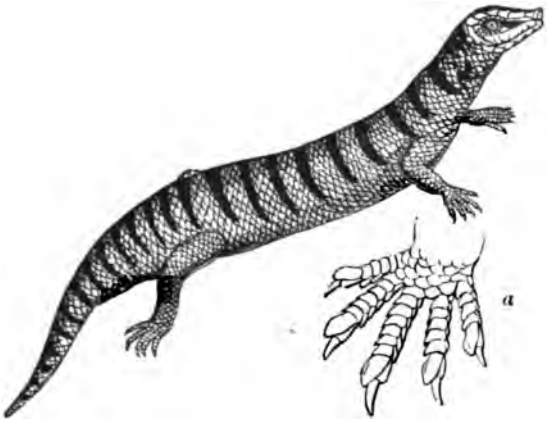
a. General colour of the neck, back, and tail, yellow, or clear silvery-gray, mixed with brown or blackish, which forms great spots dilated transversely, most frequently putting on the shape of transverse bands, the number of which is commonly seven or eight.

b. A yellow tint spread over the surface of the cranium. Neck, back, and a great part of the tail, chestnut-brown, sprinkled with very small obscure whitish spots, two or three on each scale. Across the back five or six large white bands, with an irregularly dilated black spot at each of their extremities. These spots are not situated on the back, but on the most elevated part of the lateral regions of the trunk.

c. All the scales of the neck, back, and first half of the upper surface of the tail, silvery-gray, widely radiated with white, with one or two brown spots on the posterior border of the radiations.

This species appears to be peculiar to Africa, inhabiting the western and northern parts, but particularly the latter. Bruce met with it in Syria and in Abyssinia. M. Rüppell observed it in the last country, and many travellers have seen it in Egypt, whence the greater portion of specimens with which collections are furnished are sent. It is at present rather common in Upper and Middle Egypt, and it appears from Belon and Rondeletius that it was there found abundantly in the 16th century, when it still was an object of commerce. In truth it was one of the most approved remedies in the ancient Pharmacopœias, and was considered a sort of universal medicine, a specific against all kinds of maladies. Pliny ('Nat. Hist.,' xxviii. 8) proclaims the medicinal and renovating powers of the *Scincus*, and quotes Apelles for its efficacy against wounds inflicted by poisoned arrows.

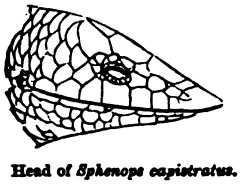
The better opinion seems to be that this is the Σκιγκος of Dioscorides and the *Scincus* of Pliny; and though the descriptions given by the ancients are not sufficiently accurate to enable us to pronounce positively on its identity, enough remains in tracing its history downwards to render it highly probable that such is the fact.



Scincus officinalis. Five-ninths of natural size.
a, fore foot, seen from above.

Sphenops, Wagler.

S. capistratus. Colour ferruginous-gray, more or less yellow, or brownish on the upper parts. From 9 to 13 longitudinal stripes composed of so many successions of black points placed on the lateral borders of the scales. These stripes, which spring on the occiput and the posterior region of the temples, run along the neck, the back, and the tail throughout its whole length, or nearly so. The upper surface of the limbs presents also generally rows of black points. The scales are also fringed with brown. On the sides of the head is a small black band commencing at the nostril, passing upon the eye, traversing the temple, and losing itself upon the neck. The lower parts of the animal are white.



Head of *Sphenops capistratus.*

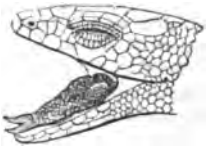
This species is widely spread in Egypt, the only country known to Messrs. Duméril and Bibron where it has yet been found. M. Rüppell and M. A. Lefebvre sent specimens—the last-named traveller the most

abundantly—to France, and M. Lefebvre informed Messrs. Duméril and Bibron that it was very common in the oasis of Bahrieh, at Zabou, Qasr, and Bahoueit. He brought home more than a hundred individuals which he captured himself. Both M. Lefebvre and Cocteau state that the animal only burrows to a small depth, for the slightest disturbance made by the feet of the passer-by discovers its retreat.

Diploglossus, Wiegm. (*Celestus*, part., *Tiliqua*, part., Gray).

D. Sagræ. Form resembling that of *Seps* in the slenderness of the body, the length of the tail, and the shortness of the limbs; colour brown-ash, with metallic reflections on the upper parts of the head, trunk, tail, and limbs, more or less deep in different individuals; of each side of the body a black band which springs on the frenal region, passes on the eye and temple, extends the whole length of the side, and loses itself on the side of the tail, at some distance from its origin; the labial plates are yellowish, bordered with black, and the lower regions have also a yellowish tint, but with silvery reflections.

It is a native of Cuba, where it lives on land in cool places and light and humid lands. It is very quick in its motions.



Head of *Diploglossus Sagræ.* Mouth open to show the tongue.

Gongylus, Dum. and Bibron.

G. ocellatus. The form of this species is heavy and stout, and it varies greatly in colour. Messrs. Duméril and Bibron record five varieties.

It is the *Scincus ocellatus* of authors; *Tiliqua ocellata*, and Lacépède's Galleywasp of Gray.

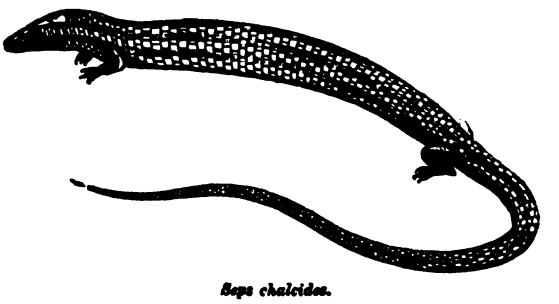
This species is spread over the whole of the shores of the Mediterranean; but it is in Sicily, Sardinia, Malta, Cyprus, and Egypt that it is especially found. Messrs. Quoy and Gaimard captured a specimen in the Isle of Teneriffe, and it is said to have been found in the south of France; but Messrs. Duméril and Bibron are not sure of this.

Dry and slightly elevated spots are chosen by this Skink, and there it hides itself in the sand or under stones. Its food consists of small insects, which it seizes after the manner of the true Lizards. It suffers itself to be caught without defending itself; and though its movements are not so rapid as those of the Lizards, it possesses more agility than its form would lead one to expect.

Gongylus ocellatus. Five-ninths of natural size.

Seps, Daudin (*Zynis*, Oken, Fitzing., Wiegm.

S. chalcides, Bonap. Form slender and serpentine. Messrs. Duméril and Bibron enumerate six varieties. In all of them the lower parts are more or less grayish or whitish.

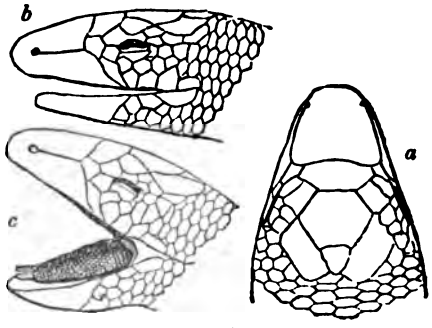


Seps chalcides.

The south of France, Italy, all the islands of the Mediterranean, Spain, and all the Mediterranean shore of Africa, claim this species as a resident. It is viviparous, and lives upon worms, small terrestrial molluscs, spiders, and all kinds of insects.

Acontias, Cuvier.

A. meleagris. It is a native of South Africa; very common near the Cape of Good Hope. [MELEAGRIS; BLINDWORM; SEPSIDÆ.]



Head of *Acontias*.

a, seen from above; *b*, profile; *c*, the same view, with the mouth open to show the tongue.

SCINCOIDÆ, SCINCOIDEA, SCINCOIDEÆ, SCINCOIDIANS. [SCINCIDÆ.]

SCINK, or SKINK. [SCINCIDÆ.]

SCIRPUS, a genus of Plants belonging to the natural order *Cyperaceæ* and the tribe *Scirpeæ*. It has fertile nearly equal glumes; the lower ones are perhaps the largest, and one or two of them empty. The bristles are either absent, or about 6 in number. The nut is plano-convex, or trigonous, tipped with the filiform not dilated base of the style.

S. maritimus has stalked or sessile spikes in a dense terminal cluster, several foliaceous bracts, bifid glumes, with an intermediate point; acute segments and a trigonous smooth nut. The stem is from 1 to 3 feet high, and leafy. It is found in salt-marshes in Great Britain, and is much relished by cattle. Withering says that the roots of this species are esculent, and have been ground down and used instead of flour in times of scarcity.

S. lacustris, Bullrush, has a round stem from 4 to 6 feet high, naked, with one or two long sheaths at the base, the spikes in a terminal twice compound panicle; the glumes are emarginate, mucronate, glabrous, and fringed. The nut obtusely trigonous and obovate; stigmas 3. The panicle is not lateral, although the bract closely resembles a continuation of the stem. It is found in rivers and ponds in England. The root is astringent and diuretic, and was once used in medicine. The leaves are employed for making matting, chair bottoms, and many other domestic purposes.

S. triqueter has a stem acutely triquetrous throughout, flat or concave between the angles, with one or two long sheaths at the base, the upper one terminating in a very broad triquetrous leaf. The spikes are in a small cymose panicle, the glumes emarginate, mucronate, glabrous, and fringed; the lobes rounded-obtuse, and the nut roundish-obovate, plano-convex, and smooth. This species is found on the muddy banks of the Thames, near London, and the Arun, near Amberly, Sussex.

S. Holoschœnus is the Ὁλόσχοινος of Theophrastus.

S. tuberosus is the Pi-Tsi, or Water-Chestnut, of the Chinese, and is cultivated by them for food in large tanks, which are regularly manured and the water at intervals drawn off. The tubers are eaten both raw and cooked, and are esteemed both as food and medicine. There are 14 British species of *Scirpus*, none of which however are worth description on account of any qualities they possess.

(Babington, *Manual of British Botany;* Lindley, *Vegetable Kingdom;* Burnett, *Outlines of Botany.*)

SCISSURELLA. [TURBINIDÆ.]

SCITAMINACEÆ, a natural order of Plants embracing the *Marantaceæ*, with 1 anther-valve, and the *Zingiberaceæ* with 2 anther-valves. The separation of these orders is now generally recognised. [MARANTACEÆ; ZINGIBERACEÆ.]

SCIURIDÆ, a family of Animals belonging to the order *Rodentia* [RODENTIA], and embracing the various forms of Squirrels. It has the following characters:—Molar teeth simple, with tuberculous crowns, five above, four below, on each side; the lower incisors very much compressed. Toes long, armed with sharp claws, four on the anterior and five on the posterior feet; anterior thumb very short. Tail long and tufted. Cheek-pouches in some. In others the skin of the sides extended between the anterior and posterior limbs.

The geographic range of the Squirrels is very wide both in the Old and New World. None appear to have been discovered in Australia.

The *Sciuridæ* have been divided into two principal groups:—

A. Squirrels with free limbs.

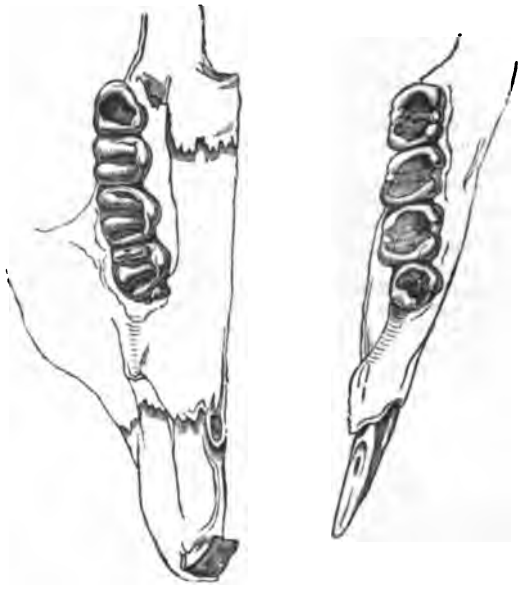
Genera.—*Tamias, Sciurus, Macroxus*, and *Anisonyx*.

B. Squirrels with their limbs invested in the skin of the sides.

Genera.—*Pteromys* and *Sciuropterus*.

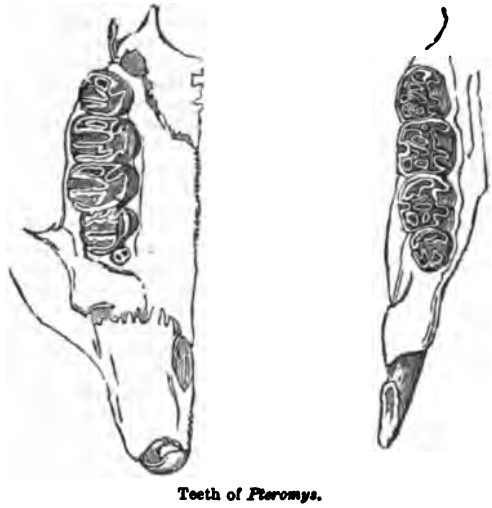
The following dentition is given by M. F. Cuvier for *Tamias, Sciurus, Macroxus*, and *Sciuropterus*:—

$$\text{Incisors, } \frac{2}{2}\text{; Molars, } \frac{5-5}{4-4} = 22.$$



Teeth of *Tamias, Sciurus, Macroxus*, and *Sciuropterus*.

The same author has published the following modification as characteristic of *Pteromys*, the numbers of the teeth being the same with those of the genera above-mentioned.



Teeth of *Pteromys*.

Tamias (Ground Squirrels).—Skull presenting a uniform curved line on its upper part when viewed in profile, and offering, when seen below, a very slender condition of all the anterior parts. Cerebral cavity but little extended, and advancing only to one half of the skull. The species are found in Europe, Asia, and North America.

T. striatus. Upper part of the body yellow-brown, with five brown longitudinal stripes and two white ones on the upper parts; white beneath; lumbar region rusty, as well as the tail, which is blackish above, and bordered with black below. Length rather more than 9 inches, including the tail, which measures about 3 inches.

Pallas states that this Ground-Squirrel burrows in woody districts, in small hillocks, or near the roots of trees; but never makes its nest in the trunks or branches of trees, like the Common Squirrels, although, when frightened from its hole, it climbs with ease, speedily making its way from branch to branch. The nest is reached by a winding tunnel, and there are generally two or three lateral chambers, for the stowage of winter food. It is allied in its habits to the Hamster and *Citillus* (*Spermophilus*), is connected with the latter by the convexity of its nose, and has cheek-pouches; but differs altogether in its manners from the Tree-Squirrels.

Sir John Richardson remarks that the *Sciurus* (*Tamias*) *Lysteri* of Ray, the Hackee of the United States, Ohiboin of the Hurons, Striped Dormouse of Pennant, is considered by the author of the above description, and subsequent writers, to be the same with the Asiatic *S. striatus*; but he adds that the descriptions given of the latter do not exactly correspond with American specimens, and that he is not aware that the identity of the species on the two continents has been established by actual comparison. He allows however that the observations of Pallas regarding the manners and form of the Asiatic animal apply exactly to the American one.

The Hackee, Sir John Richardson states, is common on the north shores of lakes Huron and Superior; but he does not believe that it exists in a higher latitude than the 50th parallel. Although very wild, it is, he says, fond of establishing its abode in the immediate vicinity of man, and multiplies greatly in cultivated places. ('Fauna Boreali-Americana.')

T. Palmarum is the *Mustela Africana* of Clusius; *Sciurus Palmarum* of Linnæus; and Le Palmiste of Buffon. Pennant thus describes the species:—"Squirrel with plain ears; an obscure pale yellow stripe on the middle of the back, another on each side, a third on each side of the belly; the two last at times very faint; rest of the hair on the sides, back, and head, black and red, very closely mixed; that on the thighs and legs more red; belly pale yellow; hair on the tail does not lie flat, but encircles it, is coarse, and of a dirty yellow barred with black. Authors describe this kind with only three stripes: this had five, so possibly they vary." Length about 13 inches, of which the tail measures 6 inches.

Vary they certainly do, for Mr. Bennett has figured two marked varieties in his 'Zoological Gardens.' One was perfectly black, and exhibited no traces of the usual stripes. The other variety had red eyes, and appeared to be an albino: it was of a dull reddish-white, marked with three very faint stripes of a still lighter hue. They were presented to the Zoological Society in 1828.

The Palm Squirrels, which derive their name from being often seen on those trees, are common about Indian towns and villages, dwelling about the roofs of houses and old walls. The female lays her young in holes of old walls. They are great destroyers of fruit, but are very familiar, entering houses to pick up the crumbs. Pennant states that Governor Loten informed him that they lived much in the cocoa-trees, and were very fond of the Sury, or palm-wine, which is procured from the tree; from which it obtained, among the Indians, the name of Suricatsje, or the little cat of the Sury.

T. quadrivittatus, Four-Banded Pouched Squirrel, is the Four-Lined Squirrel of Godman, and Sassacka-Wappiscoos of the Cree Indians. Head long, tapering considerably from the eyes to the end of the nose, which is not however remarkably sharp. Mouth situated far back; whiskers black and rather shorter than the head; eyes small when compared with a true squirrel; ears erect, semi-ovate, obtuse, and flat, except a slight duplicature at the base of the anterior margin; it is covered on both sides with a coat of short hair; cheek-pouches extending to the angle of the jaw. Body more slender than that of the squirrels in general. Five blackish lines and four alternating white ones occupy the whole back; sides reddish-brown, under parts gray: tail long and slender, exhibiting dusky and light-brown colours. Length 9 inches 9 lines; of which the tail measures 4 inches 3 lines.

Sir John Richardson, from whose long and accurate description the above characters are drawn, states that this diminutive Ground-Squirrel is common throughout the woody districts, as far north as Great Slave Lake, if not farther. It is found, he tells us, at the south end of Lake Winipeg, in 50° N. lat., and, within that range, seems to replace *Sciurus Lysteri*. ('Fauna Boreali-Americana.')

Sciurus (True Squirrels). A slight depression of the frontal bones, and a very slight posterior projection of the same; profile of the face very nearly straight; cranial cavity as long as two-thirds of the face. No cheek-pouches. Tail distichous.

The species are found in Europe, Asia, India and Indian Islands, Africa, North America, South America, and West Indian Islands.

S. vulgaris (the Common Squirrel). It is the Ecureuil of the French; Scojattolo, Schiarro, and Schiaratto of the Italians; Arda, Ardilla, and Esquilo of the Spaniards; Ciuro of the Portuguese; Eichhorn and Eichhörnchen of the Germans; Inkhoorn of the Dutch; Ikorn and Graskin of the Swedes; Ekorn of the Danes; and Gwiwair of the Welsh.

The length of the Common Squirrel, including the tail (which last measures about 6 inches 3 lines), is about 14 inches 9 lines. Mr. Bell, after stating that it is liable to considerable variety of colour, becoming gray in the northern regions, and quoting the passage in 'Lachesis Lapponica,' which relates how the inhabitants of the Lapland Alps procure a number of this species in their gray or winter clothing for the sake of their skins, proceeds to remark that even in this country a certain degree of change takes place in the colour of the fur in spring and autumn. Mr. Blyth informed him of this fact. In summer the fur is coarser and more uniformly red, and the pencils of hairs on the ears are lost; in winter a grayish tint appears on the sides, the pencils on the ears are long and well developed, and the fur is softer and fuller. In July, and not till then, the summer change is perfect. It is found generally in Europe and the north of Asia.

"This animal," says Pennant, "is remarkably neat, lively, active, and provident; never leaves its food to chance, but secures in some hollow tree a vast magazine of nuts for winter provision. In the summer it feeds on the buds and young shoots, and is particularly fond of those of the fir and pine, and also of the young cones. It makes its nest of the moss or dry leaves, between the fork of two branches, and brings four or five young at a time. Squirrels are in heat early in the spring, when it is very diverting to see the female feigning an escape from the pursuit of two or three males, and to observe the various proofs they give of their agility, which is then exerted in full force."

S. cinereus, the Gray Squirrel. Ashy-gray on the upper surface and sides, each hair being marked by alternate rings of black and gray. Inner sides of the limbs and under surface of the body pure white. Tail nearly equal in length to the body, and when thoroughly developed, completely overshadowing it. Both surfaces of the tail similar in colour to the back and sides, the under surface being somewhat lighter; the long diverging hairs ringed in such a manner as to give the appearance of an external border of white, inclosing a broad band of grayish-black. No decided tinge of brown on the muzzle, nor on the sides of the body, but a slight intermixture of that colour is visible on the muzzle on close examination. Ears covered with very short close-set hairs, without any appearance of the bushy pencils which surmount those of the Common Squirrel. Size one-third larger than the last-named species. This species is found in nearly the whole of the United States of America. It is most abundant in Pennsylvania and the Carolinas.

The nest of the Gray Squirrel, which swarms in some of the localities where it is found, is made upon the extremities of branches of trees, and its food consists of buds, tender shoots, nuts, acorns, and grain. In winter the provident animal retires to hollow trunks where its stores have been laid up. The fur is sought after in the market, but the gray skins of the Common Squirrel are considered of more value. They are exceedingly destructive to the crops, especially of maize, and were proscribed accordingly. Pennant says that three pence per head was the reward for every one killed, and that such a number was destroyed in one year that Pennsylvania alone paid in rewards 8000*l.* of its currency.

S. niger, the Black Squirrel. "So much confusion," says Sir John Richardson, "has crept into the accounts of the American squirrels, that great uncertainty respecting the species alluded to by authors must exist until some resident naturalist favour the world with a good monograph of the squirrels of that country. The black squirrels have been considered by some to be a variety of the *S. cinereus*, or of the *S. vulpinus*, and by others have been referred to *S. capistratus*. M. Desmarest describes a small black squirrel, which is distinguished from the large black variety of the masked squirrel by the softness of its fur. Pennant's black squirrel is evidently the *S. capistratus* of later writers."

The Black Squirrel, is larger than the Ecureuil Gris de la Caroline of M. F. Cuvier (Lesser Gray Squirrel; Pennant, 'Hist. Quad.'), and rather smaller than the Large Gray Squirrel of Catesby. It is not an uncommon inhabitant of the northern shores of lakes Huron and Superior, where the greater and smaller Gray Squirrels are never seen, and is by far the largest squirrel existing on the eastern sides of the Rocky Mountains to the northward of the Great Lakes.

It is stated that the Gray Squirrel and Black Squirrel make excellent pies; the flesh tastes like that of the rabbit, but much more juicy. The Gray Squirrel is a common dish in Virginia. It is usually broiled, and is very palatable.

S. maximus, the Malabar Squirrel. Upper parts and external surface of the limbs bright chocolate-brown, which colour terminates abruptly, and is joined by the pale yellowish-brown on the under parts, fore-arms, and internal surface of the limbs. Front of the fore-legs, neck, throat, face, and head between the ears, lighter in colour: a broad darker patch on the rest of the upper part of the head extends from the forehead to the middle of the nose. Back and shoulders sometimes deepening into black. Ears short, covered with long tufted hairs, and brush-like; from the longer part of each ear a narrow line of deep-brown passes downwards and backwards in an oblique direction. Whiskers scanty, long, and black. Claws incurved and strong, those of the anterior thumbs broad, short, and flattened. Tail distichous, the hairs expanding widely towards the extremity, bright chocolate-brown at the base, black in the middle, and chestnut in the extreme third part. Length about 33 inches, of which the tail measures rather more than one-half. It is a native of the Malabar Coast.

Sonnerat appears to have been the first zoologist who observed this richly coloured species, the largest of the true Squirrels. It haunts among palm-trees, and is stated to be very fond of the milky juice of the cocoa-nut, as well as of the solid part of the nut. In captivity it is tame and familiar; but it tries its teeth upon most substances that come within its power, and should be guarded against accordingly.

S. Getulus, the Barbary, or White-Striped Squirrel; Barbarian Squirrel of Edwards; Le Barbaresque of Buffon. Eyes full and black, with white orbits. Head, body, feet, and tail, cinereous inclining to red: lightest on the legs; sides marked lengthwise with two white stripes: belly white; tail bushy, marked regularly with shades

of black, one beneath the other: size of the Common Squirrel. (Pennant.) It is a native of the north of Africa, especially Barbary, where it lives in trees, preferring those of the Palm tribe.

S. Cepapi. Ochrey-yellow above, slightly marbled with blackish-brown; sides of the body and feet ochrey-yellow; upper lip, superciliary stripe, and lower parts of the body white, belly tinged with yellow; tail distichous, ochrey-yellow varied with blackish-brown; ears short, with obtuse apices, the external margin notched near the point; eyes brown. Figure slender. Head small. Legs long. Tail depressed, narrow, slightly distichous, and pointed at its extremity. The tints vary in different specimens. Length 14 inches 9 lines, the tail being 7 inches long. Female resembling the male in colour and size. (Smith.) It is a native of South Africa.

Dr. Smith, who named this species, and has described and figured it in his 'Illustrations of the Zoology of South Africa,' observed it for the first time upon the immediate banks of the Limpopo River, in about 24° 20′ S. lat. It was occasionally discovered upon the ground, but more frequently upon trees; and when it happened to be surprised in the former situation, it invariably endeavoured to reach the latter, and, if successful, either attempted to conceal itself in the forks of the branches, or in holes, if any existed, in the trunks or other parts. Its flight, when on the ground, was effected with amazing rapidity, and the perpendicular ascent of the tree was accomplished with equal facility. Dr. Smith concludes by stating that it feeds by day, and, according to the natives, also by night, and that in all the specimens he obtained the stomachs were fully distended with berries, &c.

Macroxus.—Frontal bones very much depressed: nasal bones but little elongated; a deep depression between the cranium and the face. Tail round. No cheek-pouches. The species are natives of Sumatra, India, Africa, and South America.

Anisonyx.—Teeth like those of the squirrels. No cheek-pouches. All the feet with five toes; the two internal toes of the anterior feet very short. Claws very long. Tail distichous. A genus, considered as not certain, established by M. Rafinesque for the reception of animals approximating to the Squirrels and the Marmots, from which they differ in the number and form of the toes. The species are natives of Columbia.

Pteromys.—Posterior part of the nasal bones a little convex; the frontal bones strongly depressed in their middle and rising slightly afterwards; the posterior parts of the head do not begin sensibly to curve downwards before the middle of the parietal bones; cerebral cavity small, only half the length of the head. The species are natives of Asia, the Moluccas, the Philippine Islands, and Java.

P. Sabrinus, var. *β. alpinus*, Rocky Mountain Flying-Squirrel. Yellowish brown above; tail flat, longer than the body, blackish-gray; flying membrane with a straight border. Length 14 inches 3 lines;

Rocky Mountain Flying Squirrel (*Pteromys alpinus*), or *Pteromys Sabrinus*, var. *β.* (Richardson, 'Fauna-Boreali-Americana.')

of which the tail, including fur, measures 6 inches 3 lines. This is the *P. alpinus* of Richardson.

Sir John Richardson observes that this animal was discovered by Mr. Drummond, on the Rocky Mountains, living in dense pine-forests, and seldom venturing from its retreats, except in the night. He had received specimens of it from the head of the Elk River, and also from the south branch of the Mackenzie. It approaches, he says, nearer to the *P. volans* of Siberia in the colour of its fur than to *P. Sabrinus*, but it has much resemblance to the latter in its form. It is, he adds, entirely destitute of any rounded process of the flying membrane behind the fore leg, and when its skull is compared with that of *P. Sabrinus*, the frontal bone between the orbits appears narrower. The size of its limbs and tail is also greater.

The habits of these animals are well described by Mr. Bennett in his account of another species. "The group to which this attractive little animal belongs," says Mr. Bennett, in his description of the American *Pteromys Volucella*, "are principally distinguished from the Common Squirrels by what is usually termed their flying membrane. This apparatus consists of a folding of the skin along either side so as to form broad lateral expansions, supported anteriorly and posteriorly by the limbs between which they are extended, and by peculiar bony processes arising from the feet. These expansions are not naked and membranous, like those of the Bats, but are actual continuations of the skin, clothed externally by a dense fur similar to that which invests every other part of the body. Neither do they serve, like the flying membranes of many of the Bats, the purposes of wings; their functions being limited to that of a parachute, giving to the animal a considerable degree of buoyancy, and thus enabling it to take leaps of almost incredible extent, through which it passes with the velocity of an arrow. The name of Flying-Squirrels is consequently founded on an erroneous assumption; but it may nevertheless be admitted as a metaphorical expression of their most distinguishing peculiarity." ('Zoological Gardens.')

Sciuropterus.—Differing from *Pteromys* in having the anterior part of the profile line of the head straight to the middle of the frontal bones, where it takes a curved direction, very much arched, without any intermediate depression. Occiput projecting; frontal bones elongated; and the capacity of the cranium comprising three-fifths of the length of the head. The species are found in Northern Asia and North America.

S. Sibiricus. It is the *Mus Ponticus* vel *Scythicus* of Gesner; *Sciurus Petaurista volans* of Klein; *Sciurus volans* of Linnæus; *Sciurus Sibiricus volans* of Brisson; *Quadrupes volatilis Russiæ* of the 'Acta Petropolitana;' Polatucha and Letaga of the Russians; Polatouche of the French; König der Grauwerke (King of the Squirrels) of the Germans; Wieiviorka Lataica af the Poles; and European Flying-Squirrel and Minene of English authors. Eyes full, the lids edged with black. Membranes extending to the base of the fore feet, and forming a large wing-like expansion on each side. Tail full and rounded at the extremity. Body, above, of a fine gray colour, resembling the hue on the back of a sea-gull; beneath, pure-white. Total length about 9½ inches, of which the tail, measured to the end of the hair, is 5 inches. It is a native of Finland, Lapland, the Russian dominions from Livonia to the river Kolyma, or Kowyona, in the north-east of Siberia.

This species haunts the woody mountainous country, feeding on the buds and fruit of the birch-trees and on the cones of the fir tribe. It is a solitary animal, and does not affect the company of others of its own kind, nor does it retire in the winter, at which season it wanders about. Its dwelling is in the hollows of trees, and its nest is generally made of moss from the birch. It raises the tail when at rest, but when it takes its flying leaps, extends that member.

S. Sagitta (*Sciurus Sagitta*, Linn.; *Pteromys Sagitta*, Geoff.). This seems to be the *Sciurus maximus volans*, seu *Felis volans*, of Brisson; Le Taguan ou Grand Ecureuil Volant of Buffon.

This squirrel has a small rounded head; cloven upper lip; small blunt ears; two small warts at the outmost corner of each eye, with hairs growing out of them; neck short. Four toes on the fore feet; and instead of a thumb, a slender bone, 2½ inches long, lodged under the lateral membrane, serving to stretch it out; thence to the hind legs extends the membrane, which is broad, and a continuation of the skin of the sides and belly; the membrane extends along the fore legs, and stretches out near the joint in a winged form: five toes on the hind feet, and on all the toes sharp compressed bent claws. Tail covered with long hairs disposed horizontally. Colour of the head, body, and tail a bright bay, in some parts inclining to orange; breast and belly of a yellowish-white. Length, from nose to tail, 18 inches; tail, 15 inches. (Pennant.)

This species inhabits Java and others of the Indian Islands. It leaps from tree to tree as if it flew; and will catch hold of the boughs with its tail. It differs in size; that described by Linnæus was the size of our squirrel, whilst that killed by Sir Edward Michelbourne in one of the Indian islands was greater than a hare. Nieuhoff describes this species under the name of the Flying Cat, and says the back is black. He has given two very good figures of it—one in his frontispiece, the other in the page he describes it in. (Pennant.)

In the description of Pennant, above given, there are two points which deserve consideration: that which describes the animal as

catching hold of boughs with its tail, and that which states its difference in size. The first is given on the authority of Sir Edward Michelbourne's voyage, in Purchas's 'Pilgrims,' and should be received with caution. The second would lead to the conclusion that more than one species had been included under the name of the animal now under discussion.

We accordingly find that Dr. Horsfield, in his valuable 'Zoological Researches in Java,' describes two Flying Squirrels (*Pteromys genibarbis* and *P. lepidus*), both nocturnal in their habits, nearly approaching to *S. Sagitta*. He describes the first as living on fruits; the second as found in the closest Javanese forests, where the height of the trees and the luxuriance of the foliage effectually conceal it. Some have thought these two were only one species. In the work last above referred to, Dr. Horsfield has given a 'General Enumeration of Indian Sciuri,' well worthy of the attention of the zoologist. He enumerates 16 species of *Sciuri*, 4 of which were first described by himself. These do not include the Flying Squirrels.

SCLERANTHACEÆ, *Scleranths*, a natural order of Ficoidal Exogenous Plants, consisting of small inconspicuous herbs. Leaves opposite, without stipules. Flowers minute, axillary, and sessile; calyx 4-5-toothed, with a stiff tube; stamens 1-10, inserted into the orifice of the tube; ovary simple, superior, 1-seeded; styles 1-2, emarginate at the apex; ovules 1-2, amphitropal, hanging down from the point of a slender cord, which rises from the base of the ovary. This order seems to be allied to *Chenopodiaceæ*. The species occur in barren places in various parts of the world. They are all uninteresting weeds of no known use.

SCLERANTHUS (from σκληρὸς, hard, and ἄνθος, a flower, in reference to the dry juiceless calyx), a genus of Plants belonging to the natural order *Scleranthaceæ*. It has a permanent 5-cleft calyx, with an urceolate tube contracted at the mouth with a glandular ring; the petals are absent; the stamens inserted in the throat of the calyx. The fruit membranous, 1-seeded, indehiscent, included in the hardened calyx. The species are small herbs, with opposite linear leaves, which are rather connate at the base. The flowers are small, greenish-white, and sessile in the axils of the forks of the branches.

S. annuus, the Annual Knawel, has subdecandrous flowers; segments of the calyx of the fruit patent acute, with a very membranous margin as long as their tube; the styles are longer than the stamens; the stem green and repeatedly dichotomous. The flower green, often solitary. It is found in sandy fields in Great Britain. The Swedes and Germans inhale the vapour arising from a decoction of this plant as a cure for the toothache.

S. perennis has decandrous flowers; the lobes of the calyx of the fruit closed, obtuse, with white and membranous edges; the styles are usually shorter than the stamens; the stem nearly simple, or irregularly branched, procumbent, and glaucous. The flowers green and white variegated. It is found in sandy places in Europe, the Levant, and in England. The Polish Cochineal (*Coccus Polonicus*) is frequently found on the roots and leaves of this plant in the summer months.

(Babington, *Manual of British Botany.*)

SCLERO'CHLOA (from σκληρὸς, hard, and χλόη, grass), a genus of Grasses belonging to the tribe *Festucineæ*. It has unequal acute membranous glumes; the outer palea with 5 faint but distinct and parallel nerves, membranous, cylindrical below, unarmed, often keeled at the tip or with a very minute mucro; the styles are terminal.

S. maritima has a branched panicle; the lowermost branches in pairs or simple; the branches alternately erect; the spikelets linear, adpressed, 4-8-flowered; the rachis terete; the outer palea obtuse, apiculate; the midrib not reaching the apex; the root stoloniferous, fibrous, with rooting or ascending scions. It is found on sea-coasts and damp places in Great Britain.

S. distans is the *Glyceria* of Smith. It has a branched panicle; the branches elongated, ultimately spreading or deflexed, the lowermost in fours or fives; the spikelets linear, 3-6-flowered; the outer palea obtuse; the midrib not reaching to the apex; the root fibrous without rooting scions. It is found on sandy sea-shores in England.

S. procumbens is known by its ovate lanceolate compact panicle; linear-lanceolate spikelets of about 4 flowers; the rachis terete, angular; the outer palea obtuse, with an apiculus formed by the extremity of the dorsal nerve; the root is fibrous; the flower large. It is found in salt-marshes in Great Britain.

There are 6 British species of this genus.

SCLERODERMI, the second family of Plectognathous Fishes (such as have incomplete and soldered jaws). The *Sclerodermi* are distinguished by their conical or pyramidal snouts, ending in a small mouth, with distinct teeth in each jaw. The skin is rough, or covered with large hard scales.

The first division of *Plectognathi* is named *Gymnodontes*. The fishes included in it have no true teeth, but a substitute in a lamellated substance resembling ivory, which covers the jaws. It includes the *Tetrodon*, the *Diodon*, the *Orthagoriscus*, or Sun-Fish, and other genera. [ORTHAGORISCUS.]

The *Sclerodermi* are mostly tropical fishes, and are remarkable for their brilliant colours. One genus only occurs in the British seas, and that but very rarely; the *Balistes*, or File-Fish, is the one alluded to. The *Ostracion* is remarkable for having its body clothed in an inflexible armour of hard plates, the tail-fins, mouth, and gill-openings, passing through holes in its coat of mail.

SCLE'RODUS, a genus of Fossil Fishes. [FISH.]

SCLEROTICA. [EYE.]

SCOLECITE. [NATROLITE.]

SCO'LIADÆ, a family of Fossorial Hymenopterous Insects, distinguished by the following characters combined:—Antennæ thick in the females, shorter than the head and thorax; femora bent near the apex, and compressed; legs short and stout, and densely clothed with spiny hairs; the thorax is often short, and produced on each side.

The family *Scoliadæ* is thus subdivided by Latreille:—

I. Palpi always very short. Ligula with three linear divisions. Abdomen of the male terminated by three spines. Stigma replaced by a small cell. *Scolia.*

II. Maxillary palpi generally elongated. Ligula broad and expanded at the apex; a recurved spine at the apex of the abdomen in the males. Stigma distinct.

A. Second joint of the antennæ exposed; two complete cubital cells, or sometimes three, in which case the central cell is small and petiolated.

a. Without incomplete cubital cell closed by the posterior border of the wing. Radial cell either wanting or open in the females. *Tiphia*, Fab., and *Meria*, Illiger.

b. With an incomplete cubital cell closed by the posterior margin of the wing. *Tengyra*, Latr.

B. Second joint of the antennæ inclosed in the basal joint. Cubital cells four in number, of which the last is completed by the posterior margin of the wing in the males; none of them petiolated. *Myzine*, Latr.

SCOLOPA'CIDÆ, a family of Birds belonging to the order *Grallatores*.

The genus *Scolopax* of Linnæus consisted of the following species:—*Guarauna, Madagascariensis, arquata, Phæopus, fusca, rusticola, Gallinago, Gallinula, Fedoa, Glottis, Calidris, Totanus, limosa, capensis, Lapponica, Ægocephala, alba*, and *candida*. ('Sys. Nat.,' ed. xii.)

According to Cuvier, this genus comprehends the following subgenera:—*Scolopax, Ibis, Numenius, Rhynchæa, Limosa, Calidris* (Cuv., *Tringa*, Temm.), *Arenaria* (Bechst., *Calidris*, Vig.), *Pelidna, Falcinellus, Machetes, Eurynorhynchus, Phalaropus, Strepsilas, Totanus, Lobipes*, and *Himantopus*. ('Règne Animal,' ed. 1829.)

Mr. G. R. Gray divides the *Scolopacidæ* into the following subfamilies and genera:—

I. *Numeninæ.—Numenius*, Ray; *Limosa*, Briss.; *Terekia*, Bonap.; *Brolia*, Vieill.; *Ibidorhyncha*, Vig.

II. *Totaninæ.—Totanus*, Ray; *Glottis*, Nils.; *Guinetta*, Briss.; *Actiturus*, Bonap.; *Catoptrophorus*, Bonap.

III. *Recurvirostrinæ.—Recurvirostra*, Linn.; *Cladorhynchus*, Gray; *Himantopus*, Briss.

IV. *Tringinæ.—Hemipalama*, Bonap.; *Heteropoda*, Bonap.; *Tringa*, Linn.; *Machetes*, Cuv.; *Pelidna*, Cuv.; (?) (*Cocorli*, Cuv.; *Eurynorhynchus*, Nils.; *Erennetes*, Ill.; *Calidris*, Ill.

V. *Scolopacinæ.—Macroramphus*, Leach; *Rhynchæa*, Cuv.; *Scolopax*, Linn.; *Rusticola*, Vieill.; *Homoptilura*, Gray; *Telmatias*, Boié; *Gallinago*, Ray.

VI. *Strepsilinæ.—Strepsilas*, Ill.

VII. *Phalaropodinæ.* — *Steganopus*, Vieill.; *Phalaropus*, Briss.; *Lobipes*, Cuv.

We now proceed to illustrate the principal genera of this family:—*Scolopax.*—Bill long, straight, compressed, soft, the point enlarged; the two mandibles furrowed for half their length; point of the upper mandible longer than the lower, the enlarged end forming a blunt hook; arête elevated at the base, projecting. Nostrils lateral, basal, slit longitudinally near the borders of the mandible, and covered by a membrane. Feet moderate, slender, naked space above the knee very small; three toes before entirely divided, the external and middle toe united; a hind toe. Wings moderate, first quill rather shorter than or of the same length as the second, which is the longest. (Temminck.)

S. rusticola, the Woodcock, is the Bécasse of the French; Beccaccia of the Italians; Waldschnepfe of the Germans; Holt Sneppe of the Danes; Morkulla of the Swedes; Blom-Rokka, Rutte, and Krogquist, of the Norwegians; and Cyffylog of the Welsh. It is most probable the Σκολόπαξ of Aristotle.

The male has the upper parts varied with ruddy, yellowish, and ash, and marked by great black spots; lower parts yellowish-red, with brown zigzags; quills striped with red and black on their external barbs; tail-feathers terminated above with gray and below with white; feet livid. Length about 13 inches.

The female is rather stouter and larger, but her colours are less vivid, and the wing-coverts have many white spots.

The distribution of this bird is very wide. The species is found in Western Lapland beyond the arctic circle, in Finland, Russia, Siberia, rarely in Germany, and more rarely in France. A few have been known to breed in Switzerland. It is very common in Italy and at

Madeira. Barbary, Athens, Smyrna, Aleppo, Egypt, Cashmere, and Japan, are other localities.

It feeds on worms, small snails or slugs, and (according to Temminck) small beetles; but earthworms appear to be its favourite nourishment. For these it bores with its long and sensitive bill with unerring certainty. The Woodcock breeds occasionally, not to say frequently, in this country, in Scotland especially. The nest is placed on the ground in a dry warm spot among herbage, and is loosely fabricated of dead leaves, of the common fern principally, and unlined.

Woodcock (*Scolopax rusticola*).

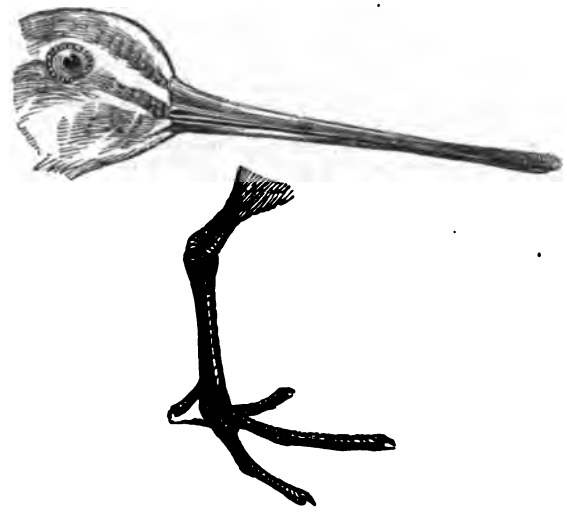
The eggs, three or four in number, are pale yellowish-white, blotched, and spotted at the larger end with ash-gray, and two shades of reddish-yellow brown, according to Yarrell; of a dirty yellow sprinkled with small spots of pale brown, according to Temminck. When surprised, the old birds have been known to carry off their young in their bills and claws.

We need hardly add that the bird, served with its trail in, is a delicious dish.

The Snipes belong to this section. Those most familiar to the English sportsman and ornithologist are the Common Snipe, the Jack Snipe, and the Solitary Snipe: Sabine's Snipe (*S. Sabini*) is of very rare occurrence, and indeed the Solitary Snipe is far from common.

S. Gallinago, Linn., *Gallinago scolopacinus*, Bonap., the Common Snipe. It is the Beccacino and Pizzarda of the Italians; Bécassine, or Bécasseau, and Chévre Volant, of the French; Heer Schnepfe and Himels Ziege of the Dutch; Watersnep of the Netherlanders; Myr Snippe of the Icelanders; Horsgjok of the Swedes; Hossegioeg of the Danes; and Ysnittan y Fyniar of the Welsh.

The normal number of tail-feathers is 14, varying to 16 (Brehm's Snipe) and 12 (Delamotte's Snipe). Upper parts variegated very nearly as in the Solitary Snipe; neck and breast striped longitudinally; sides striped transversely with white and blackish; middle of the belly and abdomen spotless, pure white; base of the bill ash-colour, the rest brown; feet pale-greenish; length about 10¼ inches, of which the bill measures about 2¾ inches.



Head and Foot of the Common Snipe.

The colours of the plumage, after the spring moult, are brighter and more brilliant with bronze reflections than after the autumnal moult: in winter the hue becomes more ashy.

Varieties.—Pure white; reddish-white; the feathers sprinkled or blotched with white, or some part of the plumage white.

Mr. Gould ('Birds of Europe') states that, although the contrary has been long stated by naturalists, he conceives that the natural range of the Common Snipe is comparatively limited; and that the Snipes from India, Africa, and North America, which have been regarded as identical with our bird, will be found, on examination, to be specifically distinct.

The following localities have been given as the range of the Common Snipe in Europe and Asia:—Russia and Siberia, from Soona to Lapland, Norway, Sweden, Denmark, Faroe Islands, Iceland and Greenland, Germany, Holland, British Islands, France, Spain, Provence, Switzerland, Italy, Hungary, and Illyria.

Marshes, moist meadows, and, in frosty weather, the edges of rushy rills, are the haunts of the Snipe. In such situations they have been seen pushing their bills, by means of repeated thrusts, quite up to the base in the mud, drawing them back with great quickness, and shifting their ground every now and then. Their food consists of such worms, insects, and small molluscs as haunt such miry places, and they have been shot in the act of feeding on leeches.

Few birds are better eating than a fresh Snipe. The old quatrain says:—

"Le bécasseau est de fort bon manger,
Duquel la chair resueille l'appetit.
Il est oyseau passager et petit:
Et par son goust fait des vins bien juger."

'Snypes' were among the birds admitted to the Earl of Northumberland's table ('Household,' 1512), and were then charged at threepence a dozen.

S. major (*Gallinago major*, Bonap.), the Solitary, Double, or Great Snipe, is the Grand or Double Bécassine of the French; Beccacino Maggiore, Pizzardone, and Croccolone, of the Italians; Mittelschnepfe and Doppelschnepfe of the Germans; Poelsnep of the Netherlanders; Great Snipe, Double Snipe, and Solitary Snipe, of the English; and Ysnid of the Welsh.

The tail is composed of 16 feathers; midrib of the first quill whitish; the black of the top of the head divided by a band of yellowish-white; eyebrows of that colour; upper parts variegated with black and bright rusty, the last-named colour disposed longitudinally; lower parts whitish-rusty; belly and sides striped with black bands; bill inclining to reddish, brown at the point; feet greenish-ash. (Temm.)

The head-quarters of this bird is the north of Europe.

In the British Islands the bird has been killed in Lancashire (the specimen from which Pennant first described it, and which was preserved in the Leverian Museum), and has been noticed as not uncommon in Norfolk. It has been very rarely seen in Ireland.

Solitary or Double Snipe (*Scolopax major*).

Sir Humphry Davy, who notices the fact of this Snipe's breeding in the great royal decoy or marsh-preserve near Hanover, says that they require solitude and perfect quiet, and that, their food being peculiar, they require a great extent of marshy meadow. They feed on the larvæ of *Tipulæ* (commonly called Father Long-Legs), or congeneous flies; and their stomach, the same author tells us, is the thinnest among the *Scolopax* tribe.

The rude nest of the Double Snipe, which is very like that of the Common Snipe, is generally placed on a hummock or tuft of grass, or a bunch of rushes on the borders of a swamp, often near willow bushes. Eggs three or four in number, yellowish olive-brown, with great spots of reddish-brown; length, 1 inch 9 lines; breadth, 1 inch [illegible]. They breed in considerable numbers in the mountainous Norway and Sweden as high as the range of birch-wood

Mr. Gould observes that there are two other snipes which exceed this in size, found in the hilly districts of India; and a third from Mexico, whose size is superior to that of a woodcock. ('Birds of Europe.')

Macroramphus, Leach; *M. griseus*, *Scolopax grisea*, Auct.; Brown Snipe of Pennant. Temminck places the genus *Strepsilas* in this family, but the species are more closely allied to the Oyster-Catchers. [CHARADRIADÆ.]

Totanus.—It has the bill moderate, straight, sometimes slightly recurved, firm, rounded, the upper mandible grooved and with its tip curving over the lower mandible; nostrils lateral, basal, linear, longitudinally cleft in the furrow of the mandible; legs long, slender, naked above the knee; toes three before, united at the base by a small membrane, and one behind, which is short; wings moderate.

Such is the character of those *Scolopacidæ* which are termed by the English Redshanks, Greenshanks, &c., and by the French Chevaliers.

T. stagnatilis. This bird is subject to considerable variations. In the first year they are the *Scolopax Totanus* of Linnæus. In their summer plumage they are the *Totanus stagnatilis* of Leisler. It is found in the north of Europe, on the borders of rivers, migrates along the eastern provinces of Europe to the Mediterranean, but never along the maritime coasts of the ocean. (Temm.)

Totanus stagnatilis.

Machetes.—Bill straight, rather slender, with a smooth and dilated tip; nostrils basal, lateral, linear, situated in the commencement of the groove; wings long and sharp-pointed; first and second quills equal and longest. Legs long, slender, and naked high above the tarsal joint; three anterior toes, one posterior, which is short; outer toe connected to the middle toe by a membrane as far as the first joint.

M. pugnax, the Ruff. It is the Combattant and Paon de Mer of the French; Salsarola and Uccello Muto of the Italians; Bruushane of the Danes; Brushane of the Swedes; Streitschnepfe and Rampfhähnlein of the Germans; Ruff (male), Reeve (female), of the English; and Yr Ymladdgar of the Welsh.

Male Ruff (*Machetes pugnax*), in Winter Plumage.

The tail rounded, the two middle feathers striped; the three lateral feathers always uniform in colour. The hues of the plumage so

variable, that it is almost impossible to find two individuals which perfectly resemble each other.

Male Ruff (*Machetes pugnax*), in his Summer dress.

The plumage of the male differs much in summer and winter. In his autumn or winter plumage he is the *Tringa variegata* of Brunwich. In his summer or nuptial plumage the male is the *Tringa pugnax* of Linnæus.

The young of the year much resembles the female in winter plumage. In this state the bird is the *Tringa littorea* of Linnæus; Le Chevalier Varié of Buffon; Shore Sandpiper and Greenwich Sandpiper of Latham.

The adult female and the young after the autumnal moult are the *Tringa equestris*, Equestrian Sandpiper of Latham; Le Chevalier Commun of Buffon; and Le Chevalier Ordinaire of Gérard. (Temm.) This bird is found in Iceland, Lapland, Scandinavia, Denmark, Siberia, Russia, France, Provence, Switzerland, Italy, Malta, Tunis, Trebizond, and the neighbourhood of the Caucasus. In Ireland the Ruff appears occasionally in spring and autumn. (Thompson.) In England it arrives in spring about April, and departs in autumn.

The food of the Ruff consists of worms and such insects as it can pick up in moist and marshy places; in the spring it is rarely found on the shores of the sea.

At one time a considerable trade was carried on in Ruffs in the fens of Lincolnshire, as they are regarded by some as delicate food. The Ruffs were caught by persons who made a living by catching them. Montagu gives a full account of these people, and their mode of catching the Ruffs, which is done by nets, the birds being decoyed by stuffed individuals.

The males arrive in England several days before the females. According to Colonel Montagu, the Reeves begin laying their eggs the first or second week in May, and he found their nests with young as early as the 3rd of June. By that time the males ceased to 'hill.' The nest was usually placed upon a stump in the most swampy places, surrounded by coarse grass, of which it was also formed. The same author describes the eggs as four in number, nearly similar in colour to those of the Snipe and Redshank, both of which breed in the same wet places, and make similar nests. The eggs of the Ruff are however, he observes, superior in size to those of the Snipe; and are known from those of the Redshank by the ground being of a greenish hue instead of rufous-white; but individuals assimilate so nearly to each other as not to be distinguished, especially as the dusky and brown spots and blotches are similar.

The food offered to the Ruffs in captivity,—and they will go greedily to it and fight for it immediately after their capture,—is bread and milk, or boiled wheat.

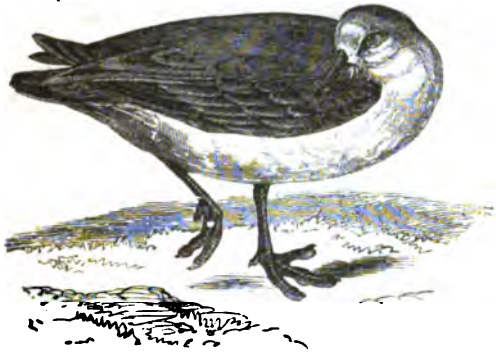
Phalaropus.—Bill long, slender, weak, straight, depressed at its base, the two mandibles furrowed up to the point; extremity of the upper mandible curved over the lower one, obtuse; point of the lower

Bill and Foot of Red-Necked Phalarope (*Phalaropus hyperboreus*).

mandible awl-shaped. Nostrils basal, lateral, oval, prominent, surrounded with a membrane; feet moderate, slender, tarsi compressed; three toes before and one behind; the anterior toes united up to the first joint, the rest of them furnished with festooned or lobated membranes dentilated on the edges; hind toe without a membrane, articulated on the inner side. Wings moderate, first and second quills longest. (Temm.)

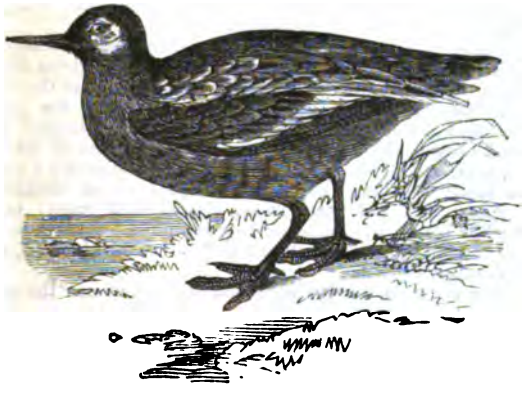
P. platyrhynchus, the Gray Phalarope. Bill wide, depressed, flattened at the base; tail long, very much rounded.

The male and female in winter plumage are the *Phalaropus lobatus* of Latham; *Tringa lobata*, Linn.; Phalarope à Festons Dentelés, Buff.; Le Phalarope Gris, Cuv.; and Gray Coot-Footed Tringa, Edwards.



Gray Phalarope (*Phalaropus platyrhynchus*), in Winter Plumage.

The young before the moult are the Gray Phalarope of Latham. The summer or nuptial plumage is the *Tringa Fulicaria* of Brunnich; *Phalaropus rufus* of Bechstein; *Tringa hyberborea* of Linnæus; Le Phalarope Rouge of Buffon and Cuvier; Phalarope Roussâtre of Brisson; Red Coot-Footed Tringa of Edwards. This bird is found within the arctic circle; the eastern parts of the north of Europe; on the Caspian Sea; and in America. It is rare in Switzerland, on the Lake of Geneva; with us it is a winter visitor. It appears to be spread generally from the northern towards the intertropical regions.



Gray Phalarope (*Phalaropus platyrhynchus*), in Summer Plumage.

Insects or crustaceans principally, which live on the surface of the water, form the principal food of the Gray Phalarope, and it rarely seeks for its nourishment on the banks or on land.

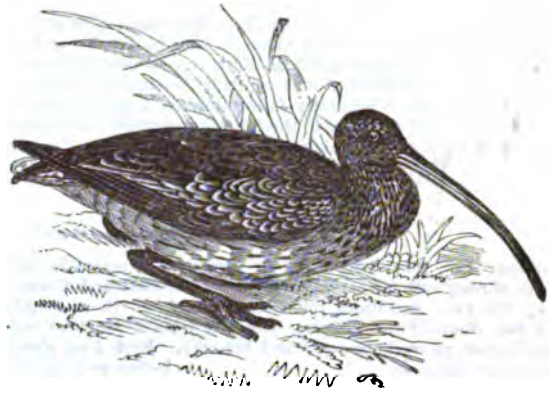
The eggs are greenish-ash, spotted and dotted with black.

Numenius.—Bill long, slender, curved, compressed, hard at the point, and subobtuse; upper mandible exceeding the lower, rounded towards the end, canaliculated for three-fourths of its length; nostrils lateral, linear, pierced in the canaliculation; face feathered, space between the eye and the bill covered with feathers. Feet slender, naked above the knee; three toes before and one behind, which last is articulated on the tarsus and touches the ground, the anterior toes united up to the first joint by a membrane. Wings moderate; first quill longest.

N. arquatus, the Curlew. It is the Courlis of the French; Ciarlotto, Ciarlotto Spadone, and Chiurle Maggiore of the Italians; Heel-Spove of the Danes; Der Grosse Krumschnäblichte Schnepfe and Keilhacke of the Germans; and Gylfinhr of the Welsh.

The male has the whole plumage bright ash-colour, with longitudinal brown spots on the head and breast, some of the feathers of those parts clouded with red; belly white, with longitudinal spots; feathers of the back and scapulars black in the middle and bordered with red; tail whitish ash, striped with brown bands disposed transversely; upper mandible blackish-brown; the lower mandible flesh-colour; iris brown; feet deep ash; length two feet and upwards. The female with the tints more ash-coloured; the red which borders the feathers of the back and scapulars less pure.

It is equally diffused from the sultry portion of the torrid zone to the frozen countries of the north: the islands of the Pacific Ocean, particularly Australia, are not devoid of its presence, and we also possess examples from China, Nepaul, &c. (Gould, 'Birds of Europe.') Dr. Andrew Smith brought individuals from South Africa.



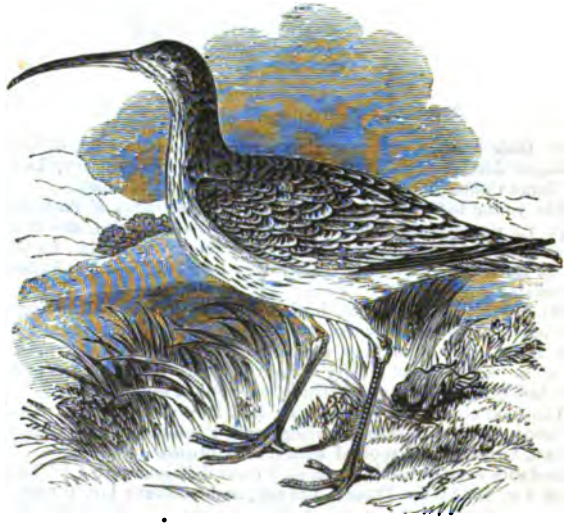
Curlew (*Numenius arquatus*).

The food of this well-known and wary bird, which in Scotland is called the Whaup, consists of earth-worms, slugs, small testaceans, and insects.

The nest, which consists of a few dried leaves, &c., carelessly put together, is placed among rushes or long grass and heath; Temminck says, often in the downs which border the sea. The egg, which is large (2 inches 7 lines long, 1 inch 11 lines broad), is olive-green, blotched, and spotted with darker green and deep-brown. It breeds in these islands.

N. phæopus, Auct., *Scolopax phæopus*, Linn.; genus *Phæopus*, Cuv. This is Le Petit Courlis, or Courlieu, of the French; Chiurlo Piccolo, Chiurlo Minore, and Mengotto, of the Italians; Regen Brachvogel, Kleine Art Brachvogel, Regenvogel, and Kleiner Gossier, of the Germans; De Kleine of Regenwulp of the Netherlanders; Mellum-Spove of the Danes; Smaae Spue of the Norwegians; Whimbrel, Curlew-Knot, Curlew-Jack, Jack-Curlew, Half-Curlew, Titterel, Chikerel, and Tang-Whaup of the English; and Coeg Ylfinhir of the Welsh.

All the plumage bright ash-colour; longitudinal brown spots on the neck and breast; on the middle of the head a longitudinal band of yellowish-white, with another twice as wide and brown on each side; belly and abdomen white; feathers of the back and scapulars very deep-brown in the middle, and bordered with brighter brown; tail ashy-brown, streaked with brown bands disposed obliquely; bill blackish, but reddish at its base; iris brown; feet lead-colour. Length of male 16 inches, bill 3 inches; of female 18 inches, bill 3¼ inches.



Whimbrel (*Numenius phæopus*).

The young of the year have the bill short, hardly an inch and a half long: this organ curves in proportion as the bird grows older.

There can be little doubt that Whimbrels were the 'Curlew Knaves' of the old Household Books.

It is very widely distributed. Denmark, Sweden, Norway, Lapland, Faroe Islands, Iceland, Germany, Holland, France (but more common in Holland than in France or Germany), Italy, Spain, Provence, Madeira, and the central part of North Africa. Asia—Caucasus, Himalaya Mountains, Bengal, and Japan.

In the British Islands (it is found in Orkney and Shetland, and has been known to breed in the latter locality) the Whimbrel occurs most plentifully in May and autumn, the periods of its northward and southward migration; but they have been seen occasionally on our shores in winter.

Their food consists of insects, small crustaceans, and worms: they breed in the north: the nest is exposed on wild heaths and moors, and the number of eggs, which are dark olive-brown, blotched with darker brown, pear-shaped, and strongly resembling those of the Curlew, but smaller, is generally four: they are sought as delicacies.

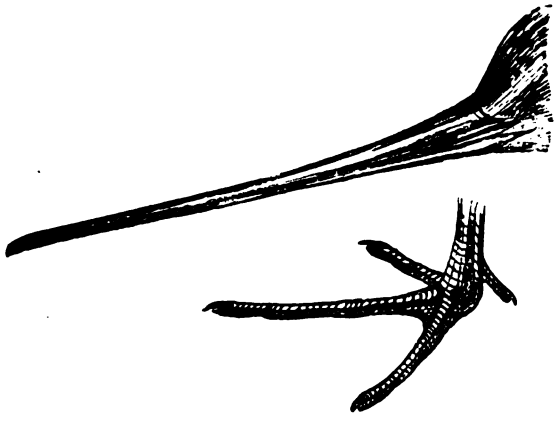
In the 'Portraits d'Oyseaux' the following quatrain appears under the figure of the Curlew, which was highly esteemed for the table:—

"De son crier le Corlis a le nom,
Duquel le bec est tourné, et voulté.
De demi pied long. Il est appresté
Es grands banquets, comme oyseau de renom."

Limosa.—Bill very long, more or less curved upwards, soft and flexible throughout its length, depressed, and flattened towards the point; the two mandibles furrowed throughout their length, the point flat, dilated, and obtuse. Nostrils lateral, longitudinally slit in the furrow, pierced through and through. Feet long, slender; a great naked space above the knee; three toes before and one behind; middle toe united to the external one by a membrane which extends up to the first joint; the posterior toe articulated upon the tarsus. Wings moderate; first quill longest. (Temm.)

All known species of the Godwits undergo a double moult, which changes nearly entirely the colour of the plumage. The females are always larger than the males, and lay very large eggs in proportion to their size; and their periodical moult takes place later than that of the males, indeed after they have assumed their new dress. (Temm.)

L. melanura, the Godwit. Bill straight; tail uniform black, with a base of pure white; claw of the middle toe long and dentilated; a white beauty-spot (miroir) on the wings.



Head and Foot of Godwit (*Limosa melanura*).

In their winter plumage they are *Limosa melanura* of Leisler; *Scolopax Limosa* of Linnæus; *Totanus Limosa* of Bechstein; La Barge ou Barge Commune of Buffon; Jadreka Snipe of Latham.

The young before their first moult is *Totanus rufus* of Bechstein.

In its nuptial plumage the bird is *Scolopax Belgica*, and *Scolopax Ægocephala* of Gmelin; *Totanus Ægocephalus* of Bechstein; La Grande Barge Rousse of Buffon; Red Godwit of Latham; and Dunkelfussiger Wasserlaufer of Meyer.

Mr. Gould says that this bird inhabits the whole of the European continent, and that examples are found in most collections from Africa and India. With us they are most frequently seen in spring and autumn. They breed mostly in high northern latitudes, but occasionally in England. In Ireland the species is but seldom seen.

The food consists of insects and their larvæ, worms, &c. The nest is formed of dry grass and herbage, and the four eggs are light olive-brown, blotched and spotted with darker brown.

Godwits were formerly considered most delicious eating ('The Devil is an Ass,' iii. 3; Sir Thomas Browne, and others); but though they are now sometimes fattened with bread and milk, like Ruffs, they are not held in half the estimation that Ruffs are.

Cladorhynchus, G. R. Gray.—This genus, which closely approximates *Himantopus*, was first characterised by the Chevalier B. Dubus, under the name of *Leptorhynchus*. Mr. Gould published a description and part figure of the species here noticed, in his 'Synopsis of the Birds of Australia,' as *Himantopus palmatus*. *Leptorhynchus* had been preoccupied in ornithology; and therefore, as Mr. Gould observes, Mr. G. R. Gray's name must stand.

C. pectoralis; Leptorhynchus pectoralis, Dubus. Body white; breast crossed by a broad band of chestnut, bordered anteriorly with black; wings and centre of the abdomen black; bill black; legs reddish-yellow. In a specimen presumed to be the female, the band on the chest was grayish-brown instead of chestnut, and there was no appearance of the black mark on the centre of the abdomen; and in another the pectoral band was apparently disappearing, from which Mr. Gould infers that this mark only exists in the breeding season. It is a native of southern and western Australia and Rottnest Island.

Cladorhynchus pectoralis.

Himantopus, Briss.—Bill long, slender, cylindrical, flattened at its base and compressed at the point; both mandibles channelled to the extent of half their length from the base. Nostrils lateral, linear. Tarsi very long and slender. Toes three before, the external and middle toe united by a membrane; nails small and flat. Wings very long, the first quill-feather the longest. (Gould.)

H. melanopterus, the *H. rufipes*, Bechst.; *Hyperbates Himantopus* of Naumann, and *Himantopus longipes* of Brehm.; *Charadrius Himantopus*, Linn. It is L'Échasse and Échasse à Manteau Noir of the French; Cavaliere Grande Italiano and Cavaliere d'Italia of the Italians; Schwarzflügelige Strandreuter of the Germans; Long-Legged Plover, Stilt, and Longshanks of the English; Cwttyn Hirgoes of the Welsh.

Face, neck, and all the lower parts pure white, assuming a rosy tint on the breast and belly; occiput and nape black or blackish, with white spots; back and wings black, glossed with green; tail ash-colour; bill black; iris crimson; feet vermilion. Length from the point of the bill to the extremity of the tail about 14 inches, and to the claws about 19 inches.

The very old male has the nape, and even sometimes the occiput, quite white.

The female is less than the male; the black of the mantle and wings has no greenish reflexions; and her general tint is browner.

The feet of the young are orange; their mantle and wings brown, with whitish edges; feathers of the upper part of the head, occiput, and nape blackish-ash with whitish borders. (*Himantopus Mexicanus*, Briss.) (Temm.)

Belon, in the 'Portraits d'Oyseaux,' superscribes a by no means bad figure with the following synonyms:—"Grec. *Ἰμαντόπους*; Italien, Merlo aquaiolo grande; François, Lon pourroit dire le Grand Chevalier d'Italie." Beneath the cut he informs us that the *Himantopus*, like the *Hæmatopus*, has only three toes, but that one is a river and the other a sea-bird, and that the former is often seen in all the countries along the river which passes by Castel Durante in the duchy of Urbino. It is there called, he says, Merlo Aquaiolo Grande, in contradistinction to another bird which is simply called Merlo Aquaiolo (our Water-Ouzel, *Cinclus*?). There is no bird, says Belon, in continuation, which has such long legs with reference to the size of its body; for, having the body of a pigeon, its red legs are a cubit long. The name *Himantopus* is taken from Pliny; and, by an awkward metaphor, implies that the legs are as slender and pliant as if cut out of a thong of leather.

Pennant says, "These birds are extremely rare in these islands. Sir Robert Sibbald records a brace that were shot in Scotland; another was shot a few years ago at Stanton-Harcourt Common near Oxford; and we have seen them often in the cabinets of the curious at Paris, taken on the French coasts."

Mr. Gould ('Birds of Europe') states that the genus *Himantopus*, although widely distributed, contains, he believes, only two well authenticated species, namely, *H. melanogaster* and the North American species. "This bird," says Mr. Gould, in continuation, "so singular in its appearance from the extraordinary length and slenderness of

its legs, has been often killed in England; but it must be classed among those birds whose visits are accidental and uncertain. It is equally scarce in Holland and the northern portion of Europe; in fact, though apparently abundant nowhere, it exhibits so wide a range, that its deficiency in point of number in any given locality is counterbalanced by its almost universal distribution."

Black-Bellied Plover (*Himantopus melanogaster*).

Tringa.—Beak of moderate length, about as long as the head, sometimes slightly curved, rather flexible, compressed at the base, depressed, dilated and blunt towards the point; both mandibles grooved along the sides; nostrils lateral, pierced in the membrane lining the groove. Legs slender; lower part of tibia naked; three toes before, one behind, those in front entirely divided to their origin; the hind toe articulated upon the tarsus. Wings of moderate size, pointed, the first feather always the longest.

T. cinerea, the Knot. It is the *T. grisea* and *T. Canutus* of Linnæus and Gmelin; *Calidris Canutus* of Cuvier: the Maubèche Grise, Maubèche Tachetée, and Le Canut of the French; Chiurlo, Piovanello Maggiore, and Paginella Maggiore, of the Italians; Rothbraune Strandlaufer, Aschgrau Strandlaufer, and Hochköpfige Strandlaufer of the Germans; Sidlingar-Kall of the Icelanders; Fiære-Pist, Fiære-Kuro, and Fiœr-Muus, of theNorwegians; Y Cnut of the Welsh.

Several other scientific names have been given to this bird according to the different stages of its plumage, such stages having been mistaken by the describers for specific differences. (Temminck, 'Manual.')

The Knot (*Tringa cinerea*).
Upper figure, summer plumage; lower figure, winter plumage. (Gould.)

Male and Female in Winter.—Bill straight, a little longer than the head, very much dilated and convex towards the tip; all the tail-feathers of equal length. Throat, middle of the belly, and abdomen, pure white; forehead, eyebrows, sides and front of the neck, breast, and flanks, white also, but varied with small brown longitudinal lines, and transversal and zigzag bands of ashy-brown; head, neck, back, and scapulars, bright ash with brown stems; rump and upper tail-coverts white, with black crescents and zigzags; wing-coverts ash, bordered with white and with brown stems; tail-feathers ash variegated with white; bill and feet greenish-black; iris brown. Length about 10 inches.

Summer or Nuptial Plumage.—Large eyebrows, throat, sides and front of the neck, breast, belly, and flanks, of a rusty or coppery ruddy; nape ruddy, with small longitudinal lines; top of the head, back, and scapulars, deep black; all these feathers bordered with vivid ruddy; on the scapulars great oval spots of the same ruddy colour; abdomen white, speckled with ruddy and blotched with black; upper coverts of the tail white, with black crescents and ruddy blotches; tail-feathers blackish-ash, variegated with whitish. Such are the old birds when in perfect plumage. (Temm.)

This bird is found in Iceland, Greenland, North Georgian Islands, Duke of York's Bay, Melville Peninsula, Hudson's Bay, Sweden and Norway, Holland in spring and autumn, the British Islands (but not known to breed there), rare in Germany, France, and the south of Europe.

According to Captain Lyon, who saw it breeding in Melville Peninsula, the Knot lays four eggs on a tuft of withered grass, without forming any nest. The eggs are of a light yellowish-brown, spotted with gray and reddish at the larger end, so as to form a sort of zone, more or less. There are but few spots towards the point.

The food of the Knot consists principally of worms, and also occasionally of small river and marsh insects, little marine crustaceans, and very small bivalve molluscs.

It is one of the most delicious of birds, and when fattened is preferred by epicures to the most luscious ruff. Camden says they derive their name from King Canute, Knute, or Knout, as he is sometimes called, probably because they were a favourite dish of that monarch.

Drayton says of this bird—

> "The Knot, that called was Canutus bird of old,
> Of that great king of Danes his name that still doth hold,
> His appetite to please, that farre and neere was sought,
> For him, as some have said, from Denmarke hither brought."
> ('Polyolbion'—25th Song.)

T. minuta, the Little Sandpiper (Fleming). It is the *T. pusilla* of Linnæus, Latham, and Pennant; the Stint of Bewick; the Minute Tringa of Selby; the Little Stint of Jenyns; the Pigmy Sandpiper of Richardson; the Bécasseau Echasses of Temminck; Gambecchio and Culetto of the Italians; Der Hochbeinige Strandlaufer and Der Kleine Schlammlaufer and Zwerg Schlammlaufer of the Germans; Stint of Zeelseurik of the Netherlanders; and Y Pibbydd Lleiaf of the Welsh.

Little Sandpiper (*Tringa minuta*).
Lower figure to the left, winter plumage; upper figure, summer plumage; lower figure to the right, young of the year. (Gould.)

It has the bill straight, shorter than the head; tail doubly forked, lateral feathers brown-ash, all variegated with white; tarsus 10 lines long.

This bird is found at Hudson's Bay, in India, South Africa, North America, and Europe. In the British Islands they have been noticed in the vicinity of the Solway, in the west of Lancashire; and on the coasts of Suffolk, Norfolk, Yorkshire, and Durham in the autumn. A small number are seen every year in Belfast Bay, according to Mr. W. Thompson.

This species haunts sandy shores, the banks of large rivers, and salt-marshes. In this country it is mostly found in company with the Dunlin and Sanderling on the sandy sea-shore.

The flesh of the Little Stint much resembles that of its congeners, but it must not be confounded with the Stint of the old feasts, which appears to have been the Dunlin or Purre.

Drayton thus celebrates it in the 'Five-and-Twentieth Song' of his 'Polyolbion':—

"The Puet, Godwit, Stint, the pallat that allure
The miser and doe make a wasteful epicure."

Tantalus, Linnæus.—This genus stands between the genera *Ardea* and *Scolopax*, in the twelfth edition of the 'Systema Naturæ.'

Cuvier places the genus *Tantalus* between the Open-Beaks (*Hians*, Lacép.; *Anastomus*, Ill.) and the Spoonbills (*Platalea*, Linn.). He characterises the genus as having the feet, the nostrils, and the bill of a stork; but the back of the bill is, he observes, rounded, and its point curved downwards and slightly notched on each side; a portion of the head, and sometimes of the neck, is, he adds, denuded of feathers. He notices the following species:—The American Tantalus, *T. loculator*, Linn.; the African Tantalus, *T. Ibis*, Linn.; and the Ceylonese Ibis, *T. leucocephalus*, the largest of all.

T. Ibis is white slightly clouded with purple on the wings, with a yellow beak, and the skin of the face naked and red. Cuvier says that it was for a long time regarded by naturalists as the bird so much revered by the ancient Egyptians under the name of *Ibis*, but that recent researches had proved that the *Ibis* is a much smaller species, of which he intends to treat thereafter. This species, he states, is not commonly found in Egypt, but that it had been brought from Senegal. *Tantalus* he arranges in the family *Cultirostres*.

Ibis (Cuv.) finds a place in the 'Règne Animal' as the second genus of Cuvier's *Longirostres*, between *Scolopax* and *Numenius* (Cuv.).

The bill is slender, cylindrical, and arched from the base; nostrils basal, lateral. Wings broad, ample; the second and third quills longest.

Cuvier states that he has separated the Ibises from the *Tantali* of Gmelin, because their bill, arched like that of the *Tantali*, is nevertheless much more feeble, and without any notch at the point, whilst the nostrils, pierced towards the back of its base, are each prolonged into a furrow which continues to the tip. The bill, he adds, is rather thick, and nearly square at its base. There is always, he further remarks, some part of the head, or even of the neck, denuded of feathers. The external toes are notably palmated at their base, and the hind toe is sufficiently long to touch the earth. Some of the species, he observes, have the legs short and reticulated: these are the most robust and have the largest bill.

I. religiosa, the Sacred Ibis. Abou-Hannes, Bruce; *Tantalus Æthiopicus* of Latham; L'Ibis Sacré, Cuv.

Sacred Ibis (*Ibis religiosa*), Cuv.—Adult.

"This," says Cuvier, "is the most celebrated species: it was reared in the temples of ancient Egypt, with veneration which approached to worship; and it was embalmed after its death, as some said, because it devoured the serpents which would otherwise have become dangerous to the country: according to others, because there was a resemblance between its plumage and some of the phases of the moon: finally, according to other some, because its advent announced the rising of the Nile. For a long time it was thought that this Ibis of the Egyptians was the *Tantalus* of Africa: we now know that it belongs to the genus of which we are treating. It is as large as a hen, with white plumage, except the end of the wing-feathers, which is black; the last coverts have their barbs elongated, loose, black, with violet reflections, and thus covering the end of the wings and tail. The bill and the feet are black, as well as all the naked part of the head and neck: this part is covered in youth, at least on its upper surface, with small blackish feathers. The species is found throughout the extent of Africa." [Abou-Hannes.]

The other species noticed by Cuvier are—L'Ibis Rouge (*Scolopax ruber*, Linn; *Tantalus ruber*, Gm.) and L'Ibis Vert, vulg. Courlis Vert (*Scolopax falcinellus*, Linn.). ('Règne Animal.')

I. falcinellus, L'Ibis Vert, is purpled chestnut, with a deep-green mantle. The young with the head and neck sprinkled with whitish. It is a native of the south of Europe and north of Africa.

This, Cuvier observes, is to all appearance the species which the ancients called the Black Ibis. [Abou-Hannes.]

I. ruber, the Scarlet Ibis, *Tantalus ruber* of Linnæus, Red Curlew of Catesby. This species is 23 inches in length and 37 in alar extent. Bill 5 inches long, thick, and of a somewhat square form at the base, gradually bent downwards and sharply ridged; black, except near the base, where it inclines to red. Iris dark-hazel. The face naked, slightly wrinkled, pale-red. Chin bare, wrinkled also. Plumage rich, glowing scarlet, except about three inches of the extremities of the four outer quill-feathers, which are deep steel-blue. Legs pale red; the three anterior toes united by a membrane as far as the first joint. (Nuttall.)

"This brilliant and exclusively American species inhabits chiefly," says Nuttall, "within the tropics, abounding in the West India and Bahama Islands, and south of the equator, at least as far as Brazil. They migrate in the course of the summer (about July and August) into Florida, Alabama, Georgia, and South Carolina; but retire into Mexico, or the Caribbean Islands, at the approach of cool weather. They generally associate in numbers, frequenting the borders of the sea, and the banks and estuaries of neighbouring rivers, feeding on small fry, shell-fish, crustacea, worms, and insects, which they collect at the ebbing of the tide. They are said to be in the habit of perching on trees in companies; but they lay their eggs, which are greenish, on the ground, amidst the tall grass of the marshes, on a slight nest of leaves. When just hatched the young are black, soon changing to gray, but are nearly white before they are able to fly; by degrees they attain their red plumage, which is not complete until the third year. The young and old associate in distinct bands. In the countries where they abound they are sometimes domesticated, and accompany the poultry. The Ibis shows great courage in attacking the fowls, and will even defend itself from the insidious attacks of the cat. It is generally esteemed as good food; and its rich and gaudy plumage is used by the Brazilians for various ornaments." (Nuttall, 'Manual of the Ornithology of the United States and of Canada.')

The following is Mr. G. R. Gray's arrangement of the British species of this family in the collection of the British Museum. He refers the genus *Ibis* to the family *Ardeidæ*, and to the tribe *Tantalinæ*, the only British species of which is *I. falcinellus*, the Glossy Ibis:—

SCOLOPACIDÆ.

I. *Limosinæ*.

Numenius arquata, the Common Curlew.
N. phæopus, the Whimbrel.
Limosa Lapponica, the Bar-Tailed Godwit.
L. ægocephala, the Black-Tailed Godwit.

II. *Totaninæ*.

Totanus fuscus, the Spotted Redshank.
T. Calidris, the Common Redshank.
T. ochropus, the Green-Sandpiper.
T. Glareola, the Wood-Sandpiper.
T. glottis, the Greenshank.
Tringoides macularia, the Spotted-Sandpiper.
T. hypoleuca, the Common Sandpiper.
T. rufescens, the Buff-Breasted Sandpiper.

III. *Recurvirostrinæ*.

Recurvirostra avocetta, the Avocet. [Avocet.]
Himantopus candidus, the Black-Winged Stilt.

IV. *Tringinæ*.

Philomachus pugnax, the Ruff.
Tringa Canutus, the Knot.
T. maritima, the Purple Sandpiper.
T. pectoralis, the Pectoral Sandpiper.
T. Schinzii, Schinz's Sandpiper
T. alpina, the Dunlin.
T. minuta, the Little Stint.
T. Temminckii, Temminck's Stint.
T. subarquata, the Curlew Sandpiper.
T. pygmæa, the Broad-Billed Sandpiper.
Calidris arenaria, the Sanderling.

V. *Scolopacinæ*.

Macroramphus griseus, the Brown Snipe.
Gallinago major, the Great Snipe.

G. Sabinii, Sabine's Snipe.
G. media, the Common Snipe.
G. Brehmii, Brehm's Snipe.
G. gallinula, the Jack-Snipe.
Scolopax rusticola, the Woodcock.

VI. *Phalaropodinæ.*

Phalaropus fulicarius, the Gray Phalarope.
P. hyperboreus, the Red-Necked Phalarope.

SCOLOPENDRA, Latreille, a genus of Animals belonging to the order *Myriapoda*, and belonging to a section of that order termed *Chilopoda*. The species of the genus *Scolopendra*, as now restricted, are distinguished from others of the section of which they form a part, by their possessing at least twenty-one pairs of legs, and there are more segments apparent on the upper surface of the body than on the under; the antennæ are composed of seventeen joints; the eyes are distinct, and are four in number on each side. The species inhabit the southern parts of Europe, and all the tropical portions of the globe; their mandibles (which, strictly speaking, it would appear are formed by the second pair of legs) are terminated by a sharp hook, which is pierced for the transmission of a venomous fluid. The *Scolopendræ* have the body long, slender, and depressed, and protected by coriaceous plates: they run very fast, and shun the light, living for the most part under logs of wood and the loose bark of decayed trees. [MYRIAPODA.]

SCOLOPE'NDRIUM, a genus of Ferns belonging to the natural order *Filicaceæ* and tribe *Asplenieæ*. The sori elongate, straight, and two together; the indusia of each pair opening towards each other.

S. vulgare, Hart's Tongue, is a particularly handsome and ornamental fern, and very different from every other British species. It is universally and abundantly distributed throughout the British Isles. It is very commonly found on old walls and ruins. It is also found in Europe, sparingly towards the north, and in the United States. It is not however described as growing in Africa, Asia, or South America. The roots are black, stout, and very long and strong; the rhizoma is tufted, blackish, scaly, almost spherical; the young fronds make their appearance in April, growing in an erect position; by degrees they become horizontal, and at length pendulous. They arrive at maturity at the end of September, and continue in full vigour throughout the whole winter. The form of the frond is linear, elongated, and quite undivided, acute at the apex, and cordate at the base. This fern is the *Phyllitis* of Ray and all older botanists. It was once much in vogue as a medicine; Ray mentions it as an astringent, and speaks of its healing powers, applied as an ointment to wounds and ulcers. Lightfoot says it is used by the country people of Scotland as a vulnerary for burns and scalds, and we learn from the 'Flore Français' that it is used in France as an astringent in cases of diarrhœa and hæmorrhage.

(Newman, *British Ferns;* Babington, *Manual of British Botany.*)

SCOLYMUS. [*See* SUPPLEMENT.]

SCOMBER. [SCOMBRIDÆ.]

SCOMBERESOX, a genus of Fishes belonging to the family *Esocidæ*. The only British species of this genus is the Gar Pike or Skipper, called also Gowdnook in Scotland. It was first described as a British species by Ray. It is not an abundant fish, but has been taken off Berwick and Yarmouth, and Portland Island, and on some occasions, has been even plentiful on the coasts of Scotland. [ESOX.]

SCO'MBRIDÆ, a family of Fishes of the section *Acanthopterygii*, of which the Common Mackerel may be regarded as a type: the Tunny, Sword-Fish, Dory, and Boar-Fish, also belong to this group, which contains a multitude of species and many genera. The body is generally covered with small scales; the tail is usually very powerful and deeply cleft: in most of the species the pectoral fins are long, narrow, and pointed; the dorsal fins are two in number, the foremost of them being composed of bony rays; the hinder dorsal is chiefly supported by soft rays, and is often divided into numerous small false fins. They are provided with numerous cæca, and these are often united in clusters.

In the genus *Scomber*, as now restricted, the body is covered with small smooth scales; the dorsal fins are widely separated; the hinder part of the second dorsal, as well as of the anal fin, is divided into numerous small spurious fins or finlets, which extend along the hinder part of the body, above and beneath, almost to the tail; the sides of the tail are carinated, and the body is elongated and tapering at both extremities.

S. Scomber, Linnæus (*S. vulgaris*, of some authors), the Common Mackerel, is a fish too well known to require to be described here. "This fish," Mr. Yarrell observes, "it is probable inhabits almost the whole of the European seas; and the law of nature which obliges it and many others to visit the shallower waters of the shores at a particular season, appears to be one of those wise and bountiful provisions of the Creator by which not only is the species perpetuated with the greatest certainty, but a large portion of the parent animals are thus brought within the reach of man, who, but for the action of this law, would be deprived of many of those species most valuable to him as food." It may be further observed, says the same author, that there is scarcely a month throughout the year in which the fishes of some one or more species are not brought within the reach of man by the operation of this law. "On the coast of Ireland the mackerel is taken from the county of Kerry on the west, along the southern shore, eastward to Cork and Waterford; thence northward to Antrim, and north-west to Londonderry and Donegal. Dr. M'Culloch says it visits some of the lochs of the Western Islands, but is not considered very abundant. On the Cornish coast, this fish in some seasons occurs as early as the month of March, and appears to be pursuing a course from west to east. They are plentiful on the Devonshire coast, and swarm in West Bay about June. On the Hampshire and Sussex coast, particularly the latter, they arrive as early as March, and sometimes even in February; and the earlier in the year the fishermen go to look for them, the farther from the shore do they seek for and find them. Duhamel says the mackerel are caught earlier at Dunkirk than at Dieppe or Havre: up our own eastern coast however the fishing is later. The fishermen of Lowestoffe and Yarmouth gain their great harvest from the mackerel in May and June. Mr. Neill says they occur in the Forth at the end of summer; and Mr. Lowe, in his 'Fauna Orcadensis,' states that they do not make their appearance there till the last week in July or the first week in August.

"The most common way of fishing for mackerel, and the way in which the greatest numbers are taken, is by drift-nets. The drift-net is twenty feet deep, by one hundred and twenty feet long; well corked at the top, but without lead at the bottom. They are made of small fine twine, which is tanned of a reddish-brown colour, to preserve it from the action of the sea-water; and it is thereby rendered much more durable."

S. colias, the Spanish Mackerel, is a rare fish on the British coasts. It is the *Colias Rondeletii* of Ray.

Thynnus has the form of the body like the Mackerel, but less compressed, with numerous scales surrounding the thorax, and the first dorsal fin extending nearly to the second.

T. vulgaris, Cuvier (*Scomber Thynnus*, Linnæus), the Tunny. It is taken in large numbers in the Mediterranean, but is seldom fished for on the British coasts, although in some parts it is said to exist in abundance. Like the Mackerel, they come in shoals to the shallow parts of the water to deposit their spawn. They sometimes attain a great size, weighing above four hundred pounds and measuring nearly eight feet in length.

T. pelamys, the Bonito, *Scomber pelamys* of Linnæus, is an occasional visitor to the coasts of England, but its true realm is in the tropics. It is a very beautiful fish of a fine blue colour, with four dark lines extending from the pectorals along the side of the belly to the tail. It rarely exceeds 30 inches in length. The Bonito of the Mediterranean, a fish of equal beauty, is a distinct species, and is the *Pelamys Sarda* of Cuvier. Its back and sides are marked by dark oblique transverse bands. It has much stronger teeth than the Bonito of the tropics.

Auxis has a nearly cylindrical body; the two dorsal fins widely separated; one row of minute teeth in each jaw.

A. vulgaris, Cuvier, *Thynnus Rochcanus* of Risso, the Plain Bonito, is also a native of the Mediterranean. It is only a straggler on the British coasts.

Xiphias has the upper jaw elongated, forming a sword.

X. gladius, Linnæus, the Sword-Fish, is an inhabitant of the Mediterranean and Atlantic, occasionally visiting our coast. It measures from 10 to 15 feet in length. Its body is lengthy and covered with minute scales, the sword forming three-tenths of its length. On its back it bears a single long elevated dorsal fin; there are no central fins. The tail is keeled. The lower jaw is sharp; the mouth without teeth. The upper part of the fish is bluish-black merging into silver below.

The Sword-Fish is said to attack the whale, wounding it with its beak. There are many well-authenticated instances of the planks of ships being perforated by the upper jaw of this powerful creature, which it has been supposed occasionally attacks the hulls of ships in mistake for the whale. Specimens of ships' timbers penetrated by its sword are preserved in many museums. The *Xiphias* is mentioned by Aristotle ('Hist. Anim.,' viii. 19), who notices the fact of its striking vessels. The young fish is said to be good eating. When very young the body is covered with small tubercles, which disappear before it attains the length of three feet.

The other British fishes belonging to this family are—*Lampris guttatus*, the Opah or King-Fish [LAMPRIS]; *Caprus Aper*, the Boar-Fish [CAPROS]; *Zeus faber*, the Dory; *Centrolophus morio*, the Black Fish [CENTROLOPHUS]; *Caranx trachurus*, the Scad or Horse-Mackerel [CARANX]; and *Naucrates ductor*, the Pilot-Fish [NAUCRATES.] [*See* SUPPLEMENT.]

SCOPELIDÆ, a family of Malacopterygious Abdominal Fishes. This family is closely allied to the *Salmonidæ*. They have the snout short, the mouth deeply cleft, the teeth rather small and sharp; the branchial rays 8 to 15; the first dorsal behind the ventral; the body in some is semitransparent.

The genus *Scopelus* is found in the Mediterranean.

(*Manual of Natural History.*)

SCOPOPHORUS. [ANTILOPEÆ.]

SCOPS. [STRIGIDÆ.]

SCORODITE. [IRON.]

SCORPÆNA, a genus of Acanthopterygious Osseous Fishes of the family *Loricati*. Their heads are large, compressed, and more or less armed with spines or tubercles; the body is oblong and scaly. On the back is a single dorsal fin; the branchiostegous membrane has seven rays; and the jaws and palatines are armed with velvety teeth. They reside mostly on rocky grounds, feeding on *Crustacea* and small fish.

S. Norvegica; *Sebastes Norvegica*, the Bergylt, or Norway Haddock, is a fish resembling the perch, and attaining a length of two feet and more. It is sometimes taken in the British seas. Some beautifully-coloured species of this genus are found in the Mediterranean.

SCORPIO. [SCORPIONIDÆ.]

SCORPION. [SCORPIONIDÆ.]

SCORPION-GRASS. [MYOSOTIS.]

SCORPION, WATER. [NEPA.]

SCORPIONIDÆ, a family of the class *Arachnida*, order *Pulmonaria*, and section *Pedipalpi*. The animals of this family, commonly called Scorpions, are distinguished from other groups of spiders by their having the abdomen articulated and terminated by a curved spur at the extremity; the palpi are very large, and the terminal segment assumes the form of the lobster's claw, being in like manner provided with pincers; the stigmata are eight in number, and situated along the inferior and lateral part of the abdomen; on the under side of the thorax are two comb-like appendages. The number of the eyes varies from eight to twelve in different species, and some sub-genera have been established upon this character. Those to which the term *Scorpio* is used in its most restricted sense have only six eyes; those Scorpions which have eight eyes constitute the sub-genus *Bathus*; and those which have twelve eyes, *Androctonus*.

"These Arachnides," says Latreille, "inhabit the hot countries of both hemispheres, live on the ground, conceal themselves under stones and other bodies, most commonly in ruins, dark and cool places, and even in houses. They run with considerable swiftness, curving the tail over the back—this they can turn in every direction, and use for the purposes of attack and defence. With their forceps they seize various insects, on which they feed after having pierced them with their sting. They are particularly fond of the eggs of spiders and insects.

The wound occasioned by the species found in the southern parts of Europe (*Scorpio Europæus*), is not usually dangerous; but according to the experiments of Dr. Maccary, made upon himself, the sting of some other and larger species produces serious and alarming symptoms, and the older the animal the more active seems to be the poison. The remedy employed is the volatile alkali, used externally and internally.

The young Scorpions are produced at various intervals, and are carried by the parent for several days upon her back, during which time she never leaves her retreat.

SCORZONERA, a genus of Plants belonging to the natural order *Asteraceæ*. The pappus is feathery, in several rows. Bracts imbricated. Receptacle naked. Achænia neither stalked nor beaked, with a lateral scar.

S. Hispanica, Viper's-Grass, has a cylindrical succulent root, branches monocephalous; leaves amplexicaul, lanceolate, wavy; involucres smooth; flowers yellow. It is found in Spain and the south of Europe. The root is said to be sudorific. It is delicate and eatable, and is supposed to be a specific against viper bites.

S. glastifolia has roots similar in quality.

S. deliciosa is cultivated as an esculent at Palermo, and the gummy root of *S. tuberosa* is eaten by the Kalmucks.

SCOTER. [DUCKS.]

SCOTOPHILUS. [CHEIROPTERA.]

SCOTORNIS. [GOAT SUCKERS.]

SCREAMER. [PALAMEDEA.]

SCREW-PINES. [PANDANACEÆ.]

SCROPHULARIA (so named from its supposed use in cases of scrofula), a genus of Plants belonging to the natural order *Scrophulariaceæ*. It has a 5-parted nearly equal calyx, a globose corolla, with a short 5-lobed limb, the segments of which are rounded, and the uppermost united into an upper lip. The style is simple, thickened at the apex, the stigma emarginate. There are 4 fertile didynamous declinate stamens, with the rudiment of a fifth appearing. The species are herbs or under-shrubs with an unpleasant smell.

S. peregrina, Figwort, has cordate shining glabrous leaves, alternate peduncles, 2-5-flowered, the lobes of the calyx not membranous, glabrous and acute. The stem is acute-angled at the base, but obtuse-angled at the apex, and of a dark purple. The leaves are full of pellucid dots. The corollas small, purple, and veiny, the lobes all denticulated. This species is the Γαλιόψις of Dioscorides, iv. 95.

S. nodosa has a nearly smooth herbage, which when bruised smells like elder. The root is whitish, tubular, and beset with fleshy knots. The leaves are stalked ovate-oblong, acute, sharply and unequally serrated, heart-shaped at the base, where they are cut away as it were to the two small lateral ribs. The flowers are a little drooping, the corollas of a dull-green, with a livid purple lip, the calyx is smooth, the capsule ovate-oblong. The leaves and roots are said to be purgative and emetic. They have a bitter taste and a disagreeable smell. A decoction is used by farmers to cure the scab in swine. Wasps greatly resort to the flowers. Goats eat the plant, but all other animals refuse it. It is native mostly throughout Europe.

S. aquatica has an entirely fibrous root. It is a smooth plant of a deep shining green-colour, the stem is quadrangular downy, the leaves copiously and finely serrated, heart-shaped at the base. The flowers are in clusters, their tube is green, the corolla of a deep red. The capsule globular. This plant is called Water-Betony, Bishop's-Leaves, and Broadwort. Its medicinal properties are the same as those of *S. nodosa*. It is called by the French Herbe du Siège, because during the siege of Rochelle by Cardinal Richelieu in 1628 the garrison supported themselves in extremity by eating the roots.

There are 73 species of Figwort; of these six are recognised British plants.

(Don, *Dichlamydeous Plants*; Babington, *Manual of British Botany*; Burnett, *Outlines of Botany*.)

SCROPHULARIA'CEÆ, *Figworts*, a natural order of Plants belonging to the dicarpous group of Monopetalous Exogens. The plants of this order are herbaceous or shrubby, with round and knotless or square and nodose stems. Leaves alternate, undivided or lobed, sometimes collateral; the floral ones sometimes double, and placed near each other. The inflorescence is variable, usually spicate, racemose or paniculate, seldom solitary. The calyx is 5-parted, seldom 4-parted; the sepals often unequal, the upper one being largest, the two lowest smaller, the lateral ones smallest; corolla 4-5-parted, tube short or long, limb flat or erect, nearly equally divided or labiate, imbricate in æstivation; stamens 2-4, didynamous, rarely equal, alternate with the lobes of the corolla, the fifth stamen and sometimes the three upper ones abortive; anthers 2-celled, or sometimes growing together 1-celled, opening longitudinally; ovary superior, 2-celled, many-seeded; style simple; stigma mostly simple, entire, emarginate or bifid, often flattened, occasionally double at the points of the divisions of the style; fruit capsular, seldom berried, bicarpellary, 2-celled, sometimes with 2 entire or bifid valves, sometimes with 4 entire ones, sometimes opening by pores or lids, dissepiment parallel or opposite to the valves, finally loose in the centre, or altogether; placentæ adhering to the dissepiment; seeds indefinite, albuminous.

Scrophulariaceæ are nearly allied to *Solanaceæ*, and in some instances it is difficult to say to which of these two orders plants may belong. Bentham separates these orders by a purely artificial distinction, considering as *Solanaceæ* such genera as have a plaited corolla and 5 stamina, and as *Scrophulariaceæ* all those in which either the fifth stamen is wanting or the æstivation of the corolla is imbricated. Of the orders with irregular flowers, those which may be mistaken for *Scrophulariaceæ* are *Gesneraceæ* and *Orobanchaceæ*, which are distinguished by their unilocular ovarium with parietal placentæ; and the *Bignoniaceæ*, *Cyrtandraceæ*, and *Pedaliaceæ*, which have seeds without albumen, and the two latter have a unilocular or spuriously 2-4-locular fruit. *Lentibulaceæ* are closely allied to this order, but are distinguished by their unilocular fruit, free central placentæ, and minute embryo.

Rhinanthus hirsuta.

a, cutting, showing leaves and inflorescence; *b*, corolla opened, showing didynamous stamens; *c*, personate corolla, and calyx; *d*, pistil; *e*, fruit; *f*, seed with embryo lying in the albumen.

The *Scrophulariaceæ* are very widely diffused over the surface of the earth, being found in the whole range of climate between the

coldest point at which vegetation occurs at the poles, and the hottest parts of the tropics. In the torrid zone of both worlds they are very abundant, and form a 26th part of the flowering plants of Europe and a 36th of those of North America. In Australia and New Zealand they are common, and the barren shores of Tierra del Fuego produce several species. *Scrophulariaceæ* are in general suspicious plants. Several of them are active poisons, and though all do not possess deleterious properties, they are all more or less acrid. Some are esculent, but they require great caution in their preparation as food: heat or vinegar appears to lessen or destroy their injurious principles, and these agents should be employed in preparing them for use. Amongst those which are edible are the *Mimulus luteus* and *M. guttatus*, the former being eaten as a pot-herb in Peru, and the latter as a salad. [MIMULUS.] *Achimenes Cochinchinensis*, when pickled, is much esteemed in the country where it grows as an article of diet. Many of the species of this order are used in medicine: the *Digitalis purpurea*, or Purple Foxglove, has a powerful influence on the system; and is a valuable remedy in many diseases. [DIGITALIS.] *Gratiola officinalis*, the Hedge Hyssop, is also an active medicine, and so efficacious was it once esteemed that it received the name of *Gratia Dei*. *Scrophularia*, the genus which is the type of the order, derives its name from the resemblance of the tumid roots of some of the species to scrophulous swellings of the neck, to which they were applied upon the absurd supposition that nature thus pointed out the remedies for diseases. *S. nodosa* has a bitter taste, and a decoction of its leaves is used for curing the scab in swine. *S. aquatica* is called by the French Herbe du Siège. [SCROPHULARIA.] There are 176 genera and 1814 species—14 are British genera.

SCRUPARIA. [POLYZOA.]

SCRUPOCELLARIA. [POLYZOA.]

SCURVY-GRASS. [COCHLEARIA.]

SCUTELLA. [ECHINIDÆ.]

SCUTELLA'RIA (from the Latin 'Scutella,' a little saucer, in reference to the form of the calyx), a genus of Plants belonging to the natural order *Labiatæ*. It has a campanulate bilabiate calyx, the lips entire, the upper one with a concave scale on its back. The tube of the corolla much exserted, 2-lipped, the upper lip concave. The filaments simple; the anthers of the two longer and inferior stamens 1-celled, of the shorter and superior stamen 2-celled. The species are annual or perennial herbs, rarely shrubs.

S. galericulata, Skullcap, has branched divaricate stems, leaves on short petioles, oblong, lanceolate, cordate below, crenate, serrate; flowers axillary, opposite, and on short pedicels. The corolla is large and blue. The whole genus is remarkable for being provided with a curved elongated support to its nut. This species was once considered efficacious in certain fevers. It is plentiful in Europe, Asia, and North America, in humid places, and in Britain.

S. minor, Smaller Skullcap, is a humble glabrous plant, with its leaves on short petioles, the lower ones broadly ovate, the middle ones ovate-lanceolate with the base cordate, the upper ones lanceolate, rounded at the base; the flowers axillary, opposite, secured; the corolla almost glabrous, with the throat hardly dilated. It is a native of Europe and Siberia, in damp places, and of Great Britain.

S. lateriflora has erect fleshy stems, petiolate, ovate-lanceolate acuminated leaves rounded at the base; the upper floral leaves hardly exceeding the calyces, the racemes axillary and terminal, the flowers opposite and secund. It is a native of North America, on the margins of ponds, and was once extolled as a remedy for hydrophobia, but on no good grounds.

Most of the species of *Scutellaria* are very pretty ornamental plants, and will grow in any common soil.

(Babington, *Manual of British Botany;* Lindley, *Flora Medica.*)

SCUTIBRANCHIATA. [MALACOLOGY.]

SCYLLA'RIDÆ, or SCYLLA'RIANS, a tribe of Macrurous Decapods, established by M. Milne-Edwards on the genus *Scyllarus* of Fabricius, and forming one of the most remarkable groups, distinguished at the first glance by the singular conformation of the external antennæ.

Jaw-Foot of *Scyllarus*.

The antennæ are inserted on the same line below the eyes; the first pair are slender, and present nothing remarkable; their first joint is nearly cylindrical and much stouter than the two following ones; finally, they terminate by two very short multi-articulate filaments. The external antennæ are foliaceous and extremely wide; the piece which carries the auditory tubercle is confounded with the epistome, and followed by four joints, the second and fourth of which are lamellar and extremely large. The buccal frame is small, and the jaw-feet are moderate and nearly pediform.

M. Milne-Edwards divides the tribe into three genera, *Scyllarus*, *Thenus*, and *Ibacus*.

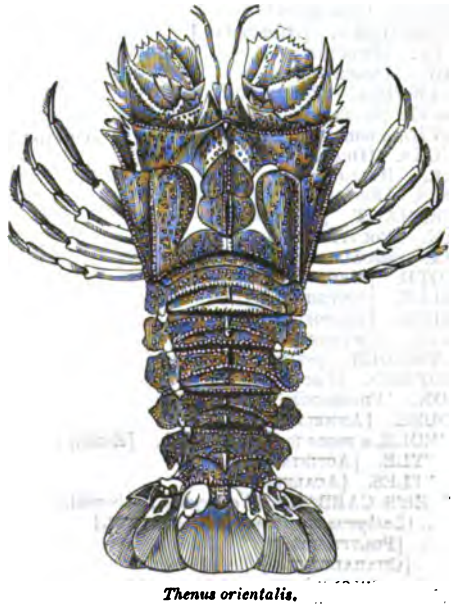
Scyllarus, Fabr.—The *Scyllari*, properly so called, differ, observes Milne-Edwards, from the other crustaceans of the same tribe in the general form of their body, which is much more elongated than that of the others, and diminishes but very little in width towards the tail. The carapace is much longer than it is wide; the lateral borders are parallel. The orbits are situated very far away from the median line, very near the external angle of the carapace, but not reaching it; they are circular, and directed upwards.

S. equinoxialis is of a yellowish colour mingled with red. Length about a foot. It is a native of the Antilles.

Scyllarus equinoxialis.

Thenus (*Scyllarus*, Fabr.; *Thenus* (?), Leach). Body very much depressed, and much narrowed from before backwards. Ocular peduncles very long. Eyes going beyond the carapace laterally; the orbits, directed outwards, occupy the external angle. Sternum much wider than in *Scyllarus*. Abdomen with nearly the same proportional length as in those crustaceans.

T. orientalis. Length about eight inches.



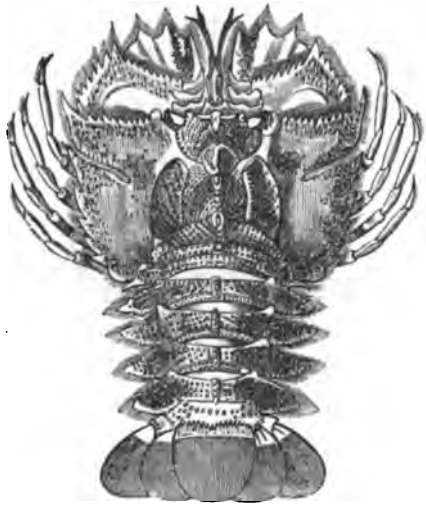
Thenus orientalis.

Ibacus, Leach.—Carapace much wider than it is long, and with a lamellar prolongation on each side, which covers the greater portion of the feet. The orbits, instead of being placed near the external

angle of the carapace, are very far distant from it. The abdomen is very short, and is suddenly narrowed from before backwards.

Carapace of *Ibacus*, seen from above.

I. Peronii. Length about five inches. It inhabits the seas of Australasia.



Ibacus Peronii.

SCYLLARUS. [SCYLLARIDÆ.]
SCYLLI'ODUS, a genus of Fossil Fishes. [FISH.]
SCYLLIUM. [SQUALIDÆ.]
SCYMNUS. [SQUALIDÆ.]
SCYPHIA, a Fossil genus of *Spongiadæ*.
SCY'TALE. [BOIDÆ.]
SCYTHIAN LAMB. [BAROMETZ.]
SCYTHROPS (Latham), an Australian genus of Birds allied to the Toucans.
SEA-ADDER, a name given to the Fifteen-Spined Stickleback. [GASTEROSTEUS.]
SEA-APE. [SQUALIDÆ.]
SEA-BEAR. [BEAR.]
SEA-BREAM. [PAGELLUS.]
SEA-BUCKTHORN. [HIPPOPHAE.]
SEA-CALF. [PHOCIDÆ.]
SEA-COW. [PHOCIDÆ.]
SEA-CRAWFISH. [PALINURUS.]
SEA-DACE. [LABRAX.]
SEA-DEVIL, a name for the Fishing Frog. [LOPHIADÆ.]
SEA-DUCKS. [DUCKS.]
SEA-EAR. [HALIOTIDÆ.]
SEA-EGGS. [ECHINIDÆ.]
SEA-ELEPHANT. [PHOCIDÆ.]
SEA-FAN. [POLYPIFERA.]
SEA-FOX. [SQUALIDÆ.]
SEA-FROTH. [MEERSCHAUM.]
SEA-HOLLY. [ERYNGIUM.]
SEA-HORSE. [HIPPOPOTAMUS.]
SEA-KALE. [CRAMBE.]
SEA-LAVENDER. [STATICE.]
SEA-LEOPARD. [PHOCIDÆ.]
SEA-LION. [PHOCIDÆ.]
SEA-MOUSE. [ANNELIDA.]
SEA-NEEDLE, a name for the Gar-Fish. [ESOX.]
SEA-NETTLE. [ACTINIA.]
SEA-NETTLES. [ACALEPHÆ.]
SEA-OTTER'S CABBAGE, (*Nereocystis Lutkeana*).
SEA-PEA, (*Lathyrus maritimus*). [LATHYRUS.]
SEA-PEN. [POLYPIFERA.]
SEA-PIE. [CHARADRIADÆ.]
SEA-PIKE. [BELONE.]
SEA-POACHER. [ASPIDOPHORUS.]
SEA-RADISH. [RAPHANUS.]
SEA-REED. [PSAMMA.]
SEA-ROCKET. [CAKILE.]
SEA-SCORPION. [COTTUS.]
SEA-SNAIL. [DISCOBOLI.]
SEA-SNIPE. [CENTRISCUS.]
SEA-STARS. [ASTERIADÆ; ECHINODERMATA.]
SEA-SWALLOWS. [STERNIDÆ.]
SEA-URCHINS. [ECHINIDÆ.]
SEA-WEEDS. [ALGÆ.]
SEA-WIFE. [LABRIDÆ.]
SEA-WOLF. [ANARRHICAS.]

SEAFO'RTHIA, a genus of Plants belonging to the natural order *Palmaceæ*, indigenous to the eastern coast of tropical Australia, and found also in the nearest Asiatic islands, named by Mr. Brown in honour of Francis, lord Seaforth, a patron of botany. The species are elegant in appearance, with pinnate fronds, the flowers polygamo-monœcious, sessile on a branched spadix, with several incomplete spathes, the male flowers above, and with two supporting each female flower. The calyx and corolla are trifid. The male flowers with numerous stamens, and the rudiment of a pistil; the female flowers without any rudiments of stamens; ovary 1-celled. Style very short; stigmas 3, spreading; berry fibrous, small, oval, 1-seeded; albumen ruminated; embryo basilary. The genus is described by Labillardière under the name of *Ptychosperma*.

SEALS. [PHOCIDÆ.]
SEBASTES. [SCORPÆNA.]
SEBESTEN. [CORDIA.]
SEBESTENS, Lindley's name for the order *Cordiaceæ*. [CORDIACEÆ.]

SECALE, a genus of Grasses, to which the cultivated Rye belongs. The flowers are arranged on a spike; the spikelets are 2-flowered, with a long stalked rudiment of a third floret; the glumes are subulate. In other respects this genus strongly resembles *Triticum*, to which the Common Wheat and Couch-Grass belong. [TRITICUM.]

S. cereale, Rye, has the glumes 1-nerved and shorter than the spikelet; the rachis is very tough. This plant is extensively cultivated in Europe, and nowhere has been observed in a truly wild state, away from the possibility of escape from cultivation, being sown by the agency of man. [RYE, in ARTS AND SC. DIV.]

S. montanum has the rachis hairy, brittle; glumes with a short point; the root fibrous. It is found on the gravelly mountains of Sicily.

S. villosum is also a European species, in which the spicules are 4-flowered, and the glumes have 2 or 3 strong ribs. It is found in France.

(Wood, *Tourists' Flora.*)

SECAMO'NE, a genus of Plants belonging to the natural order *Asclepiadaceæ*, found in the warm parts of India, Africa, Australia, and in the West Indies. The name is probably derived from the Arabic Sukmoonya, as this is the proper name in Prosper Alpinus of the *Secamone Alpinii*, or *Periploca Secamone* of Linnæus. The genus *Secamone* is characterised by having a quinquifid calyx and corolla, the latter being rotate; staminous crown 5-leaved, with the leaflets compressed laterally; pollen masses 20, erect; stigma coarctate at top; follicles smooth; seeds numerous, hairy at the umbilicus. The species form erect or climbing smooth shrubs with opposite leaves; the flowers are small, and the inflorescence in cymes, which are dichotomous, arising from between the petioles.

Some of the species of *Secamone* secrete a considerable quantity of an acrid principle, which makes them useful as medicines. Thus the roots of *S. emetica*, being emetic in action, are employed as a substitute for Ipecacuanha; whilst the substance called Smyrna Scammony is said to be obtained from the Egyptian species, *S. Alpini* of Rœmer and Schultes, the *S. Ægyptiaca* of Brown.

SECRETARY-BIRD. [GYPOGERANUS.]
SECRETING GLANDS. [GLAND; SECRETION.]

SECRETION, in the Animal Kingdom, is that process by which substances are separated from the blood, either for some ulterior purpose in the body, or to be thrown off as useless and effete matter. The term 'secretions' is often applied to those substances alone which are separated from the body for the purpose of being thrown off, but everything that is formed or separated from the blood by the action of the cells should be regarded as a secretion. The term 'excretion' is applied to those secretions which are thrown off from the body, as the urine, perspiration, &c.

The process of secretion in animals is less complicated generally than the same process in plants; for whilst in the plant all the materials for its nutrition must undergo a process of change, this is only the case with a certain number of the secretions of animals. In the great proportion of cases of nutrition effected by secretions in the animal, it consists in merely separating the materials of growth from the blood, where they already exist. It is more especially in the case of materials that are to be got rid of from the animal system that the greatest amount of chemical change is observed, as in bile, milk, saliva, &c. But even in some of these cases, as in the uric acid, and urea of the urine, and carbonic acid from the lungs, the substances got rid off seem previously formed in the blood.

In all cases the secretions of the animal body are found to take place in organs presenting three elementary conditions:—1, Cells; 2, a Basement Membrane; 3, Bloodvessels. Of these the only element universally necessary is the cell. As we find that, amongst the lowest

animals, where neither bloodvessels nor basement membranes are present, the cell has the power of forming special products, and separating them from the fluid by which it may be surrounded. [CELLS; GLANDS; MEMBRANE; INTESTINES.]

On the surface of serous membranes a serous liquid is formed, which is supposed to be simply an exudation or oozing from the vessels supplying the membrane. Whether such exudations are entitled to the name of secretions is doubtful. Various circumstances influence the function of secretion in the higher animals. Among these may be mentioned:—

1. The quantity of blood.
2. The composition of the blood.
3. The state of the nervous system.

An increased supply of blood generally increases secretion. At the same time an increased secretion from a part will draw a larger quantity of blood to a part, so that these conditions react on each other. There are however diseased conditions in which an increased supply of blood to an organ suspends altogether secretion from a part. This is the case in some stages of inflammation of the mucous membranes.

That secretion is dependent on the supply of materials in the blood is frequently observed. Thus when one kidney is diseased the blood gets a larger supply of urea, and the other kidney throws off a much larger quantity than it otherwise would do. The kidney also grows larger, and this indicates the relation between nutrition and secretion. At the same time in diseased conditions we have exceptions. In gout the kidneys seem unable to carry off the lithic acid from the blood, whilst in rheumatism the lithic acid is so freely carried off that none is found in the blood.

The nervous system in the higher animals exerts a powerful influence on the secretions. Excitement of the mind will produce tears. Fear and anxiety increase the intestinal and urinary secretions. Injuries to the spinal cord increase the phosphate in the urine. The thought of food increases the flow of saliva. The mother's breast fills with milk at the thought of or sight of her infant. Under the influence of passion or fear the milk becomes changed in composition, and injurious.

The purposes which the secretions serve are various. Some, as already stated, have no other purpose than to moisten the several parts of the body; others are appropriated to the service of important functions, as the saliva, the gastric juice, the bile, and the pancreatic and intestinal fluids, which all assist in digestion. Such also are the tears, which serve for the cleansing of the front of the eye; the milk for the food of the offspring; and various materials for the defence and comfort of the animal, and for the propagation of the species. Other secretions again, which are commonly called excretions, are the refuse of the blood, and if retained in it would exercise an injurious influence on the whole economy; such are the cutaneous perspiration, the urine, and those parts of the bile and intestinal fluids which are not used in digestion. [BILE; GLAND; INTESTINES; LIVER; MAMMARY GLAND; MILK; MUCUS; PANCREAS; SALIVA; SKIN; STOMACH.]

SECRETIONS OF PLANTS are those substances which are found in Plants, and which have been formed by the action of the cells upon the compounds which have been taken up into the plant as food. [SAP.] From this point of view all substances, whether composing a part of the tissue of plants or thrown out upon their surface, are regarded as secretions.

Although the term secretion is generally connected with the idea of separating for the purpose of throwing off, or getting rid of a product, it is very manifest that such a use of the term would restrict its application to the substances which, amongst animals, are called excretions. It does not appear that any one class of substances can be called excretions more than another in the vegetable kingdom. It is true that a theory of the practice of 'rotation of crops' supposes it to depend on poisonous excretions given off by the roots of one plant which are not poisonous to another. But the facts brought forward to support this theory are doubtful, and other explanations of the necessity of rotation have been given. [ROOT.]

In plants the organs of secretion are simpler than those of animals, as they have no fixed reservoir from which to draw the materials of secretion, as the blood. This function however seems to be performed in both plants and animals on the same general plan. It is in both cases in the interior of the cell that the most remarkable instance of the process takes place. In the plant the compounds changed are simpler, whilst the chemical forces in action during secretion are stronger than in animals. All the important secretions of plants are compounds of the four organic elements: carbon, hydrogen, oxygen, and nitrogen. These enter the plant in the form of carbonic acid and ammonia. Out of these compounds the various substances that give the hardness to the wood of plants, the nutritive value to their seeds, roots, and other parts, the colour and scents of their leaves and flowers, with the medicinal virtues of many special plants, are formed. The substances thus produced are easily distinguishable, and may be divided into two great classes.

First, Nutritive or Assimilable Secretions, that is, substances which having been formed in the plant, are used for forming its tissues, and constructing the mass of which it is composed. The principal substances which are thus employed are cellulose, starch, sugar, oil, and protein. The first four are distinguished by containing the elements carbon, hydrogen, and oxygen, whilst the latter contains in addition nitrogen. [CELLULOSE; DEXTRINE; STARCH; SUGAR; OIL; PROTEIN.]

These substances are found universally in the vegetable kingdom. No cell can be formed without one of the ternary compounds, and a portion of the quaternary substance in some form. Hence they are called in relation to the plant Nutritive Secretions. These substances are also easily convertible the one into the other; the sugar may be converted into starch or cellulose, and vice versâ, and thus their powers and properties are essentially connected with the assimilative processes of the plant.

The second class of substances are called Non-Assimilable or Special Secretions of Plants. They are substances which are not found in every part of every plant. When once formed also they are not liable to change, and are certainly never converted into the nutritive secretions; hence they are called non-assimilable. Some of these substances are very generally diffused amongst plants, as chlorophyle, which is the substance which gives the peculiar green to the leaves and other parts of plants. [CHLOROPHYLE.]

These secretions are very numerous, and may be classed under certain general heads.

1. Colouring matters. To this head may be referred chlorophyle; the colouring principle of the petals of plants seems also to be a modification of this substance. There are however other colouring matters in plants, such as those used by the dyer, and which do not give any colour to the plants in which they exist, which have nevertheless a very definite chemical composition, and by combining with various other substances produce the colours used by the manufacturers of coloured cotton, linen, silk, and woollen cloths of various kinds. These colouring matters would appear to arise from the decomposition of the assimilable secretions, as many of them bear a close relation to both the ternary and quaternary forms of these secretions.

2. Acids. Substances having an acid reaction, and capable of combining with the oxides of the metals, are very common in the vegetable kingdom. The most familiar forms are those which occur in fruits, as the oxalic, citric, malic, and tartaric acids. Oxalic acid is found in the *Oxalis Acetosella*, hence its name, and other forms of *Oxalidaceæ*. It is also found in the *Cactaceæ* and *Polygonaceæ*. In the latter order it exists in the species of *Rheum* (Rhubarb), used for making pies, and also in the Sorrels (*Rumex*). In all these cases it is combined with the oxide of some metal, either potassium or calcium. In Sorrel (*Rumex acetosa*) it exists as a quinoxalate or superoxalate of potass, which, when separated, is called Salts of Sorrel. In the *Cactaceæ* it exists as an insoluble oxalate of lime, in the form of raphides. These bodies, which are merely needle-like crystals of this salt, are very common in the vegetable kingdom. Citric Acid is found in the fruits of the order *Aurantiaceæ*, as the lemon, orange, lime, shaddock, &c. It is easily separated from these fruits in a crystalline form. It is soluble in all its combinations with the oxides of the metals, hence it does not occur as oxalic acid in the form of raphides. Tartaric Acid is found in the juice of the grape. Though closely resembling citric acid, it differs in forming an insoluble compound with potass. This compound is the supertartrate of potass, or cream of tartar of the shops. This salt is deposited whenever grape-juice is allowed to stand. It forms the basis of the tartar of wine procured from the lees. This property of tartaric acid makes the juice of the grape the most efficient compound from which to make wine. The juice of fruits containing citric acid, whose salts are soluble, are much less fitted for wine-making. Malic Acid is the acid found in the apple, and which gives the sour taste to verjuice, as also to the fermented juices of the apple and pear—cider and perry.

The chemist has described a very large number of organic acids as present in plants, and every day is increasing their number. Many of the colouring matters appear to be acids, which assume their particular colours by combination with metallic oxides, such as the lecanoric, orsellic, erythric, and parellic acids, obtained from lichens, used in making cudbear and archil. The vegetable alkalies, or alkaloids, are also found in combination with acids; thus, aconitine is found in combination with aconitic acid, morphia with meconic acid, and a variety of others.

The acids generally occur in combination, and sometimes supplant each other. Even mineral acids will sometimes take the place of organic acids; thus sulphuric acid is sometimes found combined with morphia in the place of meconic acid. On the other hand, the metallic oxides will sometimes take the place of the alkaloid, and be found in combination with the organic acid. In the instance however of gallic and tannic acids, there appears to be no combination with alkalies or alkaloids. Tannic acid, formerly called tannine, is found very generally present in the woody parts of plants. It is supposed to result from the decomposition of cellulose. Theoretically, it may easily be formed out of carbonic acid and water. Whether it passes through the stage of cellulose is doubtful. It is of great use in the arts, especially in tanning and dyeing, and for these purposes it is obtained from the bark of oak, elm, willow, sumach, and other trees. It exists in the fruits of the *Chrysobalanaceæ*, and the legumes which are called 'divi divi.' The vegetable extracts called catechu, or cutch, and the exudations which are sold by the name of kino consist

principally of tannic acid. This acid is converted into gallic acid by oxidation. Such a process takes place during the formation of the galls produced by the puncture of insects in the buds of many of the species of *Quercus*, especially *Q. infectoria*. These excrescences are called gall-nuts, and from the presence of this acid in them it has been called gallic acid. [GALLS; QUERCUS; ACACIA; PTEROCARPUS.]

The alkaloids are substances found in the leaves, fruits, bark, and other parts of plants. They are some of them peculiar to particular species of plants, whilst others are more generally diffused. Many of them possess extraordinary properties in relation to the animal kingdom, producing poisonous effects: such are strychnia, from the *Strychnos Nux Vomica;* morphia, from the *Papaver somniferum;* conia, from the *Conium maculatum*. These substances are always found in combination with organic or mineral acids. There is however another class of substances closely resembling these in their composition and action, which do not combine with acids. These are called neutral principles: such is theine, the principle found in tea, coffee, and Paraguay tea; and theobromine, the principle of cocoa.

The volatile oils are another group of secretions of great interest. They differ in composition and character from the mixed oils, and do not appear to belong to the assimilable secretions. They are many of them used as perfumes—others as stimulant medicines, and are remarkable for the interesting compounds they can be broken up into by the agency of chemistry. Their investigation is throwing much light on vegetable chemistry. [OILS.]

The resins are a group of substances standing in a similar relation to the fixed oils, as the volatile oils. They do not appear to be assimilable, they are only occasionally formed, and present special properties in particular plants. They are often combined with gum, forming the substances called gum-resins, and from this combination it may be supposed they are directly formed from the ternary assimilable secretions. When occurring with gum, as in the case of the gum-resins of the *Umbelliferæ*, or without gum, as in the resins of the *Coniferæ* and in Myrrh, they are combined with volatile oils, which appears to give them their peculiar odours, flavours, and action. In the *Coniferæ* the volatile oil they are combined with is the same in most species, and is used in the arts under the name of oil or spirits of turpentine. [CONIFERÆ.] Wax is also very commonly found in plants, and has a relation with the fixed oils. [WAX, Arts and Sci. Div.] Caoutchouc and Gutta-Percha are also compounds belonging to the non-assimilable group of vegetable secretions, and are remarkable for the absence of either oxygen or nitrogen. [INDIA RUBBER; ISONANDRA.]

Although the processes by which these products may be gradually elaborated in the vegetable kingdom may be very numerous and much more complicated than any processes with which we are at present acquainted, we can readily explain their formation from the carbonic acid, water, and ammonia, taken up by plants, and the loss of oxygen.

The following tables illustrate this process, with regard to several of the substances mentioned:—

TABLE OF SUBSTANCES FORMED FROM CARBONIC ACID AND WATER, BY THE LOSS OF OXYGEN.

Substance formed.		Carbonic Acid used in eqs.	Water used in eqs.	Oxygen lost in eqs.
Name.	Formula.			
Oxalic Acid (dry) .	C_2, H, O	2	1	1
Gallic Acid . . .	C_7, H_3, O_5	7	3	12
Tartaric Acid . .	C_8, H_6, O_{12}	8	6	10
Malic Acid . . .	C_8, H_6, O_{10}	8	6	12
Citric Acid . . .	C_{12}, H_8, O_{14}	12	8	18
Meconic Acid . .	C_{14}, H_4, O_{14}	14	4	18
Cellulose . . .	C_{12} H_{10}, O_{10}	12	8	24
Starch	C_{12}, H_{10}, O_{10}	12	10	24
Cane Sugar . . .	C_{12}, H_{11}, O_{11}	12	11	24
Glucose (dry) . .	C_{12}, H_{12}, O_{12}	12	12	24
Quassiine . . .	C_{20}, H_{12}, O_6	20	12	46
Salicine	C_{26}, H_{18}, O_{14}	26	18	56
Oil of Turpentine .	C_{10}, H_8	10	8	28
Oil of Lemons . .	C_5, H_4	5	4	14
Oil of Juniper . .	C_{15}, H_{12}	15	12	42

TABLE OF SUBSTANCES FORMED FROM CARBONIC ACID, AMMONIA, AND WATER, BY THE LOSS OF OXYGEN.

Substance formed.		Carbonic Acid used in eqs.	Water used in eqs.	Ammonia used in eqs.	Oxygen lost in eqs.
Name.	Formula.				
Asparagine .	C_8, N_2, H_{10}, O_5	8	4	2	12
Indigo . .	C_{16}, N, H_9, O_2	16	8	1	33
Nicotine . .	C_{10}, N, H_8	10	8	1	28
Coniine . .	C_{16}, N, H_{16}	16	16	1	48
Morphine .	C_{35}, N, H_{20}, O_6	35	17	1	81
Quinine. .	C_{20}, N, H_{12}, O_2	20	9	1	43
Strychnine .	C_{44}, N_2, H_{22}, O_4	44	16	2	106
Theine . .	C_{16}, N_4, H_{10}, O_4	16	0	6	28
Albumen .	C_{216}, N_{27}, H_{169}, O_{68}	216	88	27	452
Caseine . .	C_{288}, N_{36}, H_{228}, O_{90}	288	120	36	612

It should not however be lost sight of that other elements besides the four organic are constantly found present in the secretions of plants. Sulphur and phosphorus are found in fibrine, caseine, and albumen. The alkalies and alkaline earths are found very commonly associated with all these secretions, and it is very certain that plants will not form their secretions unless the inorganic elements are present. [SAP; ROOT.]

SECRETIONS, VEGETABLE. [SECRETIONS OF PLANTS.]

SECUNDINE. [SEED.]

SECURI'FERA, a family of Hymenopterous Insects of the Section *Terebrantia*, the species of which are chiefly distinguished by their having the abdomen sessile, or joined to the thorax so as to appear a continuation of that part, and not separated by a slender peduncle. In the females, the abdomen is provided with a saw-like apparatus which not only serves for depositing the eggs, but for preparing a place for their reception. The larvæ greatly resemble those of lepidopterous insects, and, like them, feed upon plants; they are cylindrical, soft, and fleshy; have the head vertical, and the three thoracic segments each provided with a pair of legs; besides these, the abdomen is often provided with pro-legs.

The *Securifera* are divided by Latreille into two sections, the *Tenthredinetæ* and the *Urocerata*. The first corresponds with the genus *Tenthredo* of Linnæus, the species of which have the mandibles elongated and compressed; the maxillary palpi are six-jointed, and the labial have four joints; the four wings are always divided by the nervures into numerous cells. The abdomen is composed of nine segments, the last of which is provided with an oviduct composed to two serrated lamellæ; these are pointed and lodged between two others forming a kind of sheath. By means of this saw-like ovipositor the female *Tenthredo* bores holes in the stems and other parts of plants, in which she deposits her eggs. In each hole, after the egg or eggs are deposited, a liquid is injected, the use of which, it is supposed, is to prevent the closing of the opening. The wounds thus made increase in volume, and form excrescences, which are either hard, or soft and pulpy, according to the nature of the plant or of the part wounded. These tumours then form the domicile of the larvæ, which inhabit them either solitarily or in society, and in them undergo their metamorphosis. Generally however the larvæ of the *Tenthredinidæ* live exposed on the leaves of the plants upon which they feed, and these larvæ are usually observed with the body more or less rolled in a spiral manner. When about to assume the pupa state, they inclose themselves in a cocoon which is sometimes fixed to the plant, but frequently they bury themselves in the ground previously to assuming the pupa state.

The second section (*Urocerata*) is distinguished from the preceding by the mandibles being short and stout, the ligula entire; the ovipositor of the females is sometimes exserted and composed of three slender appendages, and sometimes spirally rolled within the abdomen. It is composed chiefly of the Linnæan genus *Sirex*.

SEDGE. [CLADIUM.]

SEDGE-WARBLERS. [SYLVIADÆ.]

SEDGES. [CYPERACEÆ.]

SEDUM, a genus of Plants belonging to the natural order *Crassulaceæ*. It is known by possessing a 5-parted calyx with ovate usually turgid leaf-shaped sepals; five petals, which are usually spreading; ten stamens, an hypogynous scale at the base of each carpel; five carpels. They are mostly herbs or shrubby plants, with stems usually branched from the base. The flowerless stems are crowded with leaves, which are alternate, seldom opposite, fleshy, terete or flat, and entire. The flowers are commonly yellow, sometimes white or blue, and are arrayed in cymes. The species of *Sedum* are inhabitants of the temperate and warmer parts of the earth, and are mostly found in dry, barren, rocky, or arid situations where nothing else will grow. Their roots appear to serve only the purpose of holding them in the ground, whilst their leaves are so constructed that they absorb moisture from the air, and prevent its being again evaporated.

S. Rhodiola, Rose-Root Stonecrop, or Rhodiola. Leaves flat, oblong, serrated at the apex, glabrous, glaucous; root tuberous; stems single; flowers with 4 petals, 8 anthers, and dicœcious from abortion. It is a native of mountainous districts of the middle of Europe, of Siberia, and north America. In Great Britain it is found on mountains in the north of England, Scotland, and Wales. It is a glaucous plant with yellow flowers. The root, when dried, has a sweet taste and smell, and hence its common name. The leaves have been used as a cataplasm in headache, and the root has been supposed to possess anti-scorbutic qualities. In Greenland it is eaten as a salad. This and some allied species constituted the genus *Rhodiola*, but the difference between them and *Sedum* does not justify the separation.

S. Telephium, Orpine, or Tuberous Stonecrop. Leaves oblong or oval, attenuated at the base, flat, toothed, glabrous; stems erect; cymes corymbose, terminal; stamens equal in number with the petals. It is found on rocks, walls, and dry stony places in most parts of Europe: in Great Britain it is met with on the borders of fields, in hedges and bushy places, on a gravelly or chalky soil. Several varieties have been described, and sometimes as species. The most frequent is one with purple flowers, *S. T. purpureum*. The leaves of this plant are sometimes eaten as a salad; and in former times the roots were in request as a remedy in hæmorrhoids and other diseases.

S. Anacampseros, Anacampseros, or Evergreen Orpine. Leaves

wedge-shaped, obtuse, entire, nearly sessile, alternate, flat, smooth; stems decumbent; flowers corymbose. It is a native of rocks on the higher mountains of Piedmont, Savoy, Switzerland, &c. It is often cultivated in gardens. It is a trailing plant, with beautiful purple flowers. It was also formerly used in medicine.

S. acre, Acrid Stonecrop. Stems rather creeping; branches erect; leaves ovate, fleshy, sessile, suberect, alternate, glabrous; flowers sessile, on a trifid cyme; petals lanceolate, acuminated. It is one of the most common of the genus, and is found on walls, roofs of houses, rocks, and dry places, all over Europe. When chewed in the mouth, it has a hot biting taste; hence it is frequently called Wall-Pepper. When applied to the skin, it produces vesication; and, taken internally, it causes vomiting.

S. album, White Stonecrop. Branches perennial, rooting; leaves club-shaped, green, flattish, glabrous; cymes branched, terminal, subcorymbose; petals bluntish. The flowers are cymose and white. It is a native of Europe, in dry meadows, on walls and rocks. It is rare in England. With many of the more common Stonecrops, this species has been used in medicine, and also eaten cooked, or as a salad.

SEED, in Botany, is that part of a plant which contains, within several coverings, the embryo or young plant, and is itself covered over with the various parts of the pericarp or fruit. The seed in its young state is called the Ovule, or Seed-Bud, which is found in the interior of the Ovary, or Germen, at a very early period of its growth. When the ovules are first seen they are like little warty excrescences on the inside of the Ovarium, composed of delicate cellular tissue. As they increase in size they elongate, and may then be divided into two parts, a central portion, consisting of cellular tissue, called the Nucleus, and an external covering consisting of two membranes, the outer one of which is called Primine and the inner one Secundine. At one end the two membranes are open, forming a hole called the Foramen, from which the nucleus projects more or less in the early stages of its growth. As the ovule increases in size the foramen is almost closed, and in the matured seed it is called the Micropyle. The base of the ovule is attached to a membrane of the ovarium called the Placenta, and as the ovule increases in size the portion of its tissues that connects it with the ovary becomes, relatively to the ovule, small and cord-like, and hence has been called the Funiculus, or Umbilical Cord. The point where this cord unites with the ovule becomes in the seed the Hilum, and it is at this point also that a number of spiral vessels and ducts are observed to pass to the base of the seed, which has been called the Chalaza. In the progress of the growth of the ovule the nucleus increases in size, and becomes hollow inside, forming a little shut sac, which forms a kind of third membrane, called Tercine. In the interior of this sac another is formed, which, as it contains or forms a part of the embryo or young plant, is called the Sac of the Embryo. Whilst growing the parts do not always maintain the same relations to each other that we have described, and from this circumstance Mirbel has proposed a classification of ovules. When the ovule has grown regularly with the hilum and chalaza at the base and the foramen at the apex, it is called a Straight or Orthotropous Ovule. Although this appears to be the normal mode of growth, it is not the most frequent. It is seen in the walnut. If in the course of growth the ovule is bent round, so that the foramen is brought near to its base, where the hilum and chalaza exist, it is called a Curved or Campylotropous Ovule. This is seen in the *Brassicaceæ*, *Papilionaceæ*, and *Caryophyllaceæ*. When one part of the ovule grows faster than the other, the nucleus loses its relative position,—its point is in this instance directed towards the base, and the foramen is found near the hilum, and the base of the nucleus becomes situated where its apex originally was, and it carries to this point the chalaza, which is continued from the cord by means of a set of vessels called the Raphè. This forms a third class of ovules, called Contorted or Anatropous Ovules. It is seen in *Liliaceæ*, *Rosaceæ*, *Ranunculaceæ*, &c. Mirbel maintains that all ovules are originally straight, but Link doubts this. (Link, 'Grundlehren der Kräuterkunde,' Theil ii., p. 281.)

The position of the ovule in relation to the ovary is a point of some importance in systematic botany. When it arises up from the base of the ovarium, it is called Erect; when it originates a little above the base, Ascending; when it hangs from the apex of the cavity, Pendulous; when it hangs from any point below the very apex, Suspended.

Their number is also a point of value, and when there are only few and easily counted, they are said to be Definite. When their number is too great to be counted, they are called Indefinite.

Such is the state of the young seed up to the time of the influence of the pollen upon the stigma. Soon after this action takes place a minute vesicle makes its appearance on the summit of the inner sac of the nucleus. This vesicle increases in size, and is developed into three parts, a descending portion, called the Radicle, and which always points to the foramen; an ascending portion, the Plumule; and lateral or enveloping portions, the Cotyledons; the whole constituting the Embryo, or young plant.

Whilst the embryo is growing, the membranes which immediately surround it increase in size, and frequently become the seat of the deposition of a large quantity of amylaceous and other matters, called Albumen, or Endosperm, which is deposited for the purpose of supplying the young plant with nutriment during its growth. This nutritive matter however is not always deposited around the embryo, but in many cases in the cotyledons of the embryo itself, where it performs the same functions as when deposited in the tercine, or sac of the embryo. The former takes place in *Ranunculaceæ*, *Papaveraceæ*, and all that group of plants named by Lindley *Albuminosæ*, whilst the latter is seen in *Leguminosæ* and other orders.

When the embryo is fully grown the ovule has no further need of connection with the placenta, the funiculus or cord therefore dries up, and the scar which is left on the seed at its point of union with it is the Hilum or Eye; and when this is fully formed, and the embryo is capable of independent growth, the ovule becomes a Seed. Sometimes the umbilical cord, instead of disappearing, increases in size, forming a membrane which entirely envelopes the seed, and is called an Aril. One of the most remarkable instances of its existence is in the nutmeg, around which a thick aril is formed, which forms the mace of the shops. It is also well seen in the *Euonymus*, or Common Spindle-Tree, where it forms a beautiful orange-coloured mantle around the seed. It also exists in the Passion-Flower. Its uses are unknown.

The external coverings of the seed, which are called primine and secundine in the ovule, are called the Testa, Perisperm, or Spermoderm, and are nothing more than a hardened state of the ovular membranes. Whatever may be the number of these coverings in the ovule, they are seldom discernible in the seed. In the Walnut however two integuments can be plainly seen, one brown and tough, the other light and filmy; also in the Almond and some other seeds. In most instances the testa of the seed is perfectly smooth, but in others it is covered over with hair and other appendages. The cotton that is so extensively used for the manufacture of clothing is the production of the outer covering of the seeds of the cotton-plant. The Oleander is supplied with hairs at a particular part of the plant, that facilitate the moving of the seed from place to place through the air. In some instances the seeds have broad membranous expansions of the testa, called Wings, by which means they fly from one spot to another, as in the *Bignonia*. Many seeds are beautifully marked with veins running in all directions; others have minute elevations and depressions, presenting a remarkable regularity and beauty of structure.

When the seed is stripped of its testa it presents either the albumen surrounding the embryo, or the embryo itself. When the albumen is present, it varies much in character, being of a horny, oily, fleshy, or mealy consistence. These differences depend on the nature of the peculiar secretions which are mixed with fecula, or starch, in the albumen. There is a peculiar form of the albumen, which is called Ruminated, and which takes place in consequence of the abstraction of certain parts by absorption and their not being again filled up. This is the case with the Nutmeg.

There is sometimes found in seeds an organ between the albumen and embryo, which is the innermost membrane, in a state of induration and increased in size; it occurs in all the species of the Ginger tribe, and also in *Nymphæa lutea*, the Yellow Water-Lily. It is called the Vitellus.

The embryo is the most internal of all the parts of a seed. It consists, as before stated, of the radicle, plumule, and cotyledons, to which some add the Cauliculus, or Neck, which is only the point at which the radicle and plumule meet. The direction which the embryo takes varies much in different orders and genera of plants. Its directions are divided by botanists into Absolute and Relative. The absolute directions are explained by the terms straight, curved, falcate, uncinate, coiled up, folded up, spiral, bent at right angles, and serpentine. Terms have been devised also to express the relative positions of the embryo; but it is much more general for botanists to use the terms which we have referred to in speaking of the form of the ovule, and therefore we shall not explain these.

The seed-like fruits of *Lamiaceæ*, *Boraginaceæ*, *Graminaceæ*, and *Cyperaceæ* were supposed by Linnæus and his followers to be Naked Seeds. But as these have been discovered to possess a pericarpial covering, it was thought that naked seeds could not exist. This opinion however has been shown by Brown to be incorrect, as he has demonstrated that the seeds of *Coniferæ* and *Cycadaceæ* are from their youngest state destitute of pericarp, and receive impregnation through their integuments, without the intervention of style, stigma, or stigmatic surface. [Reproduction in Plants and Animals; Germination.]

SEISU'RA (Vigors and Horsfield), a genus of Birds.

S. volitans is the *Turdus volitans* of Latham; Dishwasher of the colonists of New South Wales. It is constantly in motion, displaying its tail and uttering a sound analogous to that made by sharpening an instrument on a whetstone.

SEIU'RUS. [Sylviadæ.]

SELAGINA'CEÆ. [Globulariaceæ.]

SELENITE. [Gypsum.]

SELENIUM, a non-metallic solid elementary body, discovered by Berzelius in the Iron Pyrites of Fahlun in 1818. It is not found pure in nature, but in the form of selenides of the metals copper, lead, mercury, and silver. [Copper; Lead; Mercury; Silver.]

SELF-HEAL. [Prunella.]

SEMECARPUS, a very small and entirely Indian genus of Plants belonging to the natural order *Terebinthaceæ*, of which the name is derived from *σημεῖον*, a mark, and *καρπός*, fruit, from the remarkable property possessed by the juice of the fruit, whence it is commonly

called Marking-Nut. The genus is characterised by having polygamous flowers; calyx 5-cleft; petals 5, oblong, sessile; stamens 5; disc urceolar; ovary free, sessile, girded by a tumid ring; styles 3; stigmas obtuse, emarginate. Nut compressed, heart-shaped, seated on a depressed thickened torus. Pericarp hard and thick, containing between the inner and outer layers cells full of a corrosive resinous juice.

S. Anacardium has long been known for the corrosive resinous juice contained in the nut. This juice is at first of a pale milk-colour, but when the fruit is perfectly ripe it is of a pure black colour and very acrid, and in both respects resembles that of several other plants of the same family, as in the Cashew-Nut species of *Rhus* and some of the varnish-trees. The juice is employed in medicine by the natives of India, and to mark all kinds of cotton-cloth. The colour is improved and fixed by a mixture of quicklime and water.

SEMIONOTUS. [Fish.]

SEMIOPAL. [Opal.]

SEMIPHYLLIDIANS, the third division of Lamarck's Gastropods, consisting of those whose branchiæ are placed under the border of the mantle and disposed in a longitudinal series on the right side of the body alone. The Semiphyllidians respire water only. The two genera placed by Lamarck under this division are *Pleurobranchus* and *Umbrella*.

The *Inferobranchiata* of Cuvier consisted of the genera *Phyllidia* and *Diphyllidia* only; but M. Rang arranges under that order the Semiphyllidians as well as the Phyllidians, and the following is his definition of the *Inferobranchiata*:—

Animal furnished with a foot for creeping, always very large; branchiæ in the form of a long succession of foliations, at the lower part of the body between the projecting border of the mantle and that of the foot, either all round the body or on the right of it only; the organs of generation always on the same individual; one or two pairs of tentacles.

Sometimes a shell either internal or external.

M. Rang thus defines his second family of the *Inferobranchiata*:—

Animal with the branchiæ on the right side only (with the exception of the genus *Ancylus*, which is sinister).

Sometimes a shell, either internal or external, and in the last case set on the back (recouvrante).

Under the Semiphyllidians M. Rang arranges the following genera:—*Ancylus, Pleurobranchæa, Pleurobranchus, Spiricella, Umbrella*, and *Siphonaria*.

Ancylus, Geoffroy.—Animal oval, conical, slightly recurved backwards; mantle not ample, not covering the head, and delicate upon the borders; head very large, furnished with two tentacles, which are stout, cylindrical, contractile, with eyes at their internal base, and approximated at their external side by a foliaceous appendage; mouth below, with some appearances of labial appendages on each side, foot elliptical, large; branchiæ in a sort of cavity in the middle of the right side, between the foot and the mantle; vent at the left side.

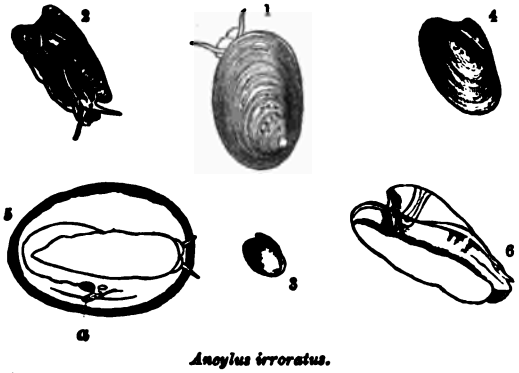
Shell delicate, covering the animal, nearly symmetrical, obliquely conical backwards; the base oval, more or less elongated; the apex pointed, but not marginal, and rather inclined to the right. (Rang.)

The species are found in fresh-water springs and streams; they creep on stones and aquatic plants.

A. irroratus. Animal pale yellowish, obscurely sprinkled with black; front and abdomen reddish; eyes black; sole of the foot spotless and palid.

Shell concentrically plaited, subdiaphanous; epidermis black-green sprinkled with black; apex sub-obtuse, posterior; aperture roundish, elliptical. Length three lines.

It is found plentifully in the ditches of the island of St. Vincent, closely adhering to dried leaves by excluding the air.



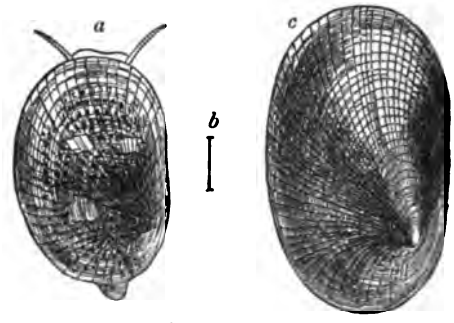
Ancylus irroratus.

1, animal creeping, magnified; 2, animal reversed; 3, 4, shell; 5, figure of the foot; *a*, branchiæ in situ; 6, animal with the shell taken off.

A. radiatus. Animal yellowish, sprinkled with black, with three or four great pale spots on the back; face reddish; abdomen obscure.

Shell oval-elliptical, glassy, diaphanous, concentrically sub-plaited, radially striated; epidermis evanescent.

It is found with the preceding.



Ancylus radiatus.

a, animal creeping, magnified; *b*, natural length of the shell; *c*, shell magnified. (Guilding.)

There are 14 recent species of *Ancylus*, and 8 fossil.

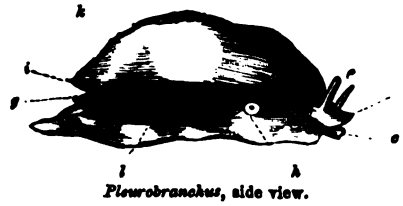
Pleurobranchæa, Meckel.—Animal oval, elongated, flat below, convex above, pointed behind; no trace of a mantle, only a slight long and narrow expansion of the skin at the middle of the right side. Head very large, with the mouth at the extremity of a proboscis. Two pairs of auriform tentacles; the anterior ones at the extremity of a muscular transverse frontal band; the posterior ones rather farther backwards, and very much separated from each other. Foot very large, more extended behind than before; a single branchia fixed at the right side and entirely exposed. Termination of the organs of generation in a common tubercle in front of the branchiæ; the anus above these, and in the middle of their length. (Rang, after De Blainville.)

P. Meckeli, Pleurobranchidium Meckeli De Blainv., is an example.

Pleurobranchæa Meckeli.

Pleurobranchus, Cuv.—Animal oblong, fleshy, convex above, with a very large and overspreading mantle. Foot large, equally outspreading, and thus leaving a wide canal all round the body. Head distinct, furnished with a veil uniting on each side with the borders of the foot, and with two tubular tentacles, which are split anteriorly; mouth at the extremity of a proboscis; branchiæ composed of a double row of lamellæ, forming a plume on the posterior right side, between the mantle and the foot; anus carried by a small tube behind the branchiæ. Organs of generation in front.

Shell sometimes rudimentary membranous, with a tolerably distinct apex, hidden in the thickness of the mantle.

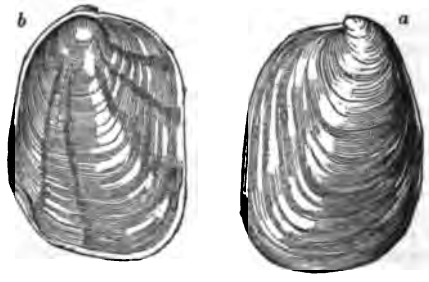


Pleurobranchus, side view.

b, veil; *e*, mouth at the extremity of a proboscis; *c*, tentacles; *g*, branchiæ; *h*, orifice of the organs of generation; *i*, position of the anus; *k*, mantle; *l*, foot. (Rang.)

Such is the definition of M. Rang, who includes *Berthella* under the genus.

The *Pleurobranchi* have been found at depths varying from the surface to 30 fathoms on rocky coasts, stones, and sea-weeds.



Shell of *Pleurobranchus membranaceus.*

a, external view; *b*, internal view.

P. reticulatus. This species is not noticed in the last edition of Lamarck.

There are about 20 species of *Pleurobranchus.*

Pleurobranchus reticulatus, seen from above. (Guerin.)

Spiricella (Rang) is a fossil genus. The shell is very much flattened, elongated, bent (arquée), with sharp edges; apex spiral, sinistrorsal, horizontal, situated backwards and to the left, open on the lower surface; an indistinct impression, but appearing to occupy the posterior part of the shell, where it shows itself nearly parallel to the border.

The only species is *S. Unguiculus.*

Umbrella, Lam. (*Gastroplax*, De Blainv.).—Animal oblong, very much depressed, convex above, very flat and fleshy below. Mantle not much extended. Head not distinct; mouth situated at the bottom of a narrow and deep notch in front of the foot, which has thick edges, and is raised all round. Four tentacles: two superior, truncated, slit, and lamellose, as it were, internally; two smaller, in form of pediculated crests, on each side of the mouth. Foot very large, spreading out on all sides, smooth and flat. Branchiæ foliaceous, disposed in a cordon all along the right side, and reaching even a little to the left in passing by the front; anus in the form of a small tube behind the branchiæ. Organs of generation very much approximated, situated to the right and forwards.

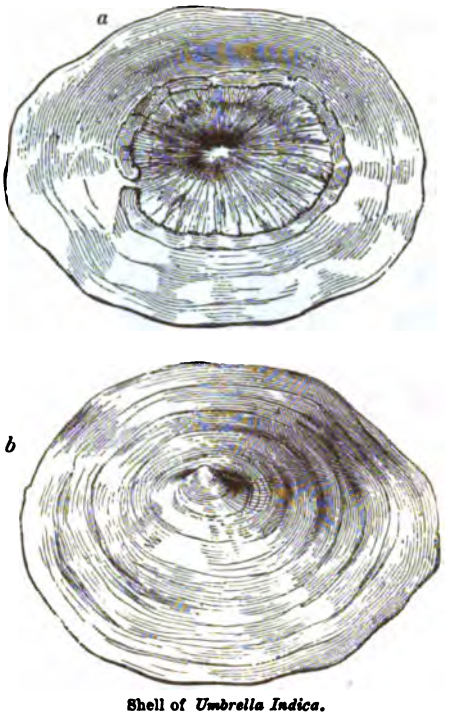
Shell external, calcareous, very much depressed, nearly entirely flat, irregularly circular, slightly convex above and concave below; apex excentric, conical, and slightly inflected; concentrically striated and radiated; edge trenchant, fixed to the dorsal part, which it covers. (Rang.)

The species are littoral. Depth, &c., much the same as in *Pleurobranchus.*

Two species only appear to be known—*U. Indica* and *U. Mediterranea.*

U. Mediterranea has the umbrella with a flattened shell; the disc of the lower surface not radiated.

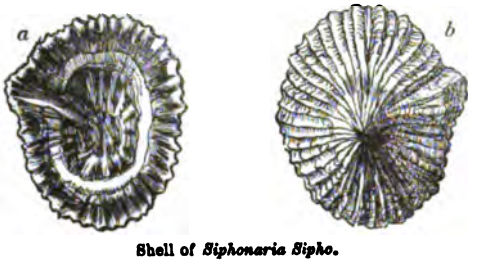
Umbrella Mediterranea, with the shell in the proper position. *a*, shell; *b*, gills; *c*, head, viewed from above. (Philippi.)



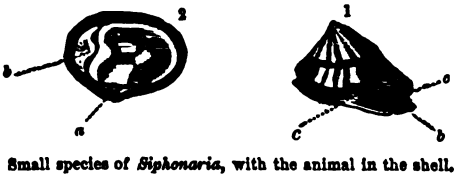
Shell of *Umbrella Indica.*
a, inside; *b*, outside.

Siphonaria, Sowerby.—Animal oval, sub-depressed; the head subdivided into two equal lobes, without tentacles or apparent eyes. Borders of the mantle crenulated. A branchia in form of a square membrane, in the sinus formed at the right, between the foot and the mantle.

Shell patelloid, elliptical, with the apex well marked, slightly to the left and posterior; a sort of canal or gutter on the right side; muscular impression of a horse-shoe shape, the right lobe divided into two by the canal. (De Blainv.)



Shell of *Siphonaria Sipho.*
a, outside; *b*, inside.



Small species of *Siphonaria*, with the animal in the shell.
1, lateral view; 2, ventral view; *a*, breathing aperture; *b*, head; *c*, mantle.

The species are littoral. Depth, &c., much the same as in *Pleurobranchus* and *Umbrella.* They are found in Brazil, the West Indies, Senegal, and Tristan d'Acunha. (Sowerby.)

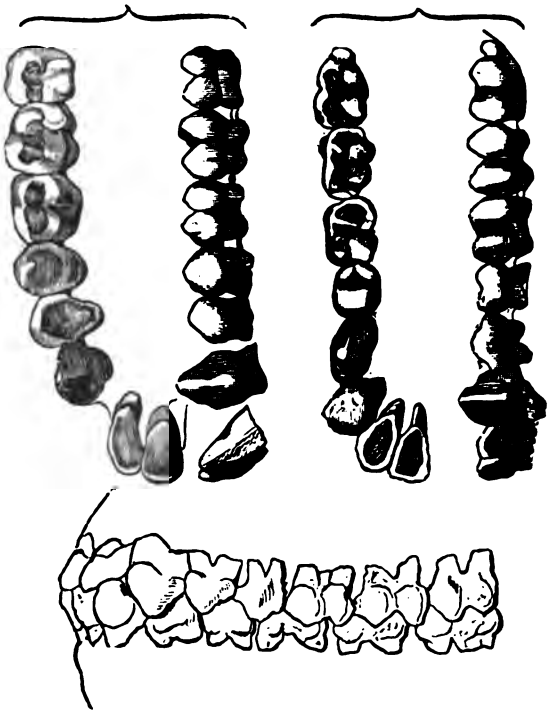
M. Deshayes, in his Tables, makes the number of living species of *Siphonaria* 21, and that of the fossil species (tertiary) 3. In the last edition of Lamarck the number of living species recorded is 19.

SEMNOPITHE'CUS, F. Cuvier's name for a genus of Monkeys.

The canines are much longer than the incisors; head round; facial angle more open than that of the Orang's; face flat. Limbs very long in proportion to the body; anterior thumbs very short. Cheek-pouches small or null. Callosities. Tail very long and slender.

Dental Formula:—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5}$ = 32.

F. Cuvier observes that the canines are often much larger than the rest of the teeth, and consequently than they are here represented. This is exemplified in the case of *S. Maurus.*



Teeth of *Semnopithecus*. (F. Cuv.)

This genus is remarkable for the large size and complication of its stomach. This was first pointed out by Professor Otto.

In 1833 the dissection of two species from the collection of the Zoological Society of London (*S. Entellus* and *S. fascicularis*) enabled Professor Owen to lay before that society an account of the structure of this genus of animals, which was published in the first volume of the 'Zoological Transactions.'

Professor Owen remarks that the genus *Semnopithecus*, which in the system of Cuvier ranks only fifth in the descending scale from man, is of late formation, and not entirely the result of newly-discovered materials. On the contrary, several species were for a long time ranked with the Guenons, in which the stomach is of the usual simple construction.

The larger of the two stomachs which formed the subjects of Professor Owen's examination was taken from a full-grown female Entellus Monkey (*S. Entellus*, F. Cuvier), which measured from the end of the nose to the root of the tail 1 foot 8 inches. The admeasurements of the stomach, distended and dried, were—

	Ft.	In.	Lin.
Length along the greater curvature	2	7	0
Length along the lesser curvature	1	0	0
Greatest circumference, a little to the right of the cardia	1	0	6
Smallest circumference (at about two inches from the pylorus)	0	3	8

Professor Owen states that this stomach may be regarded as consisting of three divisions:—1st, a cardiac pouch, with smooth and simple parietes, slightly bifid at the extremity; 2nd, a middle very wide and sacculated portion; and 3rd, a narrow elongated canal, sacculated at its commencement, and of simple structure towards its termination. The latter division, from its greater vascularity, and the more abundant distribution of the nerves of the eighth pair upon it, is regarded by the Professor as the true digestive stomach. The preceding divisions appeared to him to be preparatory receptacles or reservoirs.

Professor Owen guards against the inference that, in considering this stomach as being made up of three principal divisions, he is to be understood as supposing them to be equally distinct with the different cavities of a ruminant or cetaceous stomach. They were not characterised by any essential difference of structure, for none of them possessed a cuticular lining. The three divisions were however sufficiently obvious to justify their separate consideration for the facility of the description of so complicated an organ.

In the other species (*S. fascicularis*, the Croo of Sumatra, and *S. comatus*, Desm.) examined by Professor Owen, the stomach presented precisely the same structure as the preceding. Its dimensions however were not quite so large in proportion to the size of the animal. The individual examined was younger than the *Entellus*.

Professor Owen remarks that in consequence of the disproportionate size of the stomach in these animals, some differences are met with in the disposition of the other viscera of the abdominal cavity. The liver, instead of crossing the epigastric to the left hypochondriac region, extends downwards from the right hypochondriac to the right lumbar region, the whole of the opposite side of the abdomen, with the epigastric region being occupied by the enormous stomach. The liver is proportionately smaller in *Semnopithecus* than in *Cercopithecus* or *Macacus*. The spleen is of a more triangular shape, and is attached to the omentum continued from the left side of the stomach. The pancreas, on the contrary, is proportionately larger than in those genera. Both the biliary and pancreatic secretions enter the duodenum together, about three inches from the pylorus. Were it not for the insertion of these ducts, Professor Owen observes that one might almost suppose that what has been regarded as the true stomach was a portion of the intestinal canal.

"What then," asks Professor Owen, "are the natural habits and food of this genus? Will future observers of these Slow Monkeys, as F. Cuvier denominates them, be able to ascertain that their natural food is more strictly vegetable than that of the *Cercopitheci*, &c.? And that, like the Sloths of the New Continent, so remarkable for their complex stomachs, they also crop the tender shoots and leaves of the trees in which they habitually reside? *Cercopitheci* and *Macaci* are provided by nature with receptacles (the cheek-pouches) for storing away ill-gotten food, hastily plucked from the cultivated grounds which they invade, and which they are thus enabled to carry off in sufficient quantity, and masticate and prepare for digestion in a place of safety. The complicated stomachs of the timid Ruminants are adapted to a similar end, allowing them to accumulate their requisite quantity of herbage from exposed pastures, which they then carry off to more secure situations, and remasticate at leisure. Now, in the *Semnopitheci* it is remarkable that the cheek-pouches are very small, or are wanting altogether. I have often fed the Entellus Monkey with nuts, and have observed that, while his more fortunate neighbours the Green Monkey (*Cercopithecus Sabæus*, Geoff.) and Chinese Bonneted Monkey (*Macacus Sinicus*, Lacép.) were stowing them quickly away by the dozen into their cheek-pouches, he could not cram more than two in the same situation, and was equally averse to swallowing anything but the kernel. In this case the complicated stomach did not serve him as a substitute; but I think it very probable that it may compensate for the want of cheek-pouches when he is in a situation to collect together a quantity of soft fruits or herbs. In the gardens of the Society the *Semnopitheci* which have been there exhibited are fed exactly in the same manner as the other monkeys; and the keepers have not observed anything like rumination in them. In both the species which I have dissected, where illness and gradual decay preceded death, the stomachs were almost empty." (1833.)

Mr. Ogilby, in his 'Natural History of Monkeys,' alludes to the bezoars reported by many travellers to exist in the stomachs and intestines of the Asiatic monkeys, as confirmatory of Professor Owen's views; and adds that the bezoars produced by the monkeys of the Malay peninsula, and which can scarcely belong to a genus different from the *Semnopitheci*, are described as being smaller, rounder, and more powerful in their qualities than those obtained from ruminating animals.

The other zoological characters of this genus are thus graphically given by Mr. Ogilby in the same work:—"The extremities of the Semnopithecs are of great length, compared with the dimensions of the body. This is another instance in which the Semnopithecs resemble the Gibbons, as well as in the slender and elongated form of the body itself; but there is this remarkable distinction, that, whilst the anterior pair of extremities in the Gibbons is beyond all proportion longer than the posterior, the proportions are reversed in the Semnopithecs, and it is the posterior extremities which exceed the anterior in length. Still the disproportion is by no means so great as that which exists in the Gibbons, nor does it in the slightest degree impede the quadruped motion of the animals, when they are forced to resort to that mode of progression; but it becomes an additional evidence, particularly when taken in conjunction with other traits, of the superior development of the abdominal over the pectoral members, and the consequent degradation of the animals in the scale of existence. This evidence is still further strengthened by the very limited development of the thumb on the anterior extremities, which, as has been already observed, scarcely exceeds the tuberculous form, and enters but slightly into the functions of prehension and manipulation: thus, as it were, preparing the way for its entire disappearance in the Colobs. The organ consists nevertheless of the ordinary number of phalanges of which it is composed in other cases; but they are greatly abridged in their dimensions, both as regards thickness and length, and form a remarkable contrast to the rather immoderate development which marks the rest of the members. The tails likewise are much longer in the Semnopithecs than in any of the ordinary monkeys. Though slender however, they possess a very considerable degree of muscular power, and enter as a very important constituent into the motions and progression of the animals. When at rest and unemployed they are allowed to hang down perpendicularly, and, from their great length, which considerably exceeds that of the animal's body, have a very droll effect, which is heightened by the natural apathy and imperturbable gravity of the creatures themselves. This, when unemployed, is their natural position. They exhibit the very picture of sadness and melancholy, and appear as if perfectly regardless of everything

that passes around them; but when roused or excited they are nevertheless capable of the most surprising exertions, and astonish the spectator by a rapidity, variety, and precision of movements, which could scarcely be anticipated from creatures apparently so apathetic in mind and delicate in body. They are in reality far from meriting the name of Slow Monkeys, which some zoologists have given them; their slowness is exhibited in disposition rather than in action, and is an attribute of character rather than of structure. When young they are readily domesticated; but being less petulant, curious, and restless than the Cercopithecs and Baboons, are supposed to exhibit less intelligence, though their mental qualities, as well as their physical structure, closely assimilate them to the real Apes: the old males become morose, sullen, and mischievous."

S. Maurus, the Budeng of the Javanese, Lutung itam Maure of the Malays and Europeans, Lotong of the natives of Sumatra.

Skull and canine tooth of *Semnopithecus Maurus*. (Horsf.)

Dr. Horsfield describes this species as being on the whole of a stouter make than *S. melalophos*, and as having more robust extremities. One of the specimens in the museum at the India House measures 2 feet 3 inches from the tip of the nose to the root of the tail. The face is regularly circumscribed by hairs, which are long, and closely applied to the head; the forehead, which is gradually sloping, is entirely concealed by them. The general facial character is a flatness above, and a protrusion of the maxillæ; but the appearance of the face differs greatly in old and young subjects. The maxillæ become extended as the animal advances in age, and in young subjects the facial angle is proportionally greater. The orbits of the eyes are rather prominent, and the bones of the nose short. The nose consists of an angular ridge, which is considerably elevated between the eyes, and terminates, without any fleshy protuberance, by a membrane which is gradually attenuated below, and on each side of which the nostrils are placed. From the termination of the nose to the mouth a considerable space intervenes: the lips are small and thin. The chin is short and small; a circle of gray hairs incloses the mouth in the adult animal; and on the chin the hairs have a disposition downward, so as to exhibit the appearance of a beard. The upper part of the face is nearly naked; a few straggling stiff hairs are scattered on the cheeks and the upper lip, and on the more prominent part of the nose an interrupted series is observed. Irides of the eye dark brown. Ears concealed from view by the long hairs which cover the lateral parts of the head; they are margined, and both in form and disposition of external parts closely resemble those of man. The neck is short and considerably contracted. The trunk is of great length, broad and robust about the shoulders and the breast, and gradually of smaller dimensions towards the loins. Buttocks with very large rough callosities. Mammæ of the adult female lengthened and cylindrical. Tail as long as the body and head taken together: in some individuals, and particularly in young subjects, it exceeds those parts in length: it is cylindrical for the greatest portion of its length; the base tapers gradually, and the tip is thickened and terminated by a close tuft of long hairs of an ovate form.

Colour of Adult.—Intensely black, except the breast, the abdomen, the inner side of the extremities, and the root of the tail, which are gray. On the crown of the head the black hairs are slightly tipped with gray; and as age advances the gray portion becomes more extensive, and also shows itself on the upper parts of the body; but the extremities externally, and the tail, even in the oldest subjects, retain their blackness. The hairs are remarkably long, delicate, soft, and silky.

Colour of Young.—Immediately after birth, of a fulvous or reddish colour; with advancing age, a gray discolouration first appears on the hands, the forehead, and the tip of the tail; from these parts it gradually extends to the neck, the shoulders, and the flanks, assuming from time to time a darker hue, until the coat of the animal is jet black above and gray beneath. (Horsf.)

Budeng (*Semnopithecus Maurus*); adult and young. (Horsf.)

Dr. Horsfield states that the Budeng, or black species, is much more abundant than the red species, or Lutung of the Javanese (*S. Pyrrhus*); but the latter, both on account of its variety and comparative beauty, is a favourite among the natives. "Whenever an individual is obtained," says Dr. Horsfield, "care is taken to domesticate it, and it is treated with kindness and attention. The Budeng, on the contrary, is neglected and despised. It requires much patience in any degree to improve the natural sullenness of its temper. In confinement it remains during many months grave and morose; and as it contributes nothing to the amusement of the natives, it is rarely found in the villages or about the dwellings. This does not arise from any aversion on the part of the Javanese to the monkey race. The most common species of the island, *Cercocebus Aygula* of Geoffroy, the Egret Monkey of Pennant, is very generally domesticated; and a favourite custom of the natives is to associate it with the horse. In every stable, from that of a prince to that of a mantry, or chief of a village, one of these monkeys is found; but I never observed the Budeng thus distinguished.

"The *Semnopithecus Maurus*," he continues, "is found in abundance in the extensive forests of Java; it forms its dwellings on trees, and associates in numerous societies. Troops, consisting of more than fifty individuals, are often found together. In meeting them in the forests it is prudent to observe them at a distance. They emit loud screams on the approach of man, and by the violent bustle and commotion excited by their movements, branches of decaying trees are not unfrequently detached, and precipitated on the spectators. They are often chased by the natives for the purpose of obtaining their fur: in these pursuits, which are generally ordered and attended by the chiefs, the animals are attacked with cudgels and stones, and cruelly destroyed in great numbers. The skins are prepared by a simple process which the natives have acquired from the Europeans, and they conduct it at present with great skill. It affords a fur of a jet-black colour, covered with long silky hairs, which is usefully employed both by the natives and Europeans in preparing riding equipages and military decorations. The Budeng, during its young state, feeds on tender leaves of plants and trees; and when adult, on wild fruits of every description, which are found in great abundance in the forests which it inhabits." ('Zoological Researches in Java.')

S. melalophos. Brilliant yellow-red above, whitish below; a tuft of black hairs on the forehead in form of a bandeau; face blue.

This is the Simpai of the Malays; and in this species the great length of body and slenderness of the extremities, so characteristic of the *Semnopitheci*, are manifested in the highest degree. It is found in the forests of Sumatra.

S. Entellus, the Hoonumau (Houlmau of M. Duvaucel) of the Hindoos, Lungar of the Hill Tribes.

Semnopithecus melalophos.

The young are remarkable for the disproportionate length of the extremities, the deliberate air of their movements, and the tranquillity of their eyes and physiognomy generally. Face and hands black; body and limbs light gray or straw-colour; hair surrounding the face, and forming a projecting bandeau over the eyebrows; a peaked beard directed outwards beneath the chin. The colour always darker on the loins and along the spine, and becoming deeper as the animal advances in age, till finally the fur, becoming mixed with numerous black hairs, is of a rusty brown. The body at the same time becomes more developed and muscular, and the animal, when at its full size, is 4½ feet from the extremity of the muzzle to the origin of the tail, which is considerably longer than the body, of the same colour, and ends in a tuft of hair rather longer and darker than the general hue. It is a native of Bengal, the Himalayan Mountains, Nepaul, and Bootan.

This monkey is remarkably interwoven with the religion of the country where it is found. M. Duvaucel has given an interesting account of the careful watch which the Bengalees kept over him to prevent his killing this sacred animal, holding a high place among the thirty millions of Indian gods, and to save himself from dying within the year, which, according to popular belief, is sure to be the fate of one who puts an Entellus Monkey to death. He was harangued by the Hindoos upon the danger of injuring animals which were no other than princes and heroes under the operation of the metempsychosis. Unmoved by their eloquence, and eager to possess a specimen, he levelled and brought down a 'princess.' But the acquisition was dearly bought. The ill-fated creature had a young one on her back, and, though shot through the heart, the mother exhausted her remains of life in throwing it into the branches of a neighbouring tree; then fell and expired at the feet of M. Duvaucel. It is but just to add that he mourned over the deed he had done.

The remains of a species of quadrumanous animal allied to *Semnopithecus* were found by Captain Cautley and Dr. Falconer amongst the fossils discovered by them in the tertiary strata of the Sewalik Hills in the north of Hindoostan. ('Geol. Proc.,' 1838.)

SEMPERVIV'UM, ('always living,' from 'semper' and 'vivo,' on account of their tenacity of life), a genus of Plants belonging to the natural order *Crassulaceæ*. This genus is known by possessing a calyx 6-12-parted, and occasionally even 20-parted; petals 6-12 in number, seldom 20, more or less united at the base; 12-24 stamens or more, grown together at the base; scales at the base of the carpels, which are follicular, and equal in number to the petals. The genus is composed mostly of herbs, some of which are stemless, and have young plants growing from the axils. Others are caulescent, without young plants, or they may be shrubby and fleshy. The leaves are usually revolute, and their branches of cymose flowers are disposed in corymbs, or panicles. Their flowers are white, yellow, or purple. The species of *Sempervivum*, like the family to which they belong, have most of them thick fleshy leaves and small roots, and are adapted for growing in rocky, dry, barren places. The arrangement of their leaves is frequently very elegant, and many of the species are cultivated in our greenhouses and gardens. Some are used in the arts and medicine.

S. glutinosum, Clammy House-Leek. Stem frutescent; leaves wedge-shaped, viscid, rather scattered, fringed with cartilaginous ciliæ; petals 8-10. It is a native of Madeira. It has loose panicles of golden-yellow flowers, with a stem about two feet high. The fishermen of Madeira are in the habit of using this species to rub their nets, which are however previously steeped in an alkaline solution of some kind. They are said to endure as long as if they were tanned.

S. tectorum, Common House-Leek. Leaves ciliated; offsets spreading; petals 5-9, spreading; scales of flowers wedge-shaped, carunculate. It was originally a native of alpine and sub-alpine regions of central Europe, but it has now found its way to the tops of old walls and the thatched and tiled roofs of the houses of nearly all the countries of Europe. It is known by many other names than that of House-Leek, as Jupiter's-Eye, Bullock's-Eye, and Jupiter's-Beard.

About 36 species of this genus are described. Those known in greenhouses are chiefly brought from the Canary Islands.

SENA'CIA, a small genus of Plants belonging to the natural order *Pittosporaceæ*, named in honour of Jean Senac, a French physician. The species are natives of the West Indies, Mauritius, and of the Himalayas. The genus is characterised by its small 5-toothed calyx. Petals 5. Stamens 5, hypogynous. Younger capsules berry-formed, afterwards 2-valved, half 2-celled. Seeds 4-8. The species form smooth-branched shrubs, with feathery-veined entire leaves, and terminal corymbs of white flowers. This genus closely resembles *Celastrus*, but the hypogynous insertion of the stamens is a distinguishing character. The wood of *S. undulata* (the *Celastrus undulatus* of Lamarck), a native of the Mauritius, is well known, and esteemed for its hardness. It is thence called Bois de Joli Cœur by the French.

SENEBIERA (in honour of John De Senebier, of Geneva, a vegetable pyhsiologist), a genus of Plants belonging to the natural order *Cruciferæ*. The pouch is somewhat kidney-shaped, entire at the end, or notched above and below, and almost 2-lobed, not bursting. The cells 1-seeded.

S. coronopus, Common Wart-Cress, has an undivided uniform crested pouch with little sharp points, the pouches large in dense clusters. The leaves pinnate lobed. The stem much branched and prostrate. The sepals roundish, with white membranous margins. It is a native of Europe, North America, and England.

S. didyma, has a pouch notched by two wrinkled lobes, an extremely short style, and pinnatifid leaves. The stem is spreading, about a foot in length. The flowers small and white, in long lax clusters. It is found on waste ground near the sea in Great Britain.

S. Nilotica is eaten as a salad in Egypt. As these plants possess no beauty, they are not worth cultivating except in botanical gardens.

SENECA OIL. [NAPHTHA.]

SENE'CIO (from 'senex,' on account of its silvery capitate seed-down resembling the gray hairs of an old man), a genus of Plants belonging to the natural order *Compositæ*. The species of this genus are very numerous, but are not remarkable for either beauty or utility. The Common Groundsel (*Senecio vulgaris*) is one of the most common of weeds. [GROUNDSEL.] The flower-buds and young tops are gathered as food for young birds, and especially for domestic Canary birds. *S. Saracenicus*, Broad-Leaved Groundsel, was used by the Saracens as an application to wounds. A few of the species are cultivated, the most pleasing of which are *S. hieracifolius*, the Hieracium-Leaved Groundsel; *S. pseudo-China*, the Chinese Groundsel; *S. hastatus*, the Spleenwort-Leaved Groundsel; *S. elegans*, the Elegant Groundsel.

SENEGA. [POLYGALA.]

SENNA. [CASSIA.]

SENSATION. [NERVOUS SYSTEM.]

SENSES. The senses are the faculties by which we become acquainted with some of the conditions of our own bodies, and with certain properties and states of external things, such as their colour, taste, odour, size, form, density, motion, &c. The senses are five in number, namely, sight, hearing, taste, smell, and touch; and each of them is exercised in the recognition of an impression conveyed along some nerve to the brain. [EYE; EAR; NOSE; TONGUE; SKIN; NERVOUS SYSTEM; MUSCLE.]

SENSIBILITY, an aptitude for receiving impressions of the senses. This is its physiological meaning, as designating that faculty of the senses whereby things external are made to act upon us. That peculiar fineness of organisation which renders a man alive to the impressions of physical objects, has, by a natural metaphor, become the expression of that peculiarity of mental organisation which renders the mind alive to impressions of moral objects, such as pity for the distress of others, admiration of heroic courage or patient endurance, &c., and thus a person with a keen sense of grandeur, sublimity, nobility, beauty, or pathos, in nature or art, is said to possess great sensibility. It is this moral aspect of sensibility which in all people creates the love of poetry and fiction, and when possessed in a high degree, creates the poet himself.

SENSITIVE PLANTS is a term commonly applied to those species of plants that possess the property of visibly moving their leaves when they are touched or otherwise stimulated. This term is not applied generally to plants in which any movements can be observed; for the power of moving under the influence of certain external stimulants is a very general property of the tissues of plants, and especially of the flowers. [SLEEP OF PLANTS.]

There are a great number of species of plants of various families, that possess the power of moving their leaves under the influence of a slight touch; that which is best known is a plant belonging to the order *Leguminosæ*, called *Mimosa pudica*. [MIMOSA.] It is a native of tropical climates in moist districts, where it is exposed to a temperature of between 70° and 80° Fahr. It is in its native districts where its excitability is seen to the greatest perfection. A knock upon the ground at a short distance from the plant is sufficient to produce an influence on the leaves; and Von Martius says, that at Rio Janeiro the falling of horses' feet by the way is sufficient to set whole masses of Mimosas in motion. When in this country, the motions of the plant are always best displayed in high temperatures.

The movements are not alone produced by mechanical irritants, for if various corrosive substances, as bichloride of mercury, sulphuric acid, caustic potash, &c., are applied to the knots of the joints, the same phenomena are observed. The removal of the plant to a higher temperature will produce the same result, as well as exposing it to a lower temperature or a draught of cold air. They are destroyed by the application of chloroform and other anæsthetic agents.

Besides the *Mimosa pudica* there are several other species belonging to this genus that possess the same property, though not in so remarkable a degree. Amongst them may be named *M. sensitiva*, *M. viva*, *M. casta*, *M. asperata*, *M. quadrivalvis*, *M. pernambucana*, *M. pigra*, *M. humilis*, *M. peltata*, *M. dormiens*. Species of other genera of the same natural order *Leguminosæ* exhibiting these movements are *Smithia sensitiva*, *Æschynomene Indica*, *Æ. pumila*, and *Desmanthus stolonifer*. The locust-tree when its branches are roughly shaken closes up its leaves, and the same has been observed of *Gleditschia triacantha*, and it is probable that close observation during hot weather would prove that other leguminous plants possess this property.

Another family of plants that exhibit sensation when touched or stimulated is *Oxalidaceæ*. The *Oxalis sensitiva*, called by De Candolle on account of its sensitive properties *Biophytum*, has long been known to possess this property. *Averrhoa bilimbi* and *A. carambola* are both plants belonging to *Oxalidaceæ*, and have been described by travellers as possessing the property of folding their leaves on the application of a stimulus. But it is not only in these species that this property resides, for Professor Morren of Liège has observed it to occur more or less in all the species of the genus *Oxalis*. His observations were first made on the *Oxalis stricta*, which, if hit smartly on a warm day, will contract its leaves and assume a position as in the ordinary sleep of the leaves of these plants. He has also observed the same movements in *O. Acetosella* and *O. corniculata*, and many extra-European species. The movements in these plants consist in the folding up of their leaves, so that the two halves of the leaf approach each other by their superior surface. The midrib is also slightly bent, so that its inferior surface presents a convexity; and the petioles of the leaflets bend downwards, so that the leaf, when irritated, becomes dependent. (Morren, 'Notes sur l'Excitabilité et le Mouvement des Feuilles chez les Oxalis,' in the 6th volume of the 'Bulletins de l'Académie Royale de Bruxelles.')

In the family *Droseraceæ*, or Sun-Dews, are some plants which exhibit a considerable amount of irritability. The leaves of *Dionæa muscipula*, or Venus's Fly-Trap [DIONÆA], have the remarkable property of contracting upon insects that may happen to alight upon their surface. None of the Sun-Dews inclose insects in their leaves in this manner, but the surface of their leaves is covered with long hairs, which secrete a viscous matter. When any insect settles upon the leaf, it is entangled with the viscous secretion; and before it has time to escape, the hairs exhibit a considerable degree of irritability, and curving round, pin the animal down on the surface of the leaf.

Other instances of vegetable irritability occur in the *Berberis vulgaris*, *Mimulus*, and *Stylidium*. [BERBERIS; MIMULUS; STYLIDIUM; MOTIONS OF PLANTS; CYCLOSIS; SAP.]

SENSORIUM. [NERVOUS SYSTEM.]

SEPAL. [CALYX.]

SE'PIA. [SEPIADÆ.]

SE PIADÆ (Σηπία), a family of Cephalopodous *Mollusca*, including the forms which are ordinarily known under the name of Cuttle-Fishes.

The genera comprehended under that term have been thus defined:—Animal in the form of a sac or purse, with or without fins; head large, very distinct, crowned with brachial appendages to the number of eight or ten; arms very unequal, always furnished with suckers on their internal surface, with or without hooks; branchiæ pyramidal; orifice of the organs of generation opening into the branchial pouch, which last communicates with the external surrounding medium by a sort of funnel, the tube of which opens under the neck. Shell monothalamous or rudimentary, sometimes horny or cellular, but never polythalamous. (Rang.)

Dr. Leach divided the group of Cuttles into two families, the Octopods and the Decapods. The forms belonging to the first division are described under the article OCTOPODA.

The *Decapoda* are thus defined:—Animal generally elongated, cylindriform, having a thick sac, furnished with natatory expansions; head very distinct, crowned with ten arms, eight of which are sessile, shorter than in the Octopods, and furnished with acetabula or suckers along the whole length of their internal surface, and two much longer (tentacula), which are retractile, not situated on the same line with the arms, pediculated, and furnished with suckers, which are situated ordinarily on the enlarged and terminal portion only. No shell, but only a testaceous rudiment or support, which is either cartilaginous or calcareous in the interior of the back, in the greatest part of the genera.

Under this division are placed the *Teuthidæ*, or Calamaries, and the true *Sepiadæ*, or Cuttle-Fishes, properly so called.

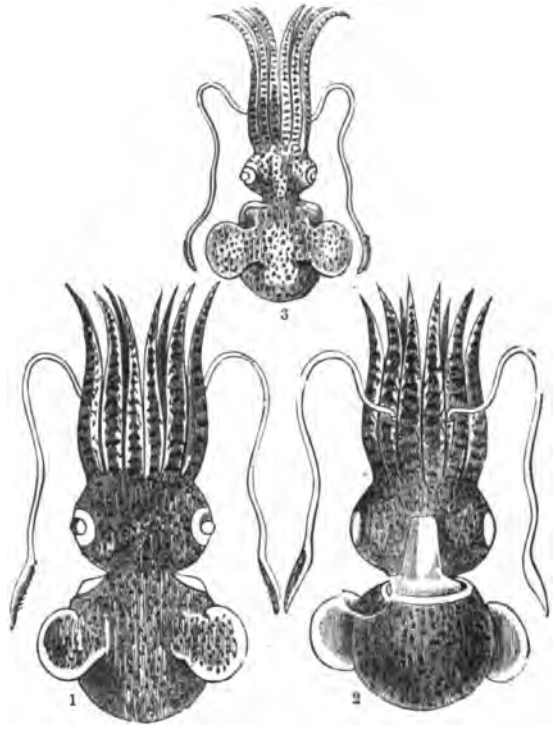
Sepiola (*Rondeletius*, Leach).—Head of equal breadth with the body, owing to the magnitude of the eyes. Body scarcely ventricose, supported by a thin flexible transparent dorsal lamina, and with natatory organs extended from the sides of the body.

S. vulgaris, Grant; *S. Atlantica*, D'Orbigny. Dr. Grant, in a paper on this species, describes the body or mantle of the specimens obtained on our coast as measuring generally about six lines in length, and as much in breadth, whilst the head measures only four lines in length, and, from the magnitude of the eyes, is equal in breadth with the body. The arms are of unequal lengths, the longest being about an inch long, and the shortest about a line less. The first or dorsal pair are the shortest, the second and fourth equal in length, and a little longer than the first pair; and the third pair the longest. This, Dr. Grant observes, is the order of the comparative lengths of the arms most common in the naked *Cephalopoda*. The third and fourth arms on each side are connected to each other by a musculo-membranous fold, which extends to about a third of their length, and is covered by the skin and subjacent coloured parts. The late Professor E. Forbes has observed that this species changes its colour according as it is exposed to light.

S. Rondeletii is a second British species, a single specimen of which was taken in Ireland by the late Mr. W. Thompson, and another in England by Mr. Joshua Alder.

S. stenodactyla is a species from the Mauritius, described by Dr. Grant in the 'Zoological Transactions.'

Three other species of *Sepiola* have been described. They are very generally distributed.



1, 2, *Sepiola stenodactyla*, back and front views (reduced); 3, *Sepiola vulgaris*, back view (natural size). (Grant, 'Zool. Trans.')

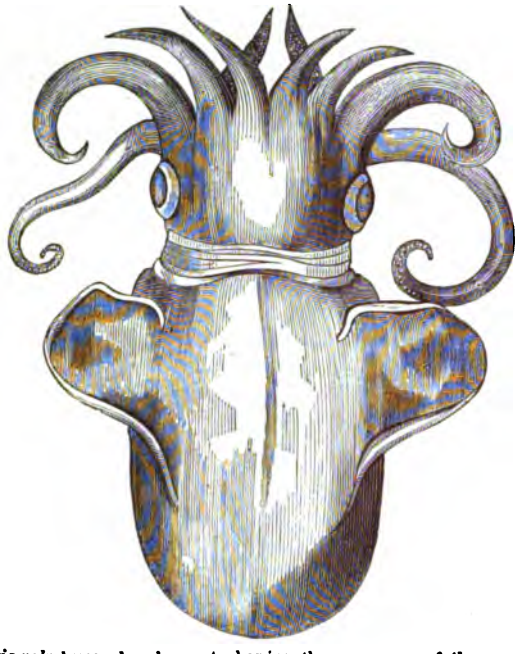
Rossia (Owen) has the body ventricose; two wide rounded subdorsal fins; anterior margin of the mantle free. Arms rather short, trihedral; the acetabula pedunculated; the peduncles very short, in two alternating rows at the base of the arms, aggregated in many rows at their point: order of the length of the equal arms, 1, 2, 4, 3. Tentacula equalling the body in length, furnished at the apex with many very small pedunculated acetabula. Gladius horny, 9 lines in length, a little dilated below.

R. palpebrosa.—Professor Owen, who established this genus upon a Cephalopod brought from the Arctic regions by Captain James Ross, R.N., and taken near the beach at Elwin Bay, Prince Regent's Inlet, on the 29th of August 1832, states that it differs from *Sepiola* and *Sepioteuthis* in the form, proportions, and position of its lateral fins, and in the extent of its horny dorsal style or gladius. In these respects, he observes, it bears a closer affinity to *Sepiola*, but differs from it generally in having the anterior margin of the mantle free in the whole of its circumference; its natural position is therefore, in his opinion, intermediate to *Sepiola* and *Sepioteuthis*, which it connects together, as well by its intermediate size as by the peculiarities of its structure.

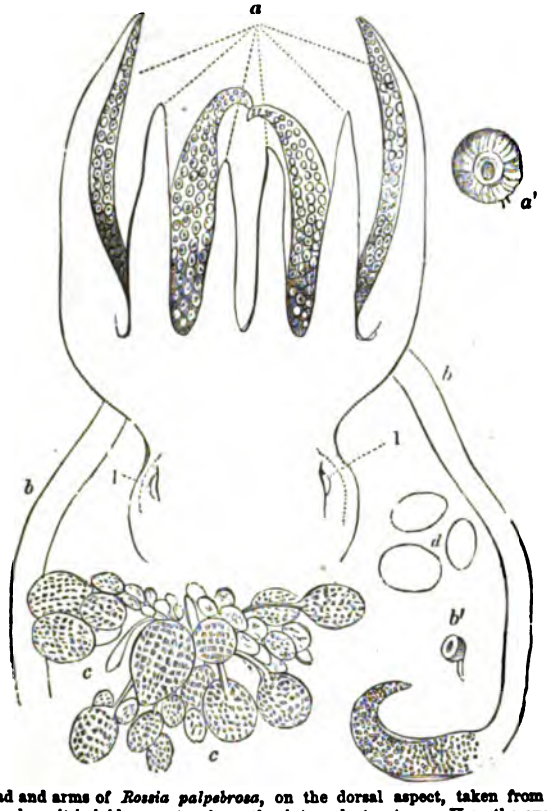
The details of the anatomy of this animal will be found in the Appendix to Captain Sir John Ross's 'Second Voyage.' The ink-bag was situated between the liver and the muscles which surround the arms, close to which its duct entered the intestine. The ink was black, of the same tint as the China ink.

With reference to the remarkable development of the skin surrounding the eyeball (whence the trivial name *palpebrosa*), by means of

which this animal evidently possesses the power of defending the eye, as the pulmonated *Vertebrata* do by means of their more regularly-formed eyelids, Professor Owen observes that the utility of the provision, in seas abounding with fragments of ice, is obvious. Six species of this genus have been described. [Rossia.]



Rossia palpebrosa, dorsal aspect, showing the appearance of the eyes while the animal was alive.



Head and arms of *Rossia palpebrosa*, on the dorsal aspect, taken from the figure where it is laid open to show the internal structure. Here the eyelids (1, 1) are represented closed after death; *a*, the eight arms; *a'*, one of the brachial suckers, magnified; *b*, the two tentacles; *b'*, a tentacular sucker, magnified; *e*, ovisacs in the ovary, appended to filamentary pedicles; *d*, eggs. (Owen, 'Ross's Appendix.')

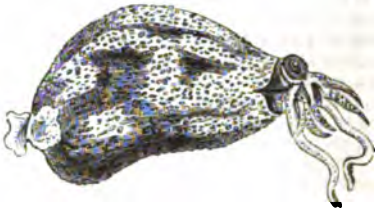
Sepioteuthis (De Blainville). Animal elongated, bordered nearly throughout its length by a natatory membrane, which is narrow and lateral; arms sessile and pedunculated, as in the Calamaries, and less enlarged than in the Cuttles; acetabula as in the Calamaries.

Internal support or gladius comparatively wide, but horny and delicate.

S. sepiacea. This species is figured in the article Cephalopoda under the name of *Sepia officinalis*, to which however it bears a very close external resemblance, so close indeed that authors generally place it immediately before that species. Thirteen species of the genus *Sepioteuthis* have been described. They are inhabitants of the West Indies, the Cape, the Red Sea, Java, and Australia.

Cranchia (Leach).—Animal furnished with a bursiform sac, which is elongated and rounded posteriorly; aperture narrow; dorsal border not distinct; head less distinct from the body; arms sessile, unequal; tentacles pedunculated, longer, retractile, terminated in a club shape; peduncles without acetabula (?): caudal fins circular, touching each other at their origin.

C. scabra. Sac rough, with hard rough tubercles. (Appendix to Tuckey's 'Congo.')

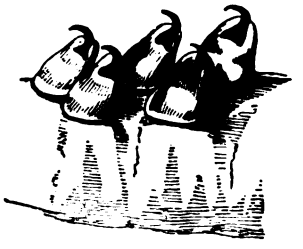


Cranchia scabra.

One other species has been described. They are both natives of the west coast of Africa.

Loligopsis (Lam.).—Body long and cylindrical, terminated by a pair of conjoined large round fins, forming generally a circular disc; anterior border of the mantle adherent to the back part of the head for a small extent. Tentacula very long and slender (frequently mutilated). Gladius long, narrowest in the middle, dilated posteriorly. There are eight species of this genus found in the North Sea, Atlantic, Mediterranean, India, Japan, and the South Seas.

Onychoteuthis (Lichtenstein).—Body and fins as in the genus *Loligo;* ventro-lateral cartilages of the mantle long and narrow; horny hoops of the tentacular, and sometimes of the brachial, acetabula produced into the forms of hooks or claws. Gladius or internal support long, broadest in the middle.



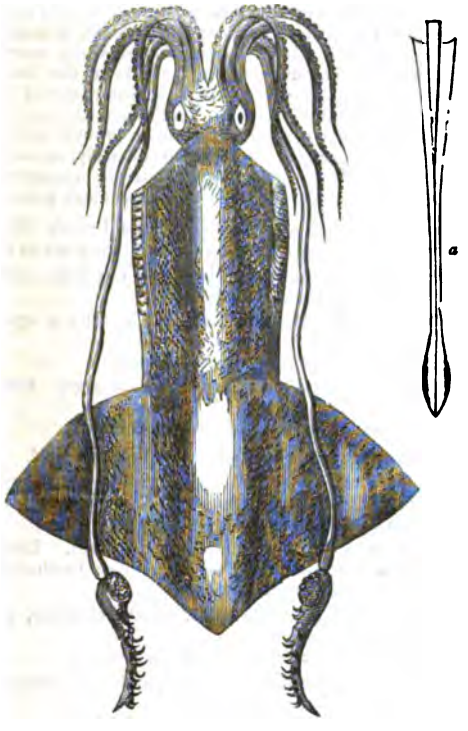
Uncinated suckers of *Onychoteuthis*, from specimen in spirits in Mus. Coll. Chir. (by permission).

O. Banksii. Professor Owen, after dwelling on Dr. Roget's accurate description of the mechanism by which the suckers of *Octopus* are worked, observes that still there are circumstances in which even this remarkable apparatus would be insufficient to enable the cephalopod to fulfil all the offices in the economy of nature for which it was created; and that in those species which have to contend with the agile, slippery, and mucus-clad fishes, more powerful organs of prehension are superadded to the suckers. Thus in the Calamary the base of the piston is, he remarks, inclosed by a horny hoop, the outer and anterior margin of which is developed into a series of sharp-pointed curved teeth. These, as he states, can be firmly pressed into the flesh of a struggling prey by the contraction of the surrounding transverse fibres, and can be withdrawn by the action of the retractor fibres of the piston. "Let the reader," adds the Professor, "picture to himself the projecting margin of the horny hoop developed into a long, curved, sharp-pointed claw, and these weapons clustered at the expanded terminations of the tentacles, and arranged in a double alternate series along the whole internal surface of the eight muscular feet, and he will have some idea of the formidable nature of the carnivorous *Onychoteuthis.*

"Banks and Solander," says Professor Owen in continuation, "in Cook's first voyage, found the dead carcass of a gigantic species of this kind floating in the sea, between Cape Horn and the Polynesian Islands, in 30° 44′ S. lat., 110° 33′ W. long. It was surrounded by aquatic birds, which were feeding on its remains. From the parts of this specimen which are still preserved in the Hunterian Collection, and which have always strongly excited the attention of naturalists, it must have measured at least six feet from the end of the tail to the end of the tentacles. The natives of the Polynesian Islands, who dive for shell-fish, have a well-founded dread and abhorrence of these

formidable Cephalopods, and one cannot feel surprised that their fears should have perhaps exaggerated their dimensions and destructive attributes."

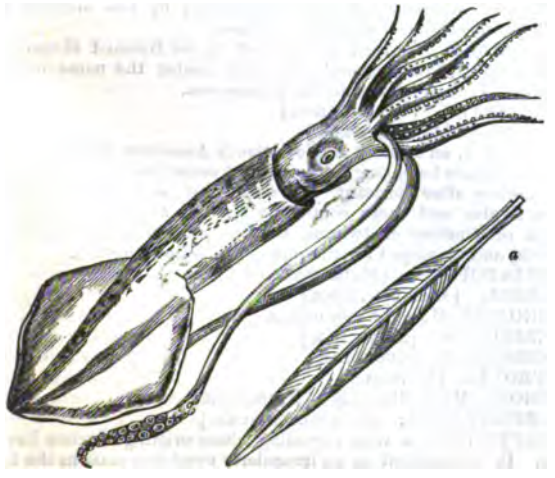
Professor Owen then notices another structure, which adds greatly to the prehensile powers of the uncinated Calamaries:—"At the extremities of the long tentacles, besides the uncinated acetabula, a cluster of small, simple, unarmed suckers may be observed at the base of the expanded part. When these latter suckers are applied to one another, the tentacles are firmly locked together at that part, and the united strength of both the elongated peduncles can be applied to drag towards the mouth any resisting object which has been grappled by the terminal hooks. There is no mechanical contrivance which surpasses this structure: art has remotely imitated it in the fabrication of the obstetrical forceps, in which either blade can be used separately, or, by the interlocking of a temporary joint, be made to act in combination." ('Cyclopædia of Anatomy and Physiology,' vol. i.)



Onychoteuthis Banksii. *a*, gladius, or dorsal support.

There are five other species of *Onychoteuthis* found in the Atlantic, Indian, and Pacific oceans.

Loligo (Lam.).—The species of this genus are described under the article LOLIGO. We here subjoin an illustration of the *Loligo vulgaris*, the Common Calamary.



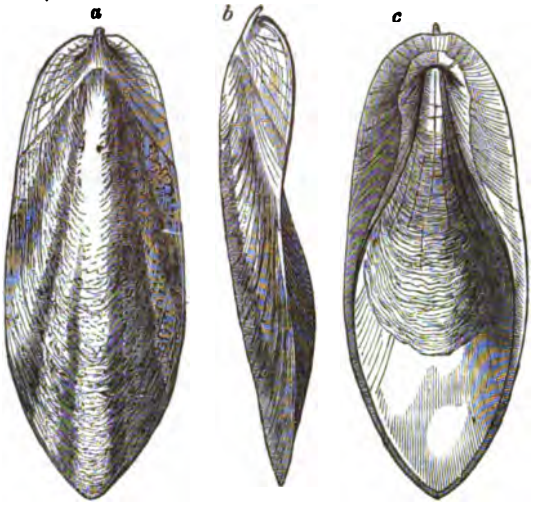
Common Calamary (*Loligo vulgaris*). *a*, its pen or internal support.

M. De Blainville gives *Loligo vulgaris* as the example of his genus *Pteroteuthis*. There are 21 species of this genus, of which three are British.

Sepia (Lam.).—Animal with an oblong depressed body, with two narrow lateral fins extending its whole length; mantle free at its anterior margin; the acetabula supported by horny hoops with the margin entire or very minutely denticulated.

Shell internal, lodged in a sac on the back part of the mantle, composed of an external calcareous apex or mucro, of a succession of calcareous laminæ with intervening spaces filled with air, and supported by columns (but not perforated by a siphon), and an internal horny layer, corresponding to the anterior horny sheath in the Belemnites. (Owen.)

S. officinalis.—This is the Common Cuttle-Fish, so well known on our coasts, and whose shell is so often thrown up by the waves on the beach.



Internal shell of Common Cuttle-Fish (*Sepia officinalis*). *a*, view of back; *b*, side view; *c*, under side.

The ink (nigræ succus loliginis) is common to this and other species of cephalopods. This fluid is not only ejected as a defence to colour the water in order to favour the escape of the animal, as was well known to the ancients (Oppian, 'Halieut.,' iii.; Pliny, 'Nat. Hist.,' ix. 29), but as a direct means of annoyance. A gallant officer who was inconsiderately collecting shells in a pair of immaculate white trowsers, came suddenly upon one of the naked cephalopods snugly harboured in a recess in the rock. They looked at each other, and the cuttle, who had his eyes about him, and knew well how to use them, upon seeing the enemy advance, took good aim, and shot so true that he covered the snowy inexpressibles with the contents of his ink-bag, and rendered them unpresentable either in drawing-room or dining-room.

That the juice was used by the ancients as ink is evident from many passages: we content ourselves with a reference to that above given, and to the lines in the graphic description of the idler by Persius. ('Sat.' iii., lin. 10, et seq.)

The flesh of the naked cephalopods was rather esteemed of old, as it is indeed now in Italy and other countries. Aristotle declares that these animals are in the highest season when pregnant, and those who wish to taste a cuttle-fish sausage, will find a receipt for making that savoury viand in Athenæus. [CEPHALOPODA.]

Mr. F. D. Bennett states that the Fe, or Cuttle-Fish, is considered a luxury by all classes of the Sandwich Islanders, and that when fresh and well cooked it is an excellent food, and in consistence and flavour not unlike the flesh of a lobster's claw. ('Narrative of a Whaling Voyage round the Globe,' London, 1840.)

Independently of the swimming powers of the naked cephalopods, and their faculty of darting backwards in the water, they can, some of them at least, throw themselves out of the water, and take leaps analogous to flights. Thus Pliny says, and not without ground for the assertion, "Loligo etiam volitat, extra aquam se efferens, quod et pectunculi faciunt sagittæ modo." ('Nat. Hist.,' ix. 29.) It is not improbable that one of the species, *Loligo Sagitta*, may have received its name from the rapidity with which this leap or flight out of the water is executed.

Mr. F. D. Bennett, who describes the sea as peculiarly animated between 28° and 31° N. lat., 154° and 160° W. long., observes that the ship was constantly attended by such vast numbers of the Albacore, that, when swimming, as is their custom, on the surface of the water, they could be seen as a dense shoal extending several hundred yards on every side of the ship, about which sword-fishes (*Xiphias*) frequently came, "making destructive onslaughts" on the Albacores. More rarely he noticed the Barracuda, and transient shoals of Bonita. "Flying-Fish and (nearly allied to these in their movements) Flying-Squid (*Loligo*) were also numerous. During a calm, in 30° N. lat., the Flying-Squid appeared in larger flights than

we had ever before witnessed. Persecuted probably by the Albacore (which select this tranquil time to descend deep in the water, and to rove far from the ship in quest of food), they rose from the sea in large flocks, leaping over its smooth surface, much in the same manner, and to the same height and distance, as the Flying-Fish. Many of them were captured by birds during their leaps; and one individual, in making a desperate effort to escape some aquatic pursuer, sprang to a considerable height above the bulwarks of the ship, and fell with violence upon the deck." In the appendix, the Flying-Squid is again noticed. "The head of this cephalopod," says the author, "is a plane circular disc, surrounded by long arms, furnished on their upper surface with many circular suckers, which hold with a tenacious grasp. The eyes are large, very perfectly formed, and lodged in spacious cartilaginous orbits. The mouth, like that of most of the cuttle-fish tribe, is horny, and shaped like the beak of a parrot. A slender neck connects the head to the body, and is received into the latter as into a capacious sheath. The trunk is conical, tapering to a point at the tail, smooth, and composed of a dense white cartilaginous structure covered with a delicate membrane or skin, beneath which are deposited the brilliant colours this mollusc often displays. Near the tail is a broad fin-like appendage, which can either be expanded horizontally on either side, or folded neatly upon the abdomen. The interior of the back contains an elastic horny rod, or substitute for the sepia bone, that occupies the same part in some other tribes of the Cuttle-Fish. It extends the entire length of the body, and is flattened at its anterior extremity, whilst its caudal end is shaped like a cup; the whole bearing some resemblance to the instrument used for tasting wine from casks. This elastic structure and the membranous expansion on each side the tail are apparently the two principal agents employed by the animal in its protracted leaps through the air. Whether the fin-like appendage is also employed in swimming is very questionable." One kind of *Loligo*, captured in the Pacific Ocean, in 34° N. lat., which measured six inches in its entire length, must, from the description of its hooks, have been an *Onychoteuthis*. This individual leaped from the sea over the high bulwarks of the ship, and alighted on the deck at a time when vast flocks of the same species were seen leaping around, and often striking with violence against the bows of the vessel, the sea being comparatively smooth. It was much injured by the violence with which it struck the deck. Another species with its two long tentacles furnished at the extremities with rows of suckers (acetabula) instead of horny-hooked appendages, resembling the above in size and form, was obtained in the Pacific. The prevailing colours were silver-white and steel-blue, spread with red spots and tints of violet and purple, a brilliant and very beautiful spot of emerald-green being placed immediately above each eye. Mr. Bennett concludes by stating that they noticed examples of this family of *Cephalopoda* from the equator to 34° N. lat., and 16° S. lat. in the Pacific Ocean.

The size of the naked cephalopods varies greatly. Some are of very large dimensions, and others—the *Sepiolæ* for instance—very small. Mr. Swainson ('Malacology') remarks that he saw many caught on the shores of Sicily, and that two would be a good load, their arms being as thick as those of a man.

We must take with some grains of allowance the stories collected by Denys de Montfort: such as that of Dens, a northern navigator, who, according to Dr. Shaw, avowed that he lost in the African seas three of his men, while they were employed during a calm in scraping the sides of his vessel, by the attack of a monster of this kind, which suddenly appeared, seized them in its arms, and drew them under water in spite of every effort to save them, and that the thickness of one of the creature's arms, which was cut off in the contest, was that of a mizen-mast, whilst the suckers were of the size of pot-lids. Then again, another crew, it was alleged, were similarly attacked off the coast of Angola. A gigantic cuttle-fish suddenly threw its arms across the vessel, and was on the point of dragging it to the bottom, when the crew succeeded in cutting off its arms with swords and hatchets. When their danger was most imminent, they prayed to St. Thomas for aid, and, in gratitude for their deliverance, dedicated, on their return home, a picture representing their perilous encounter, to the saint in his chapel at St. Malo. Dr. Hamilton gives an engraving of this adventure in the volume on 'Amphibious Carnivora,' in the 'Naturalist's Library,' and beneath it is printed, "The Kraken, supposed a *Sepia*, or Cuttle-Fish (from Denys Montfort)." Dr. Shaw observes that the existence of some enormously large species of the cuttle-fish tribe can hardly be doubted; and that though some accounts may have been much exaggerated, there is sufficient cause for believing that such species may very far surpass all that are generally observed about the coasts of European seas. The last observation may be safely admitted; but the account given by Dr. Shaw of the narrative of Dens affords one of the many proofs that a story rarely loses anything in its progress. That narrative is sufficiently marvellous; but on turning to it as recorded by Denys de Montfort, we find that only two of Dens's men are stated to have been carried off; the third having been rescued, though he died delirious on the night following the encounter. The suckers are described as having been as large as ladles (cueiller à pot), and the arm, at its base, as big as a fore-yard (vergue d'un mât de misaine). In Shaw's lectures the yard is magnified to a mast, and the ladles are promoted to pot-lids. The notion that the celebrated Kraken is not to be considered as a wild and groundless chimera, but as either identical with or nearly allied to a colossal cuttle-fish, is supported in Blackwood's 'Magazine,' vol. ii. A writer in the same work, vol. iii., attacks the opinion attempted to be sustained in vol. ii.

The other genera of *Sepiadæ* are *Gonatus*, Gray, with only one species; *Belotcuthis*, Münster, with six species; *Leptoteuthis*, Meyer, with one species; *Cheiroteuthis*, D'Orb., with two species; *Histioteuthis*, D'Orb., with two species; *Onychoteuthis*, Lichtenstein, with six species; *Enoploteuthis*, D'Orb., with ten species; *Ommastrephes*, D'Orb. with fourteen species. [CEPHALOPODA; OMMASTREPHES.]

SE'PIOLA. [SEPIADÆ.]

SEPIOTE'UTHIS. [SEPIADÆ.]

SEPS. [SEPSIDÆ; SCINCIDÆ.]

SEPSIDÆ, a family of Lizards. The type of this family is the genus *Seps*, of which the *Seps Chalcides* of Bonaparte and other naturalists may be taken as the type. [SCINCIDÆ.] The following is Dr. J. E. Gray's definition of this family:—Rostral plate rather large, square. Nostrils in the front edge of a small shield, in a notch at the hinder side of the rostral plate. Supranasal distinct, contiguous or united, frontonasal none (or small on the side of the face), frontoparietal often wanting, sometimes united, interparietal triangular. Tongue flat, scaly, nicked at the tip. Teeth conical, simple. Palate not toothed, with a deep central longitudinal groove behind. Eyes distinct, with connivent eyelids. Lower eyelid scaly, or with a transparent disc. Body fusiform or subcylindrical, elongate. Scales smooth. Toes simple, unequal, clawed. Tail conical, pointed.

In the 'Catalogue' of the specimens in the British Museum, Dr. Gray describes seven genera and seven species. They are as follows:—

a. Rostral rather produced, sharp-edged, with a large nasal notch. Head wedge-shaped.

1. *Sphænops.*—Legs 4. Mental shield small. Lower eyelid transparent.

S. sepsoides, the Sphenops; a native of Egypt.

2. *Scelotes.*—Legs 2, posterior. Mental shield large. Lower eyelid scaly.

S. bipes, the Bipes; from the Cape of Good Hope.

b. Rostral rounded, erect. Head pyramidical.

3. *Gongylus.*—Legs 4. Toes 5-5. Body subfusiform. Lower eyelid transparent. Frontoparietal shield none. Ears simple.

G. ocellatus, the Tiliguga; a native of Egypt.

4. *Thyrus.*—Legs 4. Toes 5-5. Body fusiform. Lower eyelid transparent. Frontoparietal shield distinct. Ears toothed in front.

T. Bogerii, the Thyrus; from Mauritius.

5. *Amphiglossus.*—Legs 4. Toes 5-5. Body elongate, cylindrical. Ears distinct. Lower eyelid scaly.

A. Astrolabi, the Keneux; a native of Madagascar.

6. *Seps.*—Legs 4. Toes 3-3. Body cylindrical, elongate. Ears distinct. Lower eyelid transparent.

S. tridactylus, the Cicigna; a native of Europe. [SCINCIDÆ.]

7. *Heteromeles.*—Legs 4. Toes 2-3. Body cylindrical, elongate. Ears indistinct. Lower eyelid transparent.

H. Mauritanicus, the Heteromele; from Algiers.

SEPTA'RIA, a genus of Acephalous *Mollusca*, belonging to the family Tubicolées. It has the tube testaceous, very long, gently attenuated posteriorly, and divided internally by arched incomplete partitions. Anterior extremity terminated by two slender tubes, which are not chambered in the interior.

S. arenaria is described and figured by Sir Everard Home in the 'Philosophical Transactions' for 1806, under the name of *Teredo gigantea*. It lives in sand in the Indian seas.

SERGESTES. [PALEMONIDÆ.]

SERIALARIA. [POLYZOA.]

SERIA'NA, an entirely tropical South American and West Indian genus of Plants belonging to the natural order *Sapindaceæ*, named by Schumacher after Serjeant, a French friar and botanist, but the genus is also and more commonly written *Serjania*. The species consist of climbing or twining shrubs. *S. triternata* is acrid and narcotic, and employed for the purpose of stupifying fish.

SERIATOPORA. [MADREPORÆA.]

SERICA. [MELOLONTHIDÆ.]

SERICOSTOMA. [NEUROPTERA.]

SERICULUS. [MEBULIDÆ.]

SERISOMUS. [CUCULIDÆ.]

SE'ROLIS. [ISOPODA.]

SEROUS MEMBRANES. [MEMBRANE.]

SERPENTA'RIA. [ARISTOLOCHIACEÆ.]

SERPENTINE, a rock regarding whose origin geologists have differed. It is described as an irregularly overlying mass in the Lizard district of Cornwall, as a dyke at Portsoy, and as nodular aggregations in the granite of Aberdeenshire. The relation in which it stands to Diallage Rock (a compound of diallage and felspar) is very intimate, both in the Alps, in the Shetland Isles, and in Cornwall. In fact the composition of these rocks is scarcely more different than may be seen between largely crystallised and fine-grained greenstone. Veins

and masses of trap on passing through or being in contact with limestone not unfrequently change the nature of that rock near the junction, and either fill it with serpentinous lines or masses, or produce therein asbestic or steatitic admixtures. It is a very common circumstance among the primary limestones to find light-green veins and strings of serpentine, and in the Pyrenees calcareous rocks comparatively of very recent date are similarly altered.

As a mineral Serpentine occurs, although rarely, in right rectangular prisms. It is usually massive and compact in texture, and of a dark-green or blackish-green colour. It also occurs in fibrous and lamellar varieties. Its hardness is 2·5 to 4, and it may be cut with a knife. Its specific gravity is 2·5 to 2·6. It becomes yellowish-gray on exposure, and feels sometimes a little unctuous. The following varieties are recognised:—

Precious Serpentine.—Purer specimens of a rich oil-green colour, and translucent, breaking with a splintery fracture. It is a beautiful stone when polished. It has the following composition:—

Silica	42·3
Magnesia	44·2
Protoxide of Iron	0·2
Carbonic Acid	0·9
Water	12·4
	100·0

It gives off water when heated; becomes brownish-red before the blow-pipe, but fuses only on the edges.

Common Serpentine.—Opaque, of dark-green shades of colour.

Picrolite, Schiller Asbestus.—A Fibrous Serpentine, of an olive-green colour, constituting seams in Serpentine. The fibres are coarse or fine, and brittle. It resembles some forms of asbestus, but differs in its difficult fusibility. Thomson's *Baltimorite* belongs here.

Marmolite.—A Foliated Serpentine, of greenish-white and light-green shades of colour, and pearly lustre, consisting of thin folia rather easily separable. The folia are brittle, and the variety is thus distinguished from talc and brucite. It has the following composition:—

Silica	40·1
Magnesia	41·4
Protoxide of Iron	2·7
Water	15·7
	99·9

Kerolite.—Near Marmolite, but folia not separable.

Serpentine is a very handsome stone when polished. Beautiful specimens from Cornwall, and other parts of England and Ireland, may be seen in the Museum of Practical Geology, London. When mixed with limestone it constitutes the Verd-Antique Marble. It does not wear well, although at first it receives a fine polish. Chromic iron is usually found disseminated through it. Dr. Jackson of America has shown that Epsom salts or sulphate of magnesia may be profitably manufactured from Serpentine.

(Dana, *Mineralogy.*)

SERPENTS. [OPHIDIA.]

SERPI'CULA (from 'serpo,' to creep, on account of the creeping habits of the species), a small African and Indian genus of Plants belonging to the natural order *Haloragaceæ*. The genus is characterised by being monœcious. The male flowers have the calyx small, quadripartite. Petals 4. Stamens 4 to 8. Styles 4, sterile. The female flowers have the calyx-tube adnate to the ovary, limb small, quadripartite. Petals and stamens wanting. Ovary 4-celled. Ovules and styles 4. Nuts brittle, 1-celled, 1-seeded. The species form herbaceous creeping branched plants, with axillary flowers, the males being pedicellate, and the female aggregated and almost sessile, though they are but little known. The plants of this genus are not possessed of any remarkable properties, but they must not be confounded with the *Serpicula* now *Hydrilla verticillata* of Roxburgh, which belongs to the natural family of *Hydrocharidaceæ*, and which is used in India in refining sugar, in the same way that clay is employed in other countries. A layer of the plant being spread upon the surface of the sugar, water is allowed slowly to percolate through the mass.

SERPULA. [ANNELIDA.]

SERPULI'TES, a genus of Fossil *Annelida*. [SILURIAN SYSTEM.]

SERRAFALCUS, a genus of Plants belonging to the natural order of Grasses and the tribe *Festucineæ*. It has unequal herbaceous many-flowered glumes, the lower are from 3- to 5-nerved, the upper 7 to 9. The flower is oblong and trifid. The outer palea with a short seta founded on three nerves from below the tip. The styles lateral, below the summit of the fruit. The spikelets narrow at the top.

S. secalinus has a loose panicle slightly compound, the simple peduncles about equalling the oblong glabrous spikelets, the flowers at first loosely imbricated, afterwards distinct, about as long as the straight awn, the outer palea not overlapping the next flower. The flower is large and downy, the leaves hairy with nearly smooth sheaths. It is a native of Great Britain.

S. racemosus has a close or elongated erect panicle usually simple, the spikelets glabrous ovate and somewhat compressed. The midrib of the glumes and palea scabrous towards the top, the leaves and sheathes slightly hairy. It is a common species in sandy places in the south of Great Britain.

(Babington, *Manual of British Botany.*)

SERRANUS, a genus of Fishes belonging to the family *Percidæ*. It has a single elongated dorsal fin, the rays of the anterior portion spinous, the others flexible; branchiostegous rays 7; small teeth in both jaws on the palatine bones and the vomer, some elongated teeth among the smaller ones; cheeks and operculum covered with small scales; preoperculum serrated; operculum ending in two or three flattened points projecting backwards.

Two species of this genus have been found on the British coasts, which may be given as examples of the genus.

S. cabrilla, the Smooth Serranus, is the *Perca cabrilla* of Linnæus, the *Perca channus* of Mr. Couch. It is abundant in the Mediterranean, and not uncommon on the Cornish coast.

S. gigas, the Dusky Serranus, is the *Perca robusta* of Couch. It is abundant in the Mediterranean, where it sometimes attains the weight of 60 lbs. It has been taken off the coast of Cornwall.

(Yarrell, *History of British Fishes.*)

SERRATULA, a genus of Compositous Plants of the order *Cynaraceæ*, and the section *Serratuleæ*. The heads of flowers are dicecious by abortion; the involucre is imbricated, sharp, and unawned; the scales of the receptacle split longitudinally into linear bristles; fruit compressed, not beaked, basal areola oblique; the pappus persistent. There is but one British species of this genus, *S. tinctoria*, the Saw-Wort. (Babington, *Manual of British Botany.*)

SERRICORNES, the third family of Pentamerous *Coleoptera*. They have four palpi; elytra which cover the abdomen; and antennæ which are for the most part equal throughout, or smaller at the extremity. The Linnæan genera *Buprestis*, *Elater*, *Lampyris*, and *Ptinus* belong to this family, as also do *Melyris*, *Clerus*, and *Cebrio*. The *Ptinus fur* is the little beetle whose larvæ do so much damage among collections of natural history.

SERTULA'RIA, a Linnæan genus of *Polypifera*.

SERTULA'RIADÆ, the name of a family of *Polypifera*, including the genus *Sertularia* of Linnæus. [HYDROIDA.]

SERTULARIÆA, De Blainville's name for the family of *Polypiaria*, founded on the Linnæan genus *Sertularia*.

SERUM, the name given to the fluid part of the blood, also to the fluid poured upon the surface of serous membranes. [BLOOD; MEMBRANE.]

SERVAL. [FELIDÆ.]

SERVICE-TREE. [PYRUS.]

SE'SAMUM (Σήσαμον), a genus of Plants belonging to the natural order *Sesamaceæ*, sometimes called *Pedalineæ*, containing only few genera and species. It is distinguished by having a 5-parted calyx; corolla with a short tube; bell-shaped throat; and the limb quinquifid, somewhat bilabiate. Stamens 4, didynamous, with the rudiments of a fifth stamen; stigma bilamellate; capsule oblong, 4-celled, 2-valved; seeds numerous.

The species, though now cultivated in many countries, are supposed to have been originally natives of India. They form annual plants, with opposite and alternate leaves, and axillary solitary flowers. The species are by some considered to be five in number, that is, *S. orientale*, *S. Indicum*, *S. luteum*, *S. laciniatum*, with *S. radiatum*, said to be a native of Guinea. Others consider them all to be varieties of one species. These are cultivated in various countries, but especially in India, Egypt, and Syria. They have also been taken to the West Indies, where the plant is called Banglo and Oil-Plant. Sesamum seeds are sometimes added to broths, frequently to cakes by the Jews, and likewise in the East.

SESARMA. [GRAPSIDÆ.]

SESBA'NIA, a genus of Plants belonging to the natural order *Leguminosæ*, which is so named from the Arabic name of the species, which is indigenous in Egypt. The rest are found in the equinoctial parts of the world, but the most remarkable in India. The genus is characterised by having a 5-cleft or 5-toothed calyx; the standard of the corolla roundish, larger than the keel, which is obtuse, 2-edged at the base; stamens diadelphous (9 and 1), with the sheath auricled at the base; legume elongated, slender, torulose, many-seeded. The species form shrubs or herbs with abruptly pinnate leaves, many pairs of leaflets, cauline stipules lanceolate, and the petiole ending in a bristle point. Flowers axillary, racemose, usually yellow.

S. Ægyptiaca, the Egyptian species, found also in India, forms a small and very elegant tree; its wood is employed in making the best charcoal for gunpowder.

S. cannabina, the Dhanchi of Bengal, is not found wild. It is cultivated on account of the fibres of its bark, which are coarse, but more durable than some other substitutes for hemp, especially when exposed to wet, and are therefore generally employed for the drag-ropes and other cordage about fishing-nets.

SESLE'RIA, a genus of Plants belonging to the natural order of Grasses and the tribe *Sesleriæ*. It has a spiked panicle, sessile spikelets tiled all round; the glumes are from 2- to 6-flowered, nearly as long as the spikelet; the outer paleæ keeled and membranous, with a scarious margin ending in 3 or 5 points; the dorsal rib evanescent.

S. cerulea has an ovate slightly one-sided spike, the outer palea terminating in 4 teeth, the dorsal rib rough, with a short excurrent point, the leaves abrupt, with a minute rough point; the roots are tufted, the stem from 6 to 12 inches high; the spike about half an inch long, and of a bluish-purple colour. This is the only British species. It is found chiefly on mountains.

S. Quitensis is the *Festuca quadridentata* of Humboldt and others. Humboldt tells us that it is very poisonous.

(Lindley, *Flora Medica;* Babington, *Manual of British Botany.*)

SETA'RIA, a genus of Grasses containing a few species cultivated as corn-grains in some countries. The genus is named from 'seta,' a bristle, on account of the bristly nature of the involucrum. The species are found in both the hot and temperate parts of the world. The genus nearly corresponds in character with *Panicum*, under which it is sometimes included, but it is also combined with *Pennisetum*. It is characterised by having the spikelets 2-flowered, supported by two or more bristles; the lower valve is the smallest; the lower flower is neuter or male, with the valves of the corolla coriaceous and indurated, awnless, the lower one embracing the other; petaloid scales very obtuse and subfalcate; germen emarginate; seed included within the persistent glumes. The species are found both in the hot and temperate parts of the world.

S. verticellata, Bristle-Grass, has a panicle spiked, lobed below; branches whorled; bristles of the involucre rough, with reversed teeth, outer glumella of the fruit nearly even; lower floret united with one glumella. It is found in cultivated fields in England.

S. viridis, Green Bristle-Grass, has a panicle spiked, continuous; bristles of the involucre rough, with erect teeth; outer glumella of the fruit nearly even; lower floret neuter, with one glumella. This species is also British.

S. glauca, Glaucous Bristle-Grass, has a panicle spiked, continuous; bristles of the involucre rough, with erect teeth; outer glumella of the fruit conspicuously wavy, wrinkled transversely; lower floret triandrous with two glumellas. It is found in Hertfordshire and other parts of England. The first two species are found in America and India. *S. Germanica* and *S. Italica* are cultivated as articles of diet in Europe.

SETTER, the name for that variety of the Dog which partakes of the characters of the POINTER and SPANIEL, *Canis familiaris Index* of Caius.

The Setter is less liable to be foot-sore than the Pointer; but is generally considered more difficult to break. When however a well-broken well-bred Setter is hunted frequently, no dog trained to the gun does his work better, or is more staunch. The breed originated, in all probability, between the large English spaniel and the Spanish pointer.

This variety possesses a high degree of intelligence, and is capable of the strongest attachment. Mr. Bell's account of a favourite of this breed is so interesting that we give it in his own words:—

"By far the most interesting, and, if I may so employ the term, amiable animal I have ever known, was a bitch of this kind, formerly belonging to my father, which he had from a puppy, and which, although never regularly broke, was the best dog in the field that he ever possessed. The very expression of poor Juno's countenance was full of sensibility and affection. She appeared to be always on the watch to evince her love and gratitude to those who were kind to her; and the instinct of attachment was in her so powerful that it showed itself in her conduct to other animals as well as to her human friends. A kitten which had been lately taken from its mother was sent to us, and on Juno's approach showed the usual horror of the cat towards dogs; but Juno seemed determined to conquer the antipathy, and, by the most winning and persevering kindness and forbearance, advancing or receding as she found the waywardness of her new friend's temper required, she completely attached the kitten to her; and as she had lately lost her puppies, and still had some milk left, I have often seen them lying together before the fire, the kitten sucking her kind foster-mother, who was licking and caressing her as her own offspring. She would also play with great gentleness with some tame rabbits of mine, and would entice them to familiarity by the kindness of her manner; and so fond was she of caressing the young of her own species, that when a spaniel bitch of my father's had puppies, of which all excepting one were destroyed, Juno would take every opportunity to steal the remaining one from its mother's nest and carry it to her own, where she would lick and fondle it with the greatest tenderness. Poor Busy, the mother, also a good-tempered creature, as soon as she had discovered the theft, hastened of course to bring back her little one, which was again to be stolen on the first favourable opportunity, until at length the two bitches killed the poor puppy between them, as they were endeavouring each to pull it from the other; and all this with the most perfect mutual good understanding. Juno lived to a good old age, an unspoiled pet, after her master had shot to her for fourteen seasons." ('British Quadrupeds.')

SEVERITE, a Mineral occurring massive, in pieces from two to five inches in diameter. Its fracture is uneven; the fractured surfaces dull. Hardness 1·0 to 1·5; it yields easily to the knife. Brittle. It polishes by friction. It adheres strongly to the tongue, but emits no argillaceous odour when breathed on. Colour white. Streak shining. Dull. Slightly translucent. It is found near St.-Sever, in France, in a gravelly soil. *Severite*, as shown by the annexed analysis by Pelletier, is a hydrated silicate of alumina:—

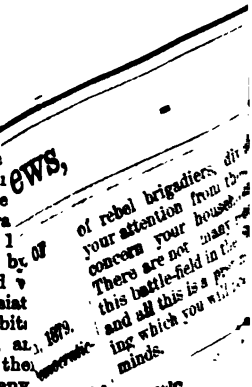
Silica	50
Alumina	22
Water	26
Loss	2
	—100

SEXES OF PLANTS. [REPRODUCTION IN PLANTS AND ANIMALS.]

SEXUAL SYSTEM. [REPRODUCTION IN PL

SEYBERTITE. [CLINTONITE.]

SEYCHELLE COCOA-NUT is the fruit o (*Lodoicea Sechellarum*), respecting which many fa formerly related, such as, that it was produced sea, the nuts being only found thrown up on the Islands. They were called Coco de Maldivia, or (the early Portuguese navigators. Many marvell were ascribed to these nuts by the physicians of t and European, and they were consequently sold present they form only objects of curiosity, and are the name of Double Cocoa-Nuts. The tree yieldi discovered by Barré, a French officer of enginee described by Sonnerat, but for the first time accura Labillardière, 'Ann. Mus.,' Paris, ix. p. 140, t. 1 description and illustrative plates have been given by the 'Botanical Magazine,' N. S., Nos. iv., v., and v paper on the subject was read at the Royal Asiat resident of the Seychelle Islands. To the inhabit useful for its timber, which is hard externally, a building their huts and for posts; the leaves and the used for the roof, walls, and partitions, and for many purposes. The nuts weigh from 20 to 25 pounds e when fresh contain a white, transparent, and jelly-like subst , which is edible. The shells are employed in making vessels and dishes of various kinds, and the entire nuts form articles of commerce, as they are esteemed in other countries both for their fabled virtues and as curiosities.



SHAD. [CLUPEIDÆ.]

SHADDOCK. [CITRUS.]

SHAG. [PELECANIDÆ.]

SHALE. Any argillaceous deposit, naturally divided into laminæ parallel to the plane of deposition, is rightly so called by geologists. These are sandy, calcareous, purely argillaceous, and carbonaceous shales. Geologists sometimes, very inconveniently, call fine-grained very laminated shales by the title of Slates. A synonym in the north of England mining-districts is Plate. [COAL FORMATION.]

SHALLOT. [ALLIUM.]

SHALLOW, a name for the Rudd. [LEUCISCUS.]

SHANNY. [BLENNIUS.]

SHARK. [SQUALIDÆ.]

SHARE-WORT, a name for *Aster tripolium*. [ASTER.]

SHAVING-BOX-FRUIT. [FEUILLEA.]

SHEA-TREE. [BASSIA.]

SHEARWATER. [PROCELLARIDÆ; PUFFINUS.]

SHEAT-FISH, a name for *Silurus glanis*. [SILURIDÆ.]

SHEEP. [OVEA.]

SHEEP'S SCABIOUS. [JASIONE.]

SHEERWATER. [RYNCHOPS.]

SHELDRAKE. [DUCKS.]

SHELL. The hard calcareous substance which protects either partially or entirely the Testaceous Molluscs externally, or supports certain of them internally, is termed Shell.

This substance, when external, may be considered as the exo-skeleton of the animal; when internal, as its endo-skeleton.

The Common or Waved Whelk of our Shores (*Buccinum undatum*) and the Common Oyster (*Ostrea edulis*), may be taken as examples of external shells; and the internal support, or cuttle-bone, as it is generally called, of the Common Cuttle-Fish (*Sepia vulgaris*) [SEPIADÆ], affords an example of an internal shell.

At one time it was supposed that the shells of the various forms of *Mollusca*, as well as those of Crabs, Lobsters, and other *Crustacea*, were merely exudations of inorganic matter from the internal structure of the animal. It has however been recently shown by the microscopic and physiological researches of Dr. Carpenter, and the observations of Mr. Bowerbank and others, that this view is entirely erroneous, and that shell, like other organic products, is the result of the regular growth of cells.

Although the forms and mode of development of these cells are very numerous, and differ in almost each particular species, a sufficient number of observations have been made to lead to the conclusion, that the growth of shells depends on the same general laws as are observed in bone, teeth, scales, horns, and other hard parts of animals. Wherever hardness and solidity is required in the animal body, there phosphate of lime and carbonate of lime are deposited, and the mode of their deposit is strikingly similar in all cases.

In a report made to the British Association, 1844, Dr. Carpenter has given the result of his researches on the structure of a large number of shells, and all observations have since tended to confirm his accuracy. He finds that certain forms of shell-structure are so constant that he proposes them, if not as a means of distinguishing species, at least of recognising groups. "My inquiries," he says, "so far as they have yet proceeded, tend to establish this position, that where a recognisable and constant diversity presents itself in the elementary structure of the shell among different groups, that diversity affords characters, which are to a very high degree indicative of the natural affinities of those groups. It is not always that peculiarities sufficiently distinct present themselves, even between

what are regarded zoologically as distinct families; but where a marked diversity does exist, I believe that it will always be indicative of the affinities of the animal. Thus the conformity in structure between all the shells of one natural family is usually so close, that any strongly marked difference in a particular genus would make me hesitate in admitting it into the group." Dr. Carpenter further adds that although the characters derived from the structure of the shell are not likely to serve for the distinction of species from each other or even genera, for the distinction of some families they furnish the best natural characters at present possessed by the naturalist.

In examining the structure of shells, very thin sections of the shell must be obtained, and on these being placed under the microscope, it will be found that they are translucent, and permit of the passage of the rays of light. This is the case with all shells, and is indicative of their crystalline character. This shows that the distinction of shells into crystalline and granular or concretionary, as proposed by Dr. J. E. Gray, is not founded on a knowledge of the microscopic structure of the shell, although for practical purposes it serves to distinguish between certain forms of shell. When it is wished to examine the animal matter of shells independent of their inorganic constituents, the shell should be immersed in dilute hydrochloric acid, which leaves the animal matter and takes away the calcareous. This process Dr. Carpenter calls 'decalcifying.'

The animal matter of the shell exhibits itself more particularly in two forms, the Cellular and the Membranous. In most cases amongst the *Mollusca* the cellular structure assumes a prismatic form. "If," says Dr. Carpenter, "a small portion be broken away from the thin margin of the shell of any species of *Pinna* and it be placed without any preparation under a low magnifying power, it presents on each of its surfaces, when viewed by transmitted light, very much the aspect of a honeycomb; whilst at the broken edge it exhibits an appearance which is evidently fibrous to the eye, but when examined under the microscope with reflected light, resembles that of an assemblage of basaltic columns. The shell is thus seen to be composed of a vast multitude of prisms, having for the most part a tolerably regular hexagonal shape and nearly uniform size. These are arranged perpendicularly to the surface of each lamina, so that its thickness is formed by their length, and its two surfaces by their extremities." The substance forming these prisms is generally transparent, but here and there is found a dark spot. This arises from the fact that the prisms are found to be composed of a series of cells laid one on the top of the other. In the majority of the cells the calcareous matter is deposited in a crystalline form, so as to give it a translucent character, but occasionally this object is not effected, and the cell is filled with air, and presents the dark appearance known to be produced under the microscope by transparent vessels containing air. This prismatic cellular substance is formed upon the external surface of the mantle or skin of the animal, and may be regarded as homologous with the epithelial cells, which constitute the epidermis of the higher animals, and is called by Dr. Carpenter a 'calcified epithelium.' That these cells are deposited by successive layers appears from the fact that, when the decalcified layers are examined they exhibit a series of transverse lines not unlike the transverse striæ of muscular fibre.

In the shells which do not present the prismatic cellular tissue there is seen a layer of membranous shell-substance. In this layer no cells can for the most part be discovered. In no shell is there an entire absence of this organic basis, and Dr. Carpenter suggests that at one time this membrane was a constituent part of the mantle of the Mollusc. It appears to be homologous with the 'basement membrane' found in the mucous membranes and the skin. This membranous substance presents a variety of appearances; sometimes it is single, as if the shelly matter had been uniformly diffused over a plane surface. It is more frequently uneven, sometimes amounting simply to a corrugation or wrinkling, at other times the wrinkles are so strongly marked that they give the appearance of a series of fusiform cells, as is well seen in the shell of the common *Patella*.

What is called the Nacre in shells, and which is more especially observed in their interior, and which is distinguished by the iridescence produced by the action of light, is found to consist of layers or folds of this membranous shell-substance. When examined under the microscope, this substance exhibits a series of layers, and it has been supposed that these are alternately layers of membranous and calcareous matter; but Dr. Carpenter has shown that when these layers are decalcified they exhibit the iridescence, but that when the corrugations are removed by stretching, the membrane no longer exhibits its beautiful hues.

The membranous shell-structure is often traversed by tubes which vary from the $\frac{1}{50000}$th to the $\frac{1}{5000}$th of an inch in diameter. Their direction and distribution is exceedingly various, but in general they form a kind of network, which spreads itself out in each layer. At other times these tubes are quite straight. They have been regarded as perforations; but Mr. Bowerbank and Dr. Carpenter have both seen in them indications of a cellular structure, and regard them as originating in the coalescence of a series of cells. This structure is not often observed in the nacreous substance.

A structure of the shell-substance occurs in *Rudistes* which Dr. Carpenter calls 'cancellated structure.' It resembles the prismatic cellular substance, but the cells are hollow instead of being filled up. Dr. Carpenter says he has not met with this structure in a decided form amongst recent shells.

The Pearls found in the interior of the shells of many species of *Mollusca* seem to result from the deposit of the nacreous substance around some nucleus mostly of foreign origin. They are probably always formed between the mantle and the shell, although sometimes found in the muscles or viscera of the animal. The *Avicula margaritifera* is called the Pearl Oyster, on account of the frequency with which pearls are found in its interior. [Aviculæ.] Pearls are not unfrequently found in the common oyster, and most fishmongers possess specimens which they have obtained from oysters they have opened. Many of the fresh-water *Conchifera* of our own rivers contain them. The *Unio margaritiferus* yields them. It is said that the reputation of British pearls excited the cupidity of Julius Cæsar, and that he presented a buckler covered with them to Venus Genetrix, which was suspended in her temple. Pliny speaks of British pearls disparagingly. Those obtained from the *Unio* are generally very good; but many are procured from the *Mytilus edulis*, and these are not so valuable. (Forbes and Hanley, 'British Mollusca.')

With regard to the growth of shells, although it is true, generally speaking, that shells cover the embryo of the testaceous mollusc in the egg, as observed by Swammerdam, Pfeiffer, and others, such is not its condition in all cases. In *Argonauta*, for instance, the shell is not coeval with the first formation of the animal. [Octopoda.]

Dr. J. E. Gray, who states that the shells of *Mollusca* appear to be coeval with the first formation of the animal, observes that the Cephalopodous *Mollusca* form no exception; their bone, composed of two or three calcareous plates, being found fully developed in the cuttle-fish some time before the young animal is hatched. These observations, he adds, are directly at variance with the theory maintained by Sir Everard Home ('Phil. Trans.,' 1817), namely, that the shell is formed after the animal has quitted the egg; and, as regards the cuttle-fish, they are opposed to the remark made by Baron Cuvier, that the young cuttle-fish, when first hatched, has only a cartilaginous plate like the *Loligo*.

The shell, when first observed on the embryo (even of the animals of spiral shells), forms, Dr. Gray observes, a short blunt more or less curved sub-cylindrical cone, covering the hinder part of its body. As the organisation of the embryo becomes developed, and the hinder part of the body extended, the shell, he remarks, increases in size, till the body and shell together occupy nearly the whole of the egg. "While in the egg," says Dr. Gray in continuation, "the embryo shells are generally of a pale horn colour, and destitute of markings; when therefore they remain attached to the apex of the spire of adult shells, they may be easily distinguished by their appearance from the part formed after their exclusion; and as in such cases they offer some characters of importance, it has been proposed to designate them by the name of the nucleus of the shell. The effect of the atmosphere on the shell is almost instantaneous. In some young *Helices*, and in a species of *Voluta*, in my collection, the very first line of calcareous matter deposited after their exclusion from the egg is marked nearly as the adult shells of the species."

The same author remarks that the nucleus which forms the original apex in all shells, and frequently remains attached to them during all the periods of their growth, is largest in those shells the animals of which are viviparous, and is consequently very distinct in *Volutæ*, *Paludinæ*, and *Cyclades*. In the oviparous species, he observes, it agrees in size with the egg of the animal; thus *Achatina octona*, which has an egg nearly equal in dimensions to the mouth of the shell, and *Bulimus ovatus* and *B. bicarinatus*, which lay large eggs, have large nuclei, the magnitude of the nucleus in general rendering the top of the spire blunt. Some, on the contrary, as *Stylina* generally, and *Pupa purpurea*, have, he adds, a very long slender acute turreted nucleus. The form and size of the eggs of these molluscs do not appear to be known.

The nucleus consists of two coats or parts: the external coat or layer, Epidermis and Periostracum of authors, is of a somewhat horny or membranous character; the inner layer constitutes the true shell. This epidermis is thinnest in such shells as are enveloped in the mantles of their animals. The gradual growth of the shell so constituted is effected by the secretion from the mantle. The preparation No. 93 A, in the Museum of the College of Surgeons in London, exhibits a *Cypræa Tigris* with the soft parts. One of the lobes of the mantle, the secreting organ of the shell, is protruded. There are glands at intervals in the mantle of those shells that are ornamented with coloured patterns in the form of necklaces or stripes, which produce those patterns in many cases with all the correctness of a design. But though the mantle is the ordinary secreting organ, the vitreous external coat giving the highly glazed appearance to which the olives owe so much of their beauty is secreted by the foot, and not by the mantle.

The plates which form the rhombic crystalline shells are, Dr. Gray observes, deposited in succession, each gradually increasing in thickness as the shell enlarges. As the animal waxes in size, the lip gradually shelves, becoming thinner from the inner to the outer edge, the innermost part being formed of three layers, the next of two, and the outer and thinnest part (that which is first formed) of only a single layer. At the approach of the periodical stoppage of the

growth of the animal, the second layer of shell, and afterwards the innermost layer, is deposited up to the edge of the mouth, which is thus completed. By this process a spiral shell, a cone for instance, becomes as it were rolled on itself.

But besides this gradual onward increase, another process is called into action in certain cases, in order to the symmetrical growth of the spiral shell. Take a *Triton* or a *Murex* for instance: the intervals of growth are marked by the elevated varices. In the direction in which the shell is, so to speak, to be rolled on itself, there will be found a thickened spreading inner lip, into which a varix descends. Now both these must be removed, in order to insure the uninterrupted progress of the shell; for if these shells be examined internally, they will be found to be smooth and uninterrupted, and what is now inside was once outside. The power of absorption then must be great to remove the masses of shell which are contained in the highly-elevated and wrought varices, for such in many shells they are, to say nothing of the thickened and patulous lip.

In the smooth shells, cones for instance, where the animal has no obstacle to remove in the enlargement of the shell, the internal volutions are often so much absorbed as to be as thin as paper, and not unfrequently have vanished altogether. In both these cases, may not the animal derive from its own shell the means of increasing it?

The Operculum would in itself almost justify a treatise, which our limits forbid. It is a horny or shelly plate, which closes more or less completely the aperture of the spiral shell; so that those spiral shells which are so furnished are in fact bivalves. They are developed with the embryo in the egg. We must refer our readers for details to the interesting papers of Dr. Gray, who has for some years past paid great attention to this subject. In the 'Medical Repository' for 1821 he first urged the importance of this adjunct as a generic and family distinction, and he pursues the subject in the memoir from which we have quoted in this article; nor has the study of this interesting part of the conformation of many testaceous molluscs been neglected by M. De Blainville and other French zoologists, who have followed it out with great assiduity.

The nucleus, spire, and indeed the upper whorls of many shells, of the Volutes for instance, and most especially of *Magilus*, become, as they advance in growth, filled more or less by a transparent calcareous secretion; and Dr. Gray remarks that the distinction between such shells and those which are decollated, such as *Bulimus decollatus*, *Cerithium decollatum*, &c., is, that in the latter the animal, instead of lining the upper whorls with an internal coat, suddenly withdraws its body from them, and forms behind its extremity a concave septum: the vital communication between the body and the apex of the shell being thus cut off, the latter part, he observes, decays in the manner of a dead shell, and falls off in particles; but M. De Blainville refers the decollation of the spire to the filling up of the inner surface of the cavity of the shell with a very brittle vitreous deposit.

Dr. Gray remarks that in many fresh-water bivalves there is deposited between the layers of the shell a lamina of animal matter, similar to the periostracum; and that in the genera *Etheria* and *Mulleria* such a coat is deposited between nearly all the layers, giving them a very peculiar olive-green colour, and having minute dots on its surface. The erosion of these shells must be familiar to all who are conversant with the subject; and Dr. Gray states that these successive depositions of animal matter enable them to offer a new layer of periostracum for the protection of each succeeding plate, as the plate above it yields to the destructive influence of the medium in which the animal resides. A similar deposit of animal matter is also found, he adds, forming green stains in the pearly inner coat of the various species of *Unionea*, and protects from the action of the water the inner part of the umbones of shells which have been eroded. Dr. Gray has observed the thick inner layer in the upper valve of *Ostrea Cornucopiæ* to be prismatic, and the outer part of the laminæ to be separated by layers of periostracum.

The disintegrated thin, lamellar, pearly gray, silvery scales of iridescent shells, when reduced to powder, may be used as a pigment to imitate the silvery appearance of fishes, &c., and indeed the disintegrated and powdered scales of the *Placunæ* (Moon-Shells, Chinese-Window Oysters, as they are called by collectors), are so used by the Chinese in their water-colour drawings.

The term Shell is also commonly applied to the covering of crustaceous animals and the crusts of *Echini*: thus people familiarly talk of the shell of a lobster or crab and of the shell of a sea-egg. Mr. Hatchett remarks that there is reason to conclude that phosphate of lime mingled with the carbonate is a chemical characteristic which distinguishes the crustaceous from the testaceous substance; and that the principal difference of the qualities of each, when complete, is caused by the proportion of the hardening substances, relative to the gluten by which they are cemented; or by the abundance and consistency of gelatinous, membranaceous, or cartilaginous substance, in and on which the carbonate of lime, or the mixture of carbonate and phosphate of lime, has been secreted and deposited. Thus the presence of phosphate of lime mingled with carbonate appears to be a chemical character of Crustaceans and *Echini*.

SHELL-INSECTS. [ENTOMOSTRACA.]

SHE-OAK. [CASUARINACEÆ.]

SHEPHARDITE. [MAGNESIA.]

SHEPHERD'S NEEDLE. [SCANDIX.]

SHEPHERD'S PURSE. [CAPSELLA.]

SHERARDIA (so named by Dillenius after his patron William Sherard, LL.D., consul at Smyrna), a genus of Plants belonging to the natural order *Rubiaceæ*. It has a funnel-shaped corolla, a dry fruit, crowned with the limb of the calyx, which is 6-toothed.

S. arvensis, Corn-Field Madder, is the only species. The stem is mostly decumbent, branched, square, and leafy; the whole plant is rough and hairy; the leaves are six in a whorl, acute, and obovate lanceolate; the flower is blue, in a small sessile terminal umbel. It is found on sandy soils, in Great Britain, Europe, and the Crimea.

(Babington, *Manual of British Botany.*)

SHO'REA, a small Indian genus of Plants, belonging to the natural order *Dipterocarpaceæ*, named in compliment to Sir J. Shore, afterwards Lord Teignmouth, then governor-general of Bengal. The genus is found as far south as the line; and *S. robusta*, the best known and most useful species, as far north as 30° N. lat., in many parts forming the forests which skirt the south-western base of the Himalaya Mountains.

The genus is characterised by having a calyx of 5 sepals enlarging into 5 long wings; petals 5; stamens 25 to 30; fruit 1-celled, 3-valved, and 1-seeded.

The family to which the *Shorea* belongs is remarkable for the number of useful products yielded by its different species, as the camphor of Sumatra, resin, wood-oil, and valuable timber. *S. robusta* is remarkable on all these accounts, as it is a lofty and ornamental tree with showy inflorescence. It is well known as a timber-tree by the name of 'Saul,' or 'Sāl,' and chiefly employed in the north-western provinces of India in all government works, house-timbers, gun-carriages, &c. The wood is of a uniform light-brown colour, close-grained and strong. The tree exudes a resin which by the natives is called 'ral,' and by the Europeans one of the kinds of Dammer, being used for the same purposes as many other resins, and in Bengal very frequently as a substitute for pitch in the dockyards. It is also sometimes used by the Hindoos as an incense.

SHRIKES. [LANIADÆ.]

SHRIMPS. [CRANGONIDÆ.]

SHRIMPS, FRESH-WATER. [GAMMARUS.]

SHRUB ('Frutex'). All plants are divided into herbs, shrubs, and trees. A shrub is a plant with a woody stem, which approaches the tree in its duration and consistence, but never attains the height of a tree, and is generally taller than the herb. It varies in height from about four to twelve feet. Linnæus attempted to distinguish trees from shrubs by the former having buds and the latter having none. But this distinction is of no avail, as plants like the willow, generally called shrubs, possess buds, whilst most trees in hot countries are without them.

In horticulture shrubs are too well known to need a definition. For practical purposes they are divided into the deciduous and evergreen kinds, and each of these kinds may be further divided, according to their hardy or tender habits, their form, size, mode of growth, colour, &c. The most ornamental flowering shrubs are those belonging to the genera *Rosa*, *Rhododendron*, *Azalea*, *Kalmia*, *Andromeda*, *Vaccinium*, &c. Among the evergreen shrubs are the Holly, the Ivy, the Jasmine, the Box, various Heaths, &c.

Shrubs are often planted together, forming what are called shrubberies, and when the kinds are judiciously selected and arranged, these collections add greatly to the beauty of the gardens and pleasure-grounds where they are introduced.

SIBBALDIA (in honour of Robert Sibbald, formerly Professor of Physic at Edinburgh), a genus of Alpine Plants, belonging to the natural order *Rosaceæ*. It has a concave 10-parted calyx, the 5 outer segments accessory; it has 5 yellow or white petals, 5 sepals, and a lateral style; the fruit consists of from 5 to 10 small nuts seated on a dry receptacle.

S. procumbens has trifoliate leaves, wedge-shaped leaflets, with three teeth at the apex, rather pilose, the flowers corymbose; petals yellow, small, shorter than the calyx. It is found on dry mountains in Scotland, in Europe, Siberia, and North America.

S. parviflora is a native of Cappadocia. It has trifoliate leaves, the leaflets beset with strigose pili on both surfaces, the flowers in glomerate heads, the petals obovate, one-half shorter than the calyx.

(Babington, *Manual of British Botany.*)

SIBTHO'RPIA, a genus of Plants named after Dr. Sibthorp, professor of botany at Oxford, the successor of Dillenius, and the father of Dr. John Sibthorp, the traveller. This genus consists of small creeping, rooting, tufted herbs with small alternate uniform leaves, a 5-parted calyx, 5-lobed subrotate corolla, 4-5 nearly equal stamens, a capitate stigma, and a suborbicular capsule dehiscing at the top. The flowers are axillary, solitary, and inconspicuous. One of the species, *S. Europæa*, is a native of Europe, and is found in Portugal, Spain, and France, and in Devonshire and Cornwall in England. This genus is referred by most botanists to the order *Scrophulariaceæ*; but it differs from this order in its globose placenta and regular flowers. It differs from *Primulaceæ* in its stamens, being alternate with the lobes of the corolla, and in its capsule being 2-celled; hence Don has proposed to place this and some other doubtful genera in a new order, *Sibthorpiaceæ*, which possesses characters intermediate between those of *Scrophulariaceæ* and *Primulaceæ*.

SICYONIA. [PALÆMONIDÆ.]

SIDA, a genus of Plants belonging to the natural order *Malvaceæ*, containing nearly 200 species, which are very extensively distributed throughout the warm parts of the world, and abound in the peninsula and plains of India. The name was originally applied by Theophrastus to a plant growing in moist situations, which is believed to have been an *Althæa*, also belonging to the family of *Malvaceæ*, and was adopted by Linnæus for this genus.

Sida is characterised by having a naked quinquifid calyx with valvate segments. Corolla with 5 petals, which are obovate, with the claws often united into a tube, and joined to the bottom of the stamen tube. The stamens numerous, with their filaments connected into a columnar tube at their base, and free at the apex, bearing the reniform anthers. The styles are numerous, but more or less united at the base. Capsule 5- or many-celled. Cocci single-seeded; seeds suspended, roundish, and flattened.

The species of this genus vary much in habit, as well as in the structure of their fruit and seeds, but they resemble each other, as indeed do all Malvaceous plants, in abounding in mucilage, and in some of them having tough ligneous fibres, which are employed for the purposes of cordage in different countries. From their mucilaginous nature several are employed as demulcents in India, such as *Sida Indica*, *S. Asiatica*, and *S. populifolia*, in the same way that the Mallow and the Marsh-Mallow are in Europe. The leaves of *S. carpinifolia* (a native of Brazil and the Canary Islands) are chewed by the Brazilians, and applied with success to the stings of wasps and bees. *S. rhomboidea* and *S. rhombifolia* abound in very delicate flax-like fibres, which may be used for many of the same purposes as hemp and flax; but when the plants are grown for the sake of their fibres, they ought to be sown thick, under which circumstances, like other plants similarly sown, they grow tall and slender without branches. So *S. periplocifolia*, a native of the Malay Islands, which succeeds well in India, may be cultivated for the same object, especially as when cut near the earth it quickly shoots into long simple twigs which abound in flax-like fibres. A species, *S. tiliæfolia*, is actually cultivated for this purpose in China. Seeds of this species were received at the Calcutta Botanic Garden under the name of King-ma from Pekin, in the neighbourhood of which the plant was said to be cultivated as a substitute for hemp and flax. At Rio Janeiro the straight shoots of *S. macrantha* are employed as rocket-sticks.

SIDERASTRÆA. [MADREPHYLLIGEA.]

SIDERITE. [QUARTZ.]

SIDERI'TIS (from σίδηρος, iron), the name of a genus of Plants belonging to the natural order *Lamiaceæ*. The species of this genus are numerous, and are inhabitants of Europe and the northern parts of Asia. Dioscorides mentions three species of *Sideritis*, which were celebrated for stanching blood and healing wounds.

The genus consists of herbs and shrubs, with small yellowish flowers arranged in whorls; a tubular 5-cleft calyx; a ringent corolla, with upper lip 2-parted, the lower lip spreading, and deeply 3-cleft; four didynamous stamens, the upper short, bearing 2-celled anthers, the lower ones longer, and bearing irregular empty anthers; an inclosed style, bifid at the top, with one of the stigmas shorter and embracing the other.

S. Romana, Roman Iron-Wort, is an annual, clothed with soft rather woolly hairs, with oblong-ovate leaves; a nearly glabrous calyx, with long mucronate teeth, the upper tooth large and ovate, the lower teeth lanceolate. This plant is a native of the Mediterranean. It was found by Dr. Sibthorp in Greece and the isles of the Archipelago; and Sir J. E. Smith believes it to be identical with the *Sideritis* of Dioscorides. It flowers from June to August, and attains a height of about six inches.

SIDEROPORA. [MADREPORÆA.]

SIDEROSCHISOLITE. [IRON.]

SIDERO'XYLON (from σίδηρος and ξύλον), a genus of Plants belonging to the natural order *Sapotaceæ*. The species of this genus are natives of Africa, America, the East Indies, and Australia. They are evergreen trees, with axillary and lateral fascicles of flowers. They are remarkable for the hardness and weight of their wood, which sinks in water, and the genus has hence derived the name of Iron-Wood. The *S. inerme* (Smooth Iron-Wood) is a native of the Cape of Good Hope, and has long been cultivated in the greenhouses of Europe. None of the species however are at all remarkable for beauty.

SIEBOLDIA. [AMPHIBIA.]

SIENITE. A compound of quartz, felspar, and mica, being called Granite, we find in many instances hornblende instead of mica, and the rock is then called Sienite, or Syenite (from Syene in Egypt, where such a rock is well known). If we imagine (what is of common occurrence) the diminution of the quartz, and the partial obscuration of the crystalline structure, the rock becomes greenstone. If in place of hornblende we find hypersthene or epidote, the rock may be called Hypersthenic, or Epidotic Sienite, as in the Val di Fassa and Shetland. Definition fails in respect of Sienite, as it does in regard to other rocks of igneous origin.

Dr. M'Culloch ('Treatise on Rocks') ranks two rocks usually called Sienite (one composed of quartz, felspar, and hornblende, and the other of quartz, felspar, hornblende, and mica) as Granite. Mount Sorrel in Leicestershire, the Malvern Hills, and Criffel in Galloway, afford abundant and characteristic sienites.

SIGARE'TUS. [CHISMOBRANCHIATA.]

SIGHT. [EYE.]

SIGILLARIA, the name of an extinct genus of Plants. It is known by possessing a conical stem deeply furrowed but not jointed; with oblong discoid or nearly rounded cicatrices or scars, not arranged in a distinctly spiral manner, with frequently three smaller vascular cicatrices in the centre of the larger scars. This genus includes the *Rhytidolepis*, *Alveolaria*, *Syringodendron*, *Catenaria*, and the *Lepidodendron punctatum* and *L. appendiculatum* of various authors. The largest specimens of these plants occur in the coal-formation and in beds of the mountain-limestone series.

A variety of opinions have been entertained by geological botanists as to the affinities of these plants. Artis thinks them related to *Euphorbiaceæ*: Schlotheim refers them to Palms, and Von Martius to *Cactaceæ*. Brongniart at one time thought them a family sui generis, but has since referred them, with Count Sternberg, to the family of Arborescent Ferns. Lindley and Hutton think that "the weight of evidence seems to incline in favour of both *Sigillaria* and *Stigmaria* having been Dicotyledonous Plants, and of the highest degree of organisation, such as *Cactaceæ* or *Euphorbiaceæ*, or even *Asclepiadaceæ*." To these families they seem to approach, particularly in their soft texture, in their deeply channelled stems, and especially in their scars being placed in perpendicular rows between the furrows. These writers however add that "in the total absence of all knowledge of the leaves and flowers of these ancient trees, we think it better to place the genus among other species the affinity of which is altogether doubtful."

Brongniart, in his 'Histoire des Végétaux Fossiles,' enumerates 59 species of *Sigillaria*, and Lindley and Hutton, in the 'Fossil Flora,' have figured eight species found in Great Britain. [COAL-PLANTS.]

The circumstances under which *Sigillariæ* occur in the strata associated with coal are remarkable, and probably may be interpreted so as to reveal some of the conditions which were necessary for the production of the vegetable mass of coal. The first thing which strikes us is the hitherto almost universal absence of leaves, top, roots, and interior structure; we generally find large fragments, or perhaps almost the whole of the stems, furrowed, and marked by the bases of leaves, but in other respects deficient, truncate at top, and abruptly ending toward the bottom. If the plant lies in laminated shale above a bed of coal, it is generally compressed flat, having the exterior converted to coal, and the opposite sides nearly or quite in contact, to the exclusion of the central (perhaps cellular) portions. If in gritstone above a bed of coal, we find it more or less transverse to the strata, as if in attitude of growth, its top broken off, its lower part enlarged and tumid, and nearly touching the coal-bed, but apparently rootless; the interior full of sandy laminæ or irregular accumulations of sand, fragments of other plants, lumps of ironstone, &c. The tree was certainly hollow when the sandstone was formed; but whether through decay of the internal cellular substance, or a general wasting and consumption of vascular and cellular structure, as suggested by Mr. Hawkshaw from observations of hollowed dicotyledonous trees in South America, is still doubtful. Whether the leafless and apparently rootless trees, which in other respects are in the attitude and have the aspect of growth, did really grow where they appear, and have lost their roots by absorption and conversion into the coaly mass below, or were deposited by drifting with their roots more or less deficient, is a question of great importance, on which some of the excavations on the line of the Bolton railway, a few miles north of Manchester, have thrown much light. Here, above a thin (6-inch) coal-bed, in shaly strata much inclined, are seen several furrowed stems of trees, also inclined so as to stand at right angles to the stratification, most of them evidently rooted, by dichotomising rootbranches, in the clay over the coal. The extremities of the roots are not seen; perhaps they entered the vegetable mass which is now coal, and were carbonised with the other plants. The stems are furrowed, but less regularly than is usual in *Sigillaria*, and marked less plainly than is usual with the cicatrices of leaves. The 'bark,' as it is called, is coal, showing vegetable structure; the interior is sedimentary rock. These plants are commonly imagined to be *Sigillariæ*; at all events some of them are likely to prove so (those in which the roots are least obvious, and the base is tumid); others appear to us to be as much allied to *Lepidodendron*. We have seen specimens, in different coal-districts, certainly congeneric, and presenting the same intermediate characters between *Sigillaria* and *Lepidodendron*. Around the bases Mr. Bowman collected abundance of *Lepidostrobi*, which are usually referred to *Lepidodendron*.

Upon the whole, it is clear that here trees analogous to *Sigillaria* and *Lepidodendron* remain in the place, attitude, and circumstances of growth; their roots entered a sort of vegetable magma, partly the fallen accumulation of leaves and fruits of the forests; over this mass and around these stems water left its sediments horizontally; these horizontal strata have been upheaved, and the once vertical stems made to slope in accordance with the movement. These interesting trees have been carefully preserved in situ, by the care of Mr. Hawkshaw, and models have also been made of them. For additional remarks, *see* SUPPLEMENT.

SI'LAUS, a genus of Plants belonging to the natural order *Umbelliferæ*, and the tribe *Seselineæ*. The calyx is obsolete; the petals

ovate-oblong, entire, or slightly emarginate, with an inflexed lobe, sessile, truncate, or appendaged at the base.

S. pratensis, Meadow Pepper-Saxifrage, has an angular stem, supra-decompound leaves, pinnate leaflets with the segments rather remote. It is a smooth dark-green herb. The umbels consist of several unequal rays. The flowers are yellowish or greenish white. The fruit is roundish and ovate. It is found in damp and moist places in England, Europe, and Siberia. The whole plant has an unpleasant smell when bruised, and is said in some parts of Norfolk to give a bad flavour to the milk of cows feeding on it, and it is generally found that cattle avoid it in pastures. The species of this genus are not numerous.

(Babington, *Manual of British Botany.*)

SILENA'CEÆ, a natural order of Plants, belonging to the syncarpous group of the Polypetalous sub-class of Exogens. This order is a part of the larger order *Caryophylleæ* [CARYOPHYLLACEÆ] of Jussieu, and was originally separated by De Candolle. It has since been adoped by Bartling and Lindley in their systematic works. It differs from the remaining portion of the order *Caryophyllaceæ*, which are now called *Alsinaceæ*, in the possession of a tubular calyx, and petals with claws.

SILE'NE, a genus of Plants belonging to the natural order *Caryophyllaceæ*. It is known by its having a tubular naked 5-toothed calyx; 5 bifid unguiculate petals, which are usually crowned in the throat with 5 bifid scales; 10 stamens; 3 styles; capsules 3-celled at the base, ending in 6 teeth at the apex. The species are in general herbaceous, many of them annual, very few shrubby. Their stems are leafy, jointed, branched, and frequently glutinous below each joint. The calyx and leafstalks are also frequently viscous. The leaves are opposite, simple, and entire; the petals are mostly red and white, sometimes greenish or yellowish. Some of them give off a delicious perfume, especially at night. The extent of this genus is very great, and constant additions are being made to it by the collections of travellers. The greatest proportion are inhabitants of the south of Europe and north of Africa. Don, in Miller's Dictionary, enumerates 256 species of this genus; of these we shall give a few examples of the more common and interesting forms:—

S. acaulis, Stemless Catchfly, or Moss Campion. Whole plant glabrous, cespitose; leaves linear, ciliated at the base; peduncles solitary, 1-flowered; petals crowned, slightly notched. It is a native of Europe, and is found abundantly on the Alps. It is found on nearly all the Scotch mountains, and also on Snowdon, and the highest hills of Devonshire. Chamisso also gathered it on the islands of the western coast of North America. The flowers are of a beautiful purple colour, and it forms one of the greatest ornaments of our alpine flora. Several varieties of this plant have been recorded, varying chiefly in the form and existence of parts of the flower.

S. inflata, Bladder-Campion or Catchfly. Stems branched; flowers numerous, panicled; calyx inflated, netted; petals deeply cloven, scarcely any crown; leaves ovate-lanceolate. This is a very common plant throughout Europe, and is met with in almost every field and wayside in Great Britain. Like most plants that are widely and largely diffused, many varieties of it have been recorded. This plant has been recommended to be cultivated in the garden on account of its edible properties.

S. noctiflora, Night-Flowering Catchfly. Panicles forked; petals bifid; calyx with long teeth, oblong in fruit, with 10 connected ribs; leaves lanceolate, lower ones spathulate; whole plant clammy, pubescent. It is a native of Sweden, Germany, and Great Britain. It resembles very much the common red and white campion (*Lychnis dioica*). It is not a common plant, and is remarkable for opening its flowers at night only, and in warm weather, when they exhale a powerful and delicious scent.

S. quinquevulnerata, Five-Wounded Catchfly.

S. muscipula, Spanish or Fly-Trap Catchfly.

S. fruticosa, Shrubby Catchfly.

S. compacta, Close-Flowered Catchfly.

S. maritima, *S. Otites*, *S. Anglica*, *S. nutans*, *S. Italica*, *S. conica*, and *S. Armeria*, are all British plants.

SILEX. [SILICA.]

SILICA, a compound of oxygen, and the base known to chemists by the names of Silicium and Silicon. By some chemists Silicon is regarded as a metal, and hence the termination of its name in 'um,' while others consider it as non-metallic, but more allied to boron, and these adopt the term Silicon.

Sir H. Davy, by acting upon Silica with potassium, arrived at the conclusion that it was an oxide, containing a peculiar inflammable base, to which he gave the name of Silicium; the accuracy of this determination has since been demonstrated by Berzelius.

In Davy's experiments the Silica yielded its oxygen directly to the potassium.

The properties of Silicon are, that it has a dark-brown colour, no lustre, and is a non-conductor of electricity: it is this latter circumstance which has induced many chemists to question or deny the property of classing it with the metals. It is insoluble in water, and incombustible in air or in oxygen gas; it neither fuses nor undergoes any other change when heated in the flame of the blow-pipe. Neither the nitric, hydrochloric, sulphuric, nor hydrofluoric acid oxidises or dissolves it; but a mixture of nitric and hydrofluoric acid dissolves it readily, even cold. When ignited with chlorate of potash, silicon is not acted upon; but if deflagrated with nitrate of potash, the silicon combines with the oxygen of the decomposed acid, and is converted into silica, or silicic acid; and this uniting with the potash of the decomposed nitrate, silicate of potash is formed.

Oxygen and Silicon form only one compound, namely, silica, or silicic acid. It may be obtained artificially, but very inconveniently, by deflagrating silicon with nitrate of potash. Silica exists very largely in nature; it is indeed probably the most abundant of all substances whatever. [QUARTZ; OPAL; AGATE; FLINT.] Rock crystal is silica, nearly or quite pure, and flints or white sand are but slightly intermixed with other bodies. It is artificially obtained in a pure form by fusing crystal, sand, or flints, with about four times their weight of carbonate of soda or carbonate of potash; the resulting fused mass is either silicate of soda or silicate of potash; the latter is a deliquescent substance, and when it has become fluid by exposure to the air, has been long known by the name of Liquor of Flints: when either of these silicates is treated with hydrochloric acid diluted with water, it combines with the alkali, and with any impurity which the sand or flint might contain, such as lime, alumina, or oxide of iron, and precipitates the silica as a hydrate in the state of a colourless gelatinous mass. It possesses the following properties:—

When recently precipitated, and while it retains the state of moist hydrate, it is to a certain extent soluble in water, and still more so in acids, and also in solution of potash or soda. When it has been dried, it is an opaque white powder, inodorous, insipid, and gritty, and then with more difficulty soluble in the alkaline solutions, and scarcely at all so in any other acid than the hydrofluoric. It is infusible by the heat of ordinary furnaces, but by the oxy-hydrogen blow-pipe it is more readily fused than lime or magnesia. Its specific gravity is about 2·7. It consists of 3 parts of oxygen, 24; and 1 of silicon, 20; so that the larger proportion, by weight, of this substance is oxygen.

Although it is tasteless, and does not change vegetable blue colours red, and is insoluble in water, except under the peculiar circumstances mentioned, it is nevertheless by many chemists considered as and classed with acids, under the name of Silicic Acid; and the various compounds which it makes with alkalies and earths, to form glass, are considered as salts. Thus with potash it forms silicate of potash; with soda, silicate of soda; and with oxide of lead, silicate of lead; and these are all constituents of glass. China and porcelain, on the other hand, may be regarded as silicates of alumina and magnesia, and mortar is probably a silicate of lime.

It is from a knowledge of the chemical properties of silicic acid that the mineralogist and geologist are enabled to account for its presence in so many forms in nature. It is in fact one of the most generally diffused substances in nature. The circumstances of its deposit in the form of Agates, Chert, Flint, and other minerals have produced much discussion. In all these cases it is maintained by Mr. Bowerbank, that the silica has been deposited upon some kind of siliceous matter at the bottom of the sea. In the case of flints the spiculæ of Sponges and the skeletons of *Diatomaceæ* have been found in the midst of the silica of which they are composed. It is argued that it would be quite impossible that these bodies should be found diffused through the substances of the flint if the silica had been deposited in a mould already formed, and that the only explanation of this circumstance is to be found in the supposition that the spiculæ exist in the meshes of the sponge, and that the other creatures found in the midst of the sponge have been caught in its meshes. This explanation also applies to the occurrence of the casts of molluscous shells, fish-teeth, and other organic remains found in the interior of flints. *Echini* and *Mollusca* are often found converted into flint with no siliceous matter surrounding them. These Mr. Bowerbank maintains were first taken possession of by sponges, and that the silica has been deposited in them in virtue of this condition. It is only right to say here, that Mr. Bowerbank has in his collection specimens which support his theory in every respect. He has several recent shells which are entirely filled with sponges. If this is really the case with flints it seems equally applicable to the explanation of the formation of agates and other forms of siliceous stones. We ought to add here that with increased attention to the examination of agates and other stones, there is no reason to believe that any of them possess in their interior the remains of Mosses, *Confervæ*, or other plants, as was at one time supposed. [AGATE.]

Silicic acid combines with the earths and metals and forms a large series of the most common as well as the rarest minerals known. With lime it forms *Tabular Spar*. With boracic acid and lime, *Datholite*. With magnesia and water it forms *Talc*, *Serpentine*, *Nephrite*, *Schiller Spar*, and a large number of less-known minerals. Without water, silica and magnesia form *Pyroxene*, *Hornblende*, *Chrysolite*, *Chondrodite*, and many others. Silica, alumina, and water form *Halloylite*, *Pinite*, *Chlorophyllite*, and the *Zeolite* family. The Zeolites are *Heulandite*, *Apophyllite*, *Laumonite*, *Natrolite*, *Thomsonite*, *Harmotome*, *Analcime*, and *Chabazite*. Silica, lime, and alumina form *Prehnite*. The anhydrous silicates of alumina are *Sillimanite*, *Kyanite*, *Andalusite*, *Staurolite*, *Leucite*, and the *Felspar* family, which includes *Albite*, *Labradorite*, *Nepheline*, and many minor forms of these.

Scapolite is a silicate of alumina and lime. *Spodumene* and *Petalite*

are silicates of alumina and lithia. *Epidote* and *Idocrase* are silicates of alumina, lime, and iron. *Garnet* is a silicate of alumina, iron, and manganese.

Tourmaline is a compound of silica, alumina, lime, iron, soda, and boracic acid. *Axinite* is the same, with magnesia, instead of lime. *Iolite* is a silicate of alumina, magnesia, iron, and manganese.

Mica consists of silica, alumina, potash, iron, fluoric-acid, and water. The *Topaz* is a silicate and fluoride of alumina. *Lapis Lazuli* is a silicate and sulphate of alumina, soda, lime, and iron. *Sodalite* is a silicate of alumina, with chloride of sodium.

The *Beryl*, *Euclase*, and *Chrysoberyl*, consist of silica, alumina, and glucina. The most important of these minerals are described under their proper names in this work.

SILI'CULA, a kind of Fruit. [FRUIT.]

SI'LIQUA, a genus of *Mollusca*. [PYLORIDIA.]

SI'LIQUA, a kind of Fruit. It is characterised by having one or two cells, with many seeds, dehiscing by two valves, which separate from a central portion called the Replum. It is linear in form, and is always superior to the calyx and corolla. The seeds are attached to two placentæ, which adhere to the replum, and are opposite to the lobes of the stigma. This position of the seeds, being abnormal, can only be explained in two ways: either this fruit is in reality composed of four carpels, two of which have, during the growth of the pistil, become abortive; or the stigmas must be looked upon as the fusion of two halves, one from each side. The dissepiment of the fruit in this case is most probably a spurious one formed by the projecting placentæ. It is sometimes found incomplete, from the edges of the placentæ not meeting; it is then said to be 'fenestrate.' This kind of seed-vessel is possessed by a large number of plants belonging to the order *Cruciferæ*, and examples may be seen in the Stock or Wall-Flower (*Cheiranthus*), in the Ladies' Smock (*Cardamine*), and in the Cabbage, Turnip, and Mustard. The Linnæan class *Tetradynamia* is divided into two orders, according to the form of its fruit: those plants of the class having a silique are comprised under the order *Siliquosa*; those having a silicle, under the order *Siliculosa*.

SILK-COTTON. [BOMBAX.]

SILK-WORM. [BOMBYCIDÆ.]

SILLIMANITE, a Mineral—a crystallised Silicate of Alumina. It occurs in rhombic prisms imbedded in quartz. Cleavage parallel to the long diagonal. Its colour is dark brownish-gray or clove-brown. Fracture uneven, splintery. Specific gravity 3·41. Its lustre is vitreous, nearly adamantine on the face of cleavage. Nearly opaque. Hardness 8·0 to 8·5. It is brittle, and easily reduced to powder.

It is met with at Saybrook, Connecticut, North America. It was at one time considered to be a variety of *Anthophyllite*, but it is much harder than this mineral, and contains more alumina and less silica and oxide of iron. It more nearly resembles *Kyanite*, both in form and composition.

It yielded by the analysis of Bowen—

Silica	42·67
Alumina	54·11
Oxide of Iron	2·00
Water	0 51
	——99·29

SILLOCK. [MERLANGUS.]

SI'LPHIUM (Σίλφιον). Ancient authors mention this plant and its juice. Two kinds of this substance are described: one, from Cyrene, was probably yielded by *Thapsia Silphium* [LASER]; and the other was most likely assafœtida, which has been employed medicinally by Asiatics from very early times, though it has been known by this name in comparatively modern times.

Silphium was however remarkable for other properties, and hence has attracted the attention of modern travellers who have recently visited the countries where the *Silphium* is described as growing by the ancients. The army of Alexander, in crossing the mountain range which Arrian calls Caucasus (iii. 28, 10), and which is the same range that he afterwards mentions under the name of Paropamisus (v. 5, 3), met with the *Silphium*. Arrian says, on the authority of Aristobulus, "In this part of the Caucasus nothing grows except pines and *Silphium*, but the country was populous and fed many sheep and cattle, for the sheep are very fond of the *Silphium*. If a sheep should perceive the *Silphium* from a distance, it runs to it, and feeds on the flower, and digs up the root and eats that also. For this reason, in Cyrene, they drive the sheep as far as possible from the spots where the *Silphium* grows, and some even fence in such places to prevent the sheep from entering them if they should approach; for the *Silphium* is worth a good deal to the Cyrenæans." Burnes, in crossing the Hindu Koosh, and seeing both the men and cattle eating the young parts of the assafœtida plant, supposed that it must be the *Silphium* of Arrian. But as this author describes the country where the *Silphium* grows as abounding in cattle, Dr. Royle had concluded that the *Prangos* of Mr. Moorcroft was the *Silphium* alluded to, and which is much fed on by sheep and cattle in the present day in Tibet. Mr. Vigne, when travelling in these regions, came to the same conclusion. It is probable therefore that both plants, being umbelliferous, and employed for the same purposes in nearly the same regions, may have contributed to form the accounts which are so brief in ancient authors. [LASER; PRANGOS.]

SILURIAN SYSTEM. A considerable group of the Fossiliferous Primary Strata, occurring in remarkable perfection in Wales, especially in the eastern and some of the southern districts, and in some of the adjoining English counties, is thus named by Sir Roderick Impey Murchison.

When Sir Roderick commenced his researches in Shropshire and Wales (1831), the principal knowledge we possessed of the succession of the older stratified rocks of Great Britain, then commonly called Grauwacke and Transition Formations, was based on the still incompletely published labours of Sedgwick in Wales and the district of the English lakes; and so little was known of their fossil contents, that it is believed that the first definite notice of this kind was contained in Professor Phillips's description of a group of slate-rocks in the vicinity of Kirby Lonsdale. ('Geol. Trans.,' 1827.) Now, in consequence principally of the development given to this subject by the appearance of the Silurian researches of Sir Roderick Murchison, and other works to which it has led, we are able to trace in one consecutive history nearly the whole series of mineral depositions and organic combinations of which the ocean was anciently the theatre, from the period of the Mica Schists to the termination of the Carboniferous era.

In this survey, the Silurian Strata form a very conspicuous and interesting portion, and in the district from which the type was originally drawn they appear within distinct and definite limits, which seem to insulate them from the older and new rocks, and to justify their claim to the rank of a peculiar system; but in other districts phenomena appear which show that the order of physical changes and organic combinations which characterise the Silurian System, was in operation both before and after the period included in the ages of the four Silurian groups of Llandeilo, Caradoc, Wenlock, and Ludlow; while in other districts these characteristic assemblages do not all clearly appear; and thus we are naturally conducted to a more comprehensive view of the whole of the ancient (Palæozoic) formations.

Whatever be the true theory of the origin of the Granitoid Strata of gneiss and mica schist (with their many and various quartzose, chloritic, and calcareous accompaniments), it is at least certain, as a general rule, that rocks of this general type are prevalent among the very deepest and oldest deposits from water which retain proof of their watery aggregation, and that they are in this position devoid of the traces of ancient life.

Equally certain is the character of the great series of Neptunian rocks which lies upon the mica schist; it is a vast and various mass of strata (principally argillaceous, locally arenaceous or conglomeritic, rarely yielding limestone), in which, though unequally, and in degrees varying with locality, slaty cleavage tends to be developed. Organic life has left traces in this series of muddy sediments both of vegetable and animal origin; in the lower and older parts very sparingly, in the upper parts abundantly. If, with Professor Sedgwick and Sir Roderick Murchison, we take the series of these rocks as they appear in Wales and Cumberland, namely—

Silurian, or Upper group;
Cambrian, or Middle group;
Cumbrian, or Lower group;

we shall find in the mineral characters of these groups, in the countries named, some diagnostic marks of importance, but they vanish or become equivocal in other regions. In like manner, the organic contents seem, in the countries named, to be definitely arranged in zones, so as to mark successive periods there. No organic remains are known in the Cumbrian rocks; they are rare, and confined to a few layers, in the Cambrian deposits; and are very plentiful and general in the Silurian group. The districts in which these peculiarities occur are probably more wide and scattered farther asunder than those in which the original types of mineral structure prevail; but yet it is evident that they are limited in respect of geographical area, and variable in regard to the distinctness and completeness of the terms, even in districts not far removed from the centre of investigation. Let any one who may desire proof of this compare the argillaceous series of Ayrshire, Westmoreland, Pembrokeshire, Tyrone, or Waterford, in which Silurian fossils occur, with the full and varied series of Shropshire, the Berwyn, and Snowdon.

Under these circumstances of difficulty in regard to the right general view of the ancient fossiliferous strata, we must consider the series of Silurian rocks and fossils not as the type of this enormous sequence of mineral and organic phenomena, but as one, and perhaps the richest, of all the local physical combinations of that ancient period, and employ it as a general term of comparison for reducing to order and place many detached and difficult districts in which the strata have local, peculiar, and perhaps exceptional aspects.

Sir Roderick Murchison arranges the Silurian Strata in groups, as follows, in a descending order:—

	Formations.	Divisions.	Thickness in feet.
Upper Silurians	Ludlow rocks	Upper Ludlow rocks Aymestry limestone Lower Ludlow rocks	1500
	Wenlock rocks	Wenlock limestone Wenlock shale	1000
Lower Silurians	Caradoc rocks Llandeilo rocks		very variable.

Pyrogenous rocks are associated with the Silurian Strata in many

situations, as the Caradoc Hills, where compact felspar predominates; the Wrekin and Lilleshall Hill, characterised by sienitic rocks; Corndon, full of greenstone. Alterations of stratified rocks by the contact of igneous rocks are common in the Caradoc, Stiperstones, &c. The trap rocks near Welshpool are in places columnar; the Breiddyn Hills are mostly greenstone, and yield elongated dykes in a north-east direction, which traverse the new red-sandstone. Mineral veins (yielding lead-ore) are plentiful in Lower Silurian rocks, in the Shelve district, adjacent to the trap rocks of Corndon and the altered sandstones of the Stiperstones. "In a plan of Mr. Moro's of Linley Hall, the chief proprietor of this district, upwards of 24 are laid down in the district of Shelve alone, excluding the tracts around the Bog and Penally; so that, comprehending the principal portion of the mining-ground, we may say that it contains upwards of 30 metalliferous veins which have been profitably worked." (Murchison, 'Silurian System,' p. 282.)

Volcanic grits, composed of materials derived from igneous action, and subsequently arranged in water, are mentioned by Sir Roderick Murchison rather frequently. In the Shelve district they are traversed by lead veins; in the Caradoc Hills they abound, and were noticed as 'allied to greenstone' in the Wrekin by Mr. A. Aikin. They contain organic remains in several places, as near the Corndon Hills.

On reviewing the series of strata comprised in the Silurian System in the vicinity of Ludlow, Usk, Llandeilo, or Denbighshire, we see them to form in reality one closely-associated sequence of oceanic deposits—apparently accumulated with little local disturbance and very slight admixture of organic exuviæ from the land. Volcanic eruptions appear to have rather varied than greatly disturbed this system of operations, though it is evident they contributed no small part of the granular materials of the principally sedimentary strata. The formation of limestone is local: where coral prevailed, we find the Aymestry and Wenlock limestones, and even the calcareous parts of the Landeilo rocks, to be in a great degree filled with coral. The Brachiopod shell *Pentamerus* fills some whole beds of limestone (near Aymestry), and where it is deficient the limestone also fails, as in the district of Usk. In their course from Shropshire northward to Denbighshire, Mr. Bowman ('Reports of the British Association for 1840-41') has found the general type of the Silurian rocks to vary,

and the line of distinction between it and the slaty strata below to be extremely obscure; and similar observations are recorded by Sir Roderick Murchison in the account which he gives of these rocks in Caermarthenshire and Pembrokeshire.

Mineral character alone will scarcely suffice, anywhere, for any but an arbitrary (and therefore unsatisfactory) boundary-line between the Silurian and Cambrian deposits. It is extremely probable, perhaps we may say it is already proved, that no distinction of higher value can be found on comparing the organic remains of these groups. In Snowdon (supposed to be very low in the Cambrian series of rocks) are shells and corals, which are perhaps the same, but certainly are congeneric with and very similar to Silurian fossils; and there is really as great (if not greater) difference between the Landeilo and Wenlock rocks, in regard to fossils, than between the Silurian and Cambrian strata.

If we turn to other districts where Silurian fossils occur plentifully (North America, Ireland, Norway), the result appears the same. There is apparently only one great series of organic combinations distinguishable among the fossiliferous strata anterior to the old red-sandstone era, and it was with a perception of this important truth that Sir Roderick Murchison once proposed for the Silurian strata the title of Protozoic. If instead of this we employ Palæozoic (as suggested by Sedgwick), we shall rank all the fossiliferous strata of the Cumbrian, Cambrian, and Silurian groups as Lower Palæozoic Strata.

The lower arbitrary boundary of the Silurian Strata being thus softened or erased, we may regard its upper surface as only locally more definite. Certainly in all the region around Wales the separation of the Silurian and old red-sandstone deposits is somewhat sudden: the colour changes from gray to red; the dull mudstones become micaceous sandstones; the richly fossiliferous Upper Ludlow loses its character in unprolific red marls and grits. What few fossils do occur in these overlaid strata (except near the very bottom) are of quite other types of organisation. But these are local truths, depending mainly on the introduction of new sediments poisonous to marine invertebral life; and as these sediments are very local, we may find in other countries groups of strata newer than the Silurian, older than the Carboniferous, with fossils intermediate in character and combination to both.

The following analysis from Professor Phillips's 'Manual of Geology,' gives a more extended view of these rocks:—

Collective Titles.			Formations.		Name.	Prevalent Mineral Type.
Lower Palæozoic.	Silurian.	Upper.	Ludlow	Fossils abundant.	Tilestone	Arenaceous.
					Upper Ludlow	Argillo-Arenaceous.
					Aymestry Limestone	Calcareous.
					Lower Ludlow	Argillaceous.
			Wenlock	Fossils abundant.	Wenlock Limestone	Calcareous.
					Wenlock Shale	Argillaceous.
					Woolhope Limestone	Calcareous.
			Transition Group		May Hill or Upper Caradoc Sandstone	Arenaceous.
		Lower.	Bala or Llandeilo	Fossils abundant.	Caradoc Sandstone	Variable.
					Bala Limestone	Variable.
					Bala Slate Flags	Variable.
			Festiniog or *Lingula*	Fossils few.	Arenig Slate and Porphyry	Argillaceous.
					Tremadoc Slate	Argillaceous.
					Lingula Flags	Argillaceous.
	Cambrian.		Bangor or Longmynd	No fossils known.	Harlech Grits	Arenaceous.
					Llanberis Slates and Grits	Argillo-Arenaceous.
					Longmynd Slates	Argillo-Arenaceous.

On considering the distribution of organic remains in the successive stages of the Silurian rocks, it is evident that the greatest variety of species occurs in the lower part of the Upper and towards the upper part of the Lower Silurian rocks. In other words, the conditions favourable to organic life in the sea were in the earliest period considerable; they arrived at a maximum in the middle part of the period in the Caradoc sandstone, the Wenlock shale, and the Wenlock limestone, and still continued considerable till the Silurian depositions ceased, and were replaced by old red-sandstone nearly devoid of organic remains. *Polypiaria*, *Crinoidea*, and *Crustacea* are most numerous in the principal calcareous rock, Wenlock limestone; *Brachiopoda* are most plentiful in Caradoc sandstone; *Cephalopoda* in the Wenlock shale; fishes in the upper Ludlow rock.

The following list of fossils is given by Professor Phillips:—

Amorphozoa.

	Species.		Species.
Acanthospongia (?)	1	*Cnemidium*	1
Choria	2		

Foraminifera.

	Species.
Endothyra	1

Zoophyta. (*Zoantharia* of Edwards.)

	Species.		Species.
Aceroplaria	1	*Goniophyllum*	2
Alveolites	4	*Halysites*	1
Arachnophyllum	1	*Heliolites*	10
Aulacophyllum	1	*Petraia*	7
Aulopora	3	*Pyrilonema*	1
Chætites	4	*Protovirgularia*	1
Cladocora	1	*Sarcinula*	1
Cliziophyllum	1	*Stenopora*	1
Cœnites	5	*Strephodes*	5
Cyathaxonia	1	*Stromatopora*	2
Cyathophyllum	5	*Strombodes*	2
Cystiphyllum	4	*Syringopora*	5
Diphyphyllum	1	*Thecia*	2
Favosites	7	*Zaphrentes*	2
Fistulipora	1		

Alcyonaria.

	Species.		Species.
Didymograpsus	3	*Graptolithus*	12
Diplograpsus	10	*Rastrites*	1
Gorgonia	4	*Retiolites*	1

Hydroidia.

	Species.
Oldhamia	2

Echinodermata.

Crinoidea.

	Species.		Species.
Actinocrinus	4	*Marsupiocrinus*	1
Crotalocrinus	1	*Periechocrinus*	2
Cyathocrinus	3	*Sagenocrinus*	2
Eucalyptocrinus	3	*Sasocrinus*	1
Glyptocrinus	1	*Tetramerocrinus*	1
Ichthyocrinus	1	*Tetragonis*	1

Cystidoidea.

	Species.		Species.
Agelacrinites	1	*Echinosphærites*	4
Apiocystites	1	*Hemicosmites*	2
Caryocystites	5	*Prunocystites*	1
Echinencrinus	2	*Pseudocrinites*	4

Asteroidea.

	Species.		Species
Lepidaster	1	*Uraster*	4
Protaster	1		

Echinoidea.

	Species.
Palæchinus	1

Articulata.

Annelida.

	Species.		Species.
Aphrodita	1	*Nereites*	3
Cornulites	1	*Serpulites*	4
Crossopodia	2	*Spirorbis*	1
Lumbricaria	2	*Tentaculites*	3
Myrianites	1	*Trachyderma*	3
Nemertites	1		

Crustacea.

Entomostraca.—Trilobitidæ.

	Species.		Species.
Acidaspis	10	*Harpes*	2
Æglina	2	*Homalonotus*	5
Agnostus	4	*Illænus*	8
Amphion	1	*Lichas*	9
Ampyx	5	*Ogygia*	2
Asaphus	7	*Olenus*	4
Bronteus	2	*Paradoxides*	1
Calymene	6	*Phacops*	15
Cheirurus	4	*Proëtus*	3
Conocephalus	1	*Remopleurides*	7
Cybele	2	*Sphærexochus*	1
Cyphaspis	1	*Staurocephalus*	2
Cyphoniscus	1	*Stygina*	2
Deiphon	1	*Tiresias*	1
Eccoptocheile	1	*Trinucleus*	5
Encrinurus	4		

Other *Entomostraca.*

	Species.		Species.
Beyrichia	3	*Eurypterus*	2
Ceratiocaris	3	*Hymenocaris*	1
Cythere	1	*Leptocheles*	2
Dithyrocaris	1	*Pterygotus*	1

Bryozoa.

	Species.		Species.
Cellepora	1	*Heteropora*	1
Cercopora	5	*Intricaria*	1
Diastopora	2	*Oldhamia*	—
Discopora	3	*Polypora*	1
Escharina	1	*Ptilodictya*	8
Fenestella	6	*Retepora*	1
Glauconome	1		

Brachiopoda.

	Species.		Species.
Athyris	6	*Orthis*	45
Atrypa	9	*Orthisina*	2
Chonetes	1	*Pentamerus*	8
Crania	3	*Retzia*	3
Cyrtia	1	*Rhynchonella.*	26
Discina	12	*Siphonotreta*	2
Leptæna	42	*Spirifera*	5
Lingula	16	*Trematis*	1
Obolus	2		

Lamellibranchiata.

Monomyariæ.

	Species.		Species.
Anbonychia	7	*Posidonomya*	1
Avicula	16	*Pterinea*	10
Inoceramus	2		

Dimyaria.

	Species.		Species.
Anodonctopsis	7	*Modiola*	6
Arca	12	*Modiolopsis*	8
Cardiola	3	*Mytilus*	7
Cleidophorus	7	*Nucula*	13
Conocardium	3	*Orthonota*	3
Cypricardia	3	*Psammobia*	1
Dolabra	2	*Sanguinoletes*	10
Grammysia	4	*Tellina*	1
Leptodomus	2		

Pteropoda.

	Species.		Species.
Cornularia	3	*Pterotheca*	2
Ecculiomphalus	3	*Theca*	3

Gasteropoda.

	Species.		Species.
Capulus	2	*Natica*	1
Euomphalus	16	*Nerita*	1
Helminthochilina	1	*Patella*	1
Holopea	2	*Phasianella*	1
Holopella	9	*Pleurotomaria*	10
Loxonema	2	*Raphistoma*	2
Maclurea	2	*Trochus*	8
Macrocheilus	1	*Turbo*	10
Murchisonia	14	*Turritella*	4

Heteropoda.

	Species.
Bellerophon	13

Cephalopoda.

	Species.		Species.
Actinoceras	3	*Orthoceras*	54
Cyrtoceras	3	*Phragmoceras*	10
Lituites	11		

Fishes.

	Species.		Species.
Onchus	2	*Sphagodus*	1
Plectrodus	3	*Thelodus*	1

Of the above list, 496 were found in the Upper Silurian; 485 in the Lower Silurian; and 19 in the Cambrian.

SILU'RIDÆ, a family of Fishes belonging to the order *Malacopterygii*, placed by Cuvier, in his 'Règne Animal,' between the *Esocidæ*, or Pike tribe, and the *Salmonidæ*, or family of the Salmons; but in the 'Histoire Naturelle des Poissons,' the present group commences the *Malacopterygii*. The family *Siluridæ* constitutes a very extensive section of fishes, the species of which are for the most part confined to the fresh waters of warm climates. No group perhaps presents greater diversity of form than the *Siluridæ*, and their habits are equally interesting. Their most obvious external characters are, the want of true scales. The skin is generally naked, but in parts protected by large bony plates; the foremost ray of the dorsal and pectoral fins almost always consists of a strong bony ray, often serrated either in front or behind, or on both sides. These fishes moreover frequently are furnished with a small adipose fin on the hinder part of the back, as in the *Salmonidæ*. The mouth is almost always provided with barbules.

The genus *Silurus*, as now restricted, is distinguished by the dorsal fin being very small, without any distinct spine, and situated on the fore part of the back; the anal fin is of great length, extending along the whole belly of the fish, and sometimes joining the tail-fin; the maxillaries and intermaxillaries are furnished with small thick-set curved teeth, and there is a band of similar teeth on the vomer.

The species of this genus are confined to the Old World; the only known European species is the *S. glanis* (Linn.), a fish of very large size, which is found in the lakes of Switzerland, in the Danube, the Elbe, and all the rivers of Hungary. In Prussia and Sweden it is also found.

The *S. glanis* is introduced in several works on the fishes of this country. It has, however, says Mr. Yarrell, been suspected that the so-called *Silurus*, supposed to have been found formerly in some of the Scottish rivers, might have been the Burbot.

Cuvier states that this fish is sometimes upwards of six feet in length, and is said to weigh 300 lbs. (French). The body is elongated, and has the hinder part compressed, but towards the head its width gradually increases, and the head itself is depressed and large; its colour is dark green above, of a pale green below the lateral line,

and yellowish on the belly, and the whole body is covered with dark spots; six barbules surround the mouth, and two of these, which have their origin (one on each side) just above the angle of the mouth, are very long.

Mr. Yarrell observes, "The *Silurus* is represented as sluggish in its habits, and a slow swimmer, taking its prey by lying in wait for it, in a manner somewhat similar to the Angler, *Lophius;* hiding itself in holes or soft mud, and apparently depending upon the accidental approach of fishes or other animals, of which its long and numerous barbules may be at the same time the source of attraction to the victims, and the means of warning to the devourer. From its formidable size, it can have but few enemies in the fresh water; and from them, its dark colour, in addition to its habit of secreting itself either in holes or soft mud, would be a sufficient security. In spring, the male and female may be seen together, about the middle of the day, near the banks or edges of the water, but soon return to their usual retreats. The ova, when deposited, are green; and the young are excluded between the sixteenth and nineteenth days.

"The flesh of the *Silurus* is white, fat, and agreeable to many persons as food, particularly the part of the fish near the tail; but on account of its being luscious, soft, and difficult to digest, it is not recommended to those who have weak stomachs. In the northern countries of Europe the flesh is preserved by drying, and the fat is used as lard."

In the 'Histoire Naturelle des Poissons,' it is stated that the present fish is so voracious, that it has been known, in several instances, to devour children; and in one instance the body of a woman was found in one of these fishes.

Several examples of the restricted genus *Silurus* are found in Asia.

Cuvier separates from the typical *Siluri*, as a genus, the *Silurus mystus* of Linnæus, and some others, on account of the compressed form of the body, and the dorsal fin having a strong bony spine in front, which is denticulated on the hinder margin. The body is deepest near the middle, but tapers somewhat suddenly towards the extremities. The head is small and depressed, and the eyes are placed low down.

The species upon which Cuvier founds this genus—to which he applies the name of *Schilbe*—are found in the Nile, but there are others described in this author's great work on fishes, one of which is found in the Senegal and another in India.

Cetopsis.—This genus is founded by Agassiz on certain species found in Brazil, which in their affinities approach the genus *Silurus*, but are distinguished by the extremely small size of their eyes.

Bagrus, Cuvier.—The species of this genus are distinguished from those of the genus *Silurus*, as restricted, by their possessing an adipose fin on the hinder part of the back. The body is naked—that is, unprovided with bony plates—and the mouth is provided with barbules, the number of which, varying in different species, has been selected for the minor divisions of the group. Numerous species are found in the Indian and African rivers.

Pimelodus, Lacép.—Differs from *Bagrus* in having no teeth on the vomer; the palatines however are often provided with teeth. The species are very numerous, and are found both in the Old and New World.

Phractocephalus, Agassiz.—This genus contains but one species, an inhabitant of the Brazils; its generic distinction consists in its possessing some incomplete osseous rays enchased in the upper margin of the adipose fin.

Platystoma, Agassiz.—It is composed of several South American species which have the muzzle depressed, and are remarkable for the great number of their branchiostegous rays, which amount in some to fifteen in number.

Galeichthys, Cuv. and Val.—This genus is nearly allied to *Bagrus*, but distinguished by the head being round and unprotected by any distinct bony plate; the branchiostegous rays are 6 in number. One species is found at the Cape of Good Hope, a second is said to be found both in North America and at Rio Janeiro; several species occur in Brazil, and the Ganges also furnishes a species of the present genus.

Silundia, Cuv. and Val.—This genus is founded upon a fish from the Ganges, which has the head small and smooth, a very small adipose fin, and a long anal fin.

Arius, Cuv. and Val.—Contains many species allied to the *Bagri*, but distinguished by their palatine teeth forming two distinct and widely-separated masses. They are found in the tropical portions of both continents, and also in North America.

Auchenipterus, Cuv. and Val.—Distinguished by the small size of the head, the very minute size of the teeth, and there being 5 branchiostegous rays. All the known species are from the tropical portions of South America.

Trachelyopterus.—Founded by Messrs. Cuvier and Valenciennes, upon a small Silurian from Cayenne, in which there is no adipose fin. The teeth are fine, like the pile of velvet, and the palate is destitute of teeth; the barbules are 6 in number.

Hypophthalmus (Spix), Cuv. and Val., is composed of but few species, and these are from the tropical portions of South America.

Ageneiosus (Lacépède), Cuv. and Val.—Characters the same as in *Pimelodus*, excepting that there are no barbules, properly so called. All the species are from South America.

Synodontis, Cuv., is composed of species found in the Nile and Senegal, which have an adipose fin; the muzzle narrow, and terminated by an ethmoid, which supports two small intermaxillary bones armed with bristle-like teeth; the lower jaw composed of two short and slender rami, bearing in front a mass of teeth, which are in the form of very slender laminæ and closely packed. Each of these teeth is attached to the jaw by a flexible and very slender stalk.

Doras, Lacépède.—The species of this genus are distinguished by the lateral line being armed with bony plates, which are carinated and terminate in a spine. They are the most powerfully armed of all the *Siluridæ*; thus the Spanish colonists in South America have given to them the name of Mata-Caïman (or Crocodile-Killer), because it often happens that when they are swallowed by these large reptiles, the œsophagus and pharynx of those animals are so lacerated by the spines of the *Silurus* as to cause death. Strabo also (p. 824, Casaub.) attributes similar powers to certain fishes of the Nile, which he called *Χοῖρος*, and which are supposed by some naturalists to belong to the modern genus *Synodontis*.

Doras is divided into two sections on account of the structure of the mouth. In some it is situated at the end of a depressed muzzle, and is provided with two broad bands of delicate teeth, both in the upper and lower jaws. In others the opening of the mouth is situated on the under side of a conical muzzle, and the opening is of a circular form—here the teeth are either wanting or are hardly visible; the maxillary barbules are sometimes furnished with small lateral branches. To the first of these sections belongs the *Silurus costatus* of Linnæus, a species found in the rivers of Guiana.

A species of *Doras*, described by Dr. Hancock, in the fourth volume of the 'Zoological Journal,' p. 241, under the name of *D. costatus*, is a native of Demerara, where it is called the Flat-Head Hassar. It possesses the singular property of deserting the water and travelling over land. Dr. Hancock describes a second species, called the Round-Headed Hassar.

Both the species make nests, in which they lay their eggs in a flattened cluster, and cover them over most carefully. Their care does not end here. They remain by the side of the nest till the spawn is hatched, with as much solicitude as a hen guards her eggs; both the male and female hassar, for they are monogamous, steadily watching the spawn, and courageously attacking any assailant. Hence the negroes frequently take them by putting their hands into the water close to the nest, on agitating which the male hassar springs furiously at them, and is thus captured.

"The Round-Head forms its nest of grass; the Flat-Head of leaves. Both at certain seasons burrow in the bank; they lay their eggs only in wet weather. I have been surprised to observe the sudden appearance of numerous nests in a morning after rain occurs, the spot being indicated by a bunch of froth, which appears on the surface of the water over the nest; below this are the eggs, placed on a bunch of fallen leaves or grass, if it be the littoral species, which they cut and collect together. By what means this is effected seems rather mysterious, as the species are destitute of cutting teeth. It may possibly be by the use of their serrated arms, which form the first ray of the pectoral fins."

Callichthys, Linn., belongs to this family. [CALLICHTHYS.]

Arges, Cuv. and Val.—The principal characters of this genus are—teeth bifid at the extremity, and with the points curved inwards; palate destitute of teeth; opening of the mouth large; maxillary barbules two in number; anterior dorsal fin small, and with the front ray feeble; adipose fin long; the other fins with the outer rays prolonged into a filament.

The species which forms the type of this genus (*A. sabalo*, Cuv. and Val.) is a small fish about 8 inches in length, which was brought by Mr. Pentland from Upper Peru, being found in the neighbourhood of the mission of Santa Anna, at a height of from 4500 to 4800 French metres above the level of the sea. The specimen was given to M. Valenciennes, who prized it much, since it threw a light on the affinities of a fish described by Humboldt under the name *Pimelodus Cyclopum*, relating to which that author has given such an interesting account. The *Pimelodus Cyclopum*, which M. Valenciennes thinks most probably belongs to the present genus, is about 4 inches in length, and is found in lakes at the height of 3500 metres above the level of the sea. But the most remarkable circumstance relating to these fishes is that they are frequently ejected in the eruptions from the volcanoes of the kingdom of Quito, and in such quantities that the fetid odour arising from their putrefaction was perceived at a great distance, and the putrid fevers which prevailed in those districts were attributed to the miasmata they produce. These fishes sometimes issued from the crater of the volcano, and sometimes from lateral clefts, but constantly at an elevation of from 5000 to 5200 metres above the level of the sea. In a few hours millions are seen to descend from Cotopaxi, with great masses of cold and fresh water.

Brontes, Cuv. and Val., is founded upon a fish possessing all the characters of the preceding genus (and which, it appears, like the *Pimelodus*, is thrown out from the volcanoes of Cotopaxi), but which differs in having no adipose fin.

Astroblepus, Cuv. and Val., consists of but one species, *A. Grixalvii*, Humboldt. This fish possesses all the characters of the genus *Brontes*, having, like it, the head depressed, the eyes directed upwards, a single

dorsal fin, the external rays of the fins prolonged into a filament, and four branchiostegous rays, but it possesses no ventral fins. This fish is found at Rio de Palace, near Papayana, where it is known by the name of Pescado Negro: it attains about 15 inches in length.

Heterobranchus, Geoff.—The head is furnished with a rough bony shield, which is flat and broader than in the other Silurians, on account of the lateral laminæ furnished by the frontals and parietals, which cover the orbital and temporal bones. The barbules are eight in number. The species inhabit the rivers of Africa, and some of those of Asia.

In some species the long dorsal fin is supported throughout by rays; these constitute the sub-genus *Clarias*, Val.; and in others there is a dorsal fin supported by rays, and a second behind this, which is adipose. To these the term *Heterobranchus* is restricted in the 'Histoire Naturelle des Poissons.'

Saccobranchus, Cuv. and Val., is founded upon the *Silurus Singio* of Hamilton's 'Fishes of the Ganges,' which possesses some interesting peculiarities in its internal organisation, pointed out by Mr. Wyllie in the 'Proceedings of the Zoological Society' for May, 1840.

Plotosus, Lacépède, is distinguished by the elongated form of the body and the possession of two dorsal fins, the hindermost being supported by rays as well as the other. The species inhabit India.

Aspredo, Linn., presents very singular characters, particularly in the flattening of the head and in the dilatation of the anterior portion of the trunk, which chiefly arises from that of the bones of the shoulder; in the proportionate length of the tail; in the small size of the eyes, which are placed in the upper surface of the head. The species are found in the tropical parts of South America.

Chaca, Cuv. and Val., which is the next in succession in the 'Histoire des Poissons,' is founded upon the *Platystacus Chaca* of Buchanan Hamilton. It inhabits the rivers of India.

Sisor is also founded upon a single species described under the name *S. rhabdophorus* by the author just mentioned, in his 'Fishes of the Ganges.'

Loricaria, Linn., is distinguished by the head and body being covered throughout by large angular bony plates.

This genus is subdivided into two sub-genera. In the one (*Hypostomus*, Lacép.) there are two dorsal fins; the hinder one is small, and provided with but one ray. In the second, to which Lacépède restricts the term *Loricaria*, there is but one dorsal fin. The species of both sub-genera are found in South America.

SILVER, a metal which has been well known and highly valued from the remotest period—circumstances which are readily explained by the facts of its occurring frequently native, and possessing great lustre and fitness for immediate use without being subjected to any metallurgic process.

Native Silver occurs crystallised, arborescent, or dendritic, capillary, reticulated, granular, and massive. The primary form of the crystal is a cube. It has no cleavage. Fracture hackly. Colour white, but externally often blackish, owing probably to the presence of a little sulphur. Hardness 2·5 to 3. Lustre metallic. Colour pure white, except when tarnished. Streak shining. Opaque. Specific gravity 10·47. Malleable, but commonly less so than pure silver, probably owing to an admixture of other metals. Soluble in nitric acid, and the solution colourless when pure, but blue if copper be present; and if antimony, a white substance; and if gold, a black one remains undissolved. Fuses into malleable globules before the blow-pipe.

Native Silver is met with in most parts of the world; in the British Isles, Germany, Hungary, in the north of Europe, but especially, and in largest quantity, in Mexico and South America. Silver occurs in mixture or combination with other metals.

Antimonial Silver. Stibiuret of Silver.—This occurs in crystals, in grains, and massive. The primary form of the crystal is a right rhombic prism. Cleavage parallel to the terminal plane and short diagonal of the prism. Fracture uneven. Colour silver white, or, when tarnished, yellowish-white. Streak silver white. Lustre metallic. Opaque. Slightly malleable. Easily frangible. Hardness 3·5. Specific gravity 9·44 to 9·8. Before the blow-pipe on charcoal it readily melts, with the formation of white antimonial vapour, into a grayish globule, which is not malleable, but eventually pure silver is obtained. It is not totally soluble in nitric acid, oxide of antimony remaining undissolved.

The Massive Varieties are amorphous, and have a granular or foliated structure.

Antimonial Silver is found in clay-slate at Andreasberg in the Hartz, in Baden, near Guadalcanal in Spain, at Salzburg, and at Allemont in France.

The Andreasberg mineral (1), analysed by Vauquelin, and the Baden (2), by Klaproth, gave the annexed results:—

	(1)	(2)
Silver	78	84·76
Antimony	22	16·24
	—100	——100

Telluric Silver occurs in coarse-grained masses. Colour gray. Lustre metallic. Soft. Somewhat malleable. Specific gravity about 8·5. It is dissolved by nitric acid, and when heated, and before the blow-pipe on charcoal, gives a fused blackish mass, containing specks of metallic silver.

It is found at the silver-mines of Savodinski, in the Altai Mountains, Siberia.

Its analysis by Rose gives—

Silver	62·42
Tellurium	36·96
Iron	00·24
	——99·62

Native Amalgam is a compound of silver and mercury. [MERCURY.]

Auriferous Native Silver occurs crystallised in cubes, capillary, and disseminated. Colour yellowish-white. Specific gravity 14·0 to 17·0. Different varieties give the annexed results—

	Fordyce.	Klaproth.	Boussingault.			
Silver	72	84	15·5	17·6	26	35 07
Gold	28	64	84·5	82·4	74	64·93
	100	98	100	100	100	100

Arsenical Antimonial Silver, or rather *Arsenio-Ferruginous Antimonial Silver.*—This substance occurs mammillated or in small globular and reniform masses, and sometimes investing other substances. When untarnished it is nearly silver-white, but is commonly tarnished yellowish or blackish; its lustre is metallic. It is harder than antimonial silver, but is sectile and brittle. Specific gravity 9·4.

Before the blow-pipe antimony and arsenic are volatilised with the alliaceous smell, and a globule of impure silver remains. Its localities are nearly the same as those of antimonial silver. Klaproth obtained from a specimen from Andreasberg—

Silver	12·75
Antimony	4
Iron	44·25
Arsenic	35
	——96

The native compounds of silver next to be described are those in which it occurs in combination with the non-metallic elements. It is not found simply combined with oxygen, nor at all with azote, hydrogen, or fluorine.

Chloride of Silver; Horn Silver; Muriate of Silver; Laxmannite.—This ore occurs crystallised and massive. Primary form of the crystal a cube. No cleavage. Fracture uneven. Hardness 1·0 to 1·5. Yields to the pressure of the nail. Streak shining. Specific gravity 4·75 to 5·55. Translucent. Opaque. Lustre resinous. Colour gray, yellowish, greenish, and blue of various shades. Malleable and sectile. Fusible in the flame of a candle. Heated with potash by the blow-pipe, yields a globule of metallic silver. Insoluble in nitric acid, but dissolved by ammonia. When rubbed with a piece of moistened zinc, the surface becomes covered with metallic silver.

This ore occurs in various parts of Europe and America, along with others of the same metal. The largest masses, which are of a greenish colour, are brought from Mexico and Peru. It is found in veins, chiefly in primitive rocks.

Two specimens from Peru (1) and from Saxony (2), analysed by Klaproth, gave—

	(1)	(2)
Chlorine	24	21·50
Silver	76	67·75
Oxide of Iron	—	6·00
Alumina	—	1·75
Sulphuric Acid	—	0·25
	—100	——97·25

Buttermilk Silver; Earthy Corneous Silver.—This is regarded as a variety of the foregoing. It is described as being of a brownish colour, with occasionally a tinge of green or blue. It is opaque, dull, with an earthy fracture, and is soft, sectile, and heavy. It occurs massive, and also investing other substances. It occurs only at Andreasberg, in the Harz.

According to Klaproth, it is composed of—

Chlorine	8·28
Silver	24·64
Alumina	67·08
	——100

Iodide of Silver; Iodyrite.—Occurs massive in thin plates, which are silver- or grayish-white, and which become bluish by exposure to the air. Transparent. Translucent. Lustre resinous to adamantine; in thin laminæ flexible and malleable. Melts on charcoal before the blow-pipe, vapour of iodine being evolved, and globules of silver remaining. It is found at Abarradon near Mazapil, in the state of Zacatecas, Mexico, in serpentine.

Sulphuret of Silver; Vitreous Silver; Silver Glance; Henkelite.—Occurs crystallised and massive. Primary form a cube. Fracture fine-grained and uneven; sometimes small and flat conchoidal. Colour lead-gray; blackish when tarnished. Lustre metallic. Opaque. Hardness 2·0 to 2·5. Malleable. Sectile. Specific gravity about 7·2.

When heated by the blow-pipe, sulphur is expelled and silver remains. It occurs in Saxony, Bohemia, and in great abundance in Mexico. It has been occasionally found in Cornwall, and in most silver-mines.

Analysis (1) by Klaproth, of a specimen from Freiberg; (2) by Berzelius:—

	(1)	(2)
Sulphur	15	12·95
Silver	85	87·05
	—100	—100

Black Sulphuret of Silver; Earthy Silver Glance.—Derived from the decomposition of the last-mentioned. Occurs massive and pulverulent. Fracture uneven. Colour dark-lead gray, inclining to black. Devoid of lustre, or only feebly glimmering. Somewhat sectile. Streak shining, metallic. It is found in Norway, Siberia, Hungary, &c., usually investing other silver-ores or filling up cavities in them.

Sulphuret of Silver and Arsenic; Light Red Silver; Proustite.—Primary form a rhomboid. Colour cochineal to aurora red; streak lighter. Lustre adamantine. Translucent to transparent. Specific gravity 5·5 to 5·6.

It is found at Joachimsthal, Johanngeorgenstadt, Annaberg, &c.

Rose's analysis (1) and Proust's (2) give the following as the composition of a specimen from Joachimsthal:—

(1)		(2)	
Sulphur	19·51	Sulphuret of Silver	74·35
Silver	64·67	Sulphuret of Arsenic	25
Arsenic	15·09		
Antimony	00·69		99·35
	—99·96		

Sulphuret of Silver and Antimony; Ruby Silver; Dark Red Silver; Braardite.—Occurs crystallised and massive. Primary form a rhomboid. Cleavage parallel to the primary planes, usually indistinct. Fracture conchoidal. Colour, by reflected light, from lead-gray to iron-black; by transmitted light, from brilliant to dark-red. Lustre adamantine. Translucent. Opaque. Hardness 2·0 to 2·5. Extremely brittle. Streak red. Specific gravity 5·8 to 5·9.

Massive Varieties.—Structure granular, compact, lamellar, dendritic, amorphous. It is found in many parts of Europe and America, as Germany, Norway, Mexico, and Peru, and also in Cornwall.

According to Bonsdorff, a specimen from Andreasberg yielded by analysis—

Sulphur	16·609
Silver	58·949
Antimony	22·846
	—98·404

Sulphuret of Silver and Antimony; Miargyrite.—Occurs crystallised. Primary form an oblique rhombic prism. Cleavage imperfect. Fracture uneven. Colour iron-black in mass; but in thin fragments deep-red by transmitted light. Nearly opaque. Lustre bright metallic. Hardness 2·0 to 2·5. Very sectile. Streak dark-red. Surfaces of the crystals usually striated. Specific gravity 5·2 to 5·4.

It is found with argentiferous arsenical pyrites at Braunsdorft, near Freiberg, Saxony. According to Rose, it yielded—

Sulphur	21·95
Silver	36·40
Antimony	39·14
Copper	1·06
Iron	0·62
	—99·17

Sulphuret of Silver and a little Iron; Biegsamer Silberglanz.—Occurs crystalline and massive. Crystals small and tabular. Cleavage parallel to the terminal planes. Colour nearly black. Lustre metallic. Very soft. Readily separable into thin flexible laminæ. It is found only in Hungary and at Freiberg.

According to Wollaston, this mineral (which is extremely rare) consists of sulphuret of silver with a little iron.

Sulphuret of Silver and Iron; Sternbergite; Flexible Sulphuret of Silver.—Occurs crystallised. Primary form a right rhombic prism. Cleavage parallel to the terminal plane, distinct. Laminæ very flexible. Colour dark-brown, often with a blue tarnish. Streak black. Lustre metallic. Hardness 1·0 to 1·5. Specific gravity 4·2 to 4·25.

It is found at Johanngeorgenstadt, Schneeberg, and Joachimsthal in Bohemia, with other silver ores.

A specimen from the last-mentioned locality yielded, according to the analysis of Zippe—

Sulphur	30
Silver	33·2
Iron	36
	—99·2

Brittle Sulphuret of Silver, Antimony, and Iron; Brittle Silver Glance.—Occurs crystallised. Primary form a right rhombic prism. Crystals commonly macled. Fracture usually conchoidal, with a shining metallic lustre. Colour dark-gray or iron-gray. Hardness 2·0 to 3. Specific gravity 5·9 to 6·4.

It is found in Saxony, Bohemia, Hungary, Siberia, and Mexico.

Analysis of a specimen from Freiberg by—

	Klaproth.	Rose.
Sulphur	12	16·42
Silver	66·5	68·54
Antimony	10	14·68
Iron	5	0·00
Copper	0·5	0·64
	—98·5	—100·28

Sulphuret of Silver and Copper; Silberkupferglanz.—Occurs massive. Compact. Fracture brilliant, granular, flat conchoidal. Colour dark lead-gray. Streak shining. Lustre metallic. Opaque. Soft. Specific gravity 6·25. It is found at Schlangenberg, near Colivan in Siberia.

Its analysis by Stromeyer gives—

Sulphur	15·96
Silver	52·87
Copper	30·83
Iron	00·34
	—100

Sulphuret of Silver, Antimony, and Copper; Romelite; Mine d'Argent grise Antimoniale.—It occurs crystallised. Primary form a right rhombic prism. Cleavage parallel to the lateral planes. Colour nearly silver-white. Lustre shining, metallic. Opaque. Hardness 2·0 to 2·5. Extremely brittle. Specific gravity 5·5 to 5·6.

It consists principally of sulphur and the metals above named, but in proportions not yet determined.

Sulphuret of Silver, Arsenic, Antimony, and Copper; Polybasite; Brittle Silver.—It occurs crystallised. Primary form a right rhombic prism. Cleavage imperfect. Fracture uneven. Colour iron-black. Lustre metallic. Translucent. Opaque. Hardness 2·0 to 2·5. Specific gravity 6·269.

It is found in Bohemia, Saxony, and other parts of Europe; and in Mexico and Peru.

Analysis of a specimen from Mexico (1) by Rose, and from Freiberg (2) by Brandes:—

	(1)	(2)
Sulphur	17·04	19·40
Silver	64·29	65·50
Arsenic	3·74	3·30
Antimony	5·09	0·00
Copper	9·93	3·75
Iron	0·06	5·46
	—100·15	—97·41

Sulphuret of Silver, Iron, Copper, Bismuth, and Lead; Bismuthic Silver.—It occurs in acicular crystals and massive. Fracture uneven. Colour, when first broken, lead-gray, but liable to tarnish.

Massive Varieties disseminated, amorphous. Fracture fine-grained, uneven. Lustre metallic. Opaque. Soft. Sectile and brittle.

It is found accompanying pyrites and galena at Schnappach in the valley of Kinzig, Baden.

Analysis by Klaproth:—

Sulphur	16·3
Silver	15.0
Iron	4·3
Copper	0·9
Bismuth	27·0
Lead	33·0
	—96·5

Seleniuret of Silver; Selensilver.—Occurs crystallised. Primary form a cube. Occurs in thin plates. Hardness between gypsum and calcspar. Flexible. Specific gravity 8·0. Colour iron-black; streak the same, but brighter. It is found at Tilkerode in the Hartz, associated with seleniuret of lead.

Analysis by G. Rose:—

Selenium	24·05
Silver	65·56
Seleniuret of Lead, with a little Iron	6·79
	—96·40

Seleniuret of Silver and Copper; Eukairite.—It occurs massive. Structure granular. Colour gray. Lustre shining. Disposed in films on calcareous spar. It is found in a copper-mine at Skrickerum in Smaland, Sweden.

Its analysis by Berzelius gives—

Selenium	26
Silver	38·93
Copper	23.05
Earthy matter	8·90
Carbonic Acid and loss	3·12
	—100

Carbonate of Silver and Antimony; Selbite.—It occurs massive and disseminated. Fracture uneven. Colour grayish-black. Structure fine granular. Lustre metallic. Opaque. Soft. Brittle. Heavy. It is found at Altwolfach in the Black Forest.

Its analysis by Selb gives—

Carbonic Acid	12
Silver	72·6
Oxide of Antimony and a trace of Copper	15·5
	—100·1

This analysis cannot however be correct, if the ore contain carbonate of silver.

Arseniate of Silver and Iron; Gansekothig-erz; Gooseduug Silver-Ore.—It occurs massive. Mammillated. Fracture conchoidal; sometimes earthy, and mixed with cobalt-ore. Colour yellow or pale-green. Streak white. Lustre resinous. It is found chiefly in the mines of Clausthal in the Hartz; and also in Cornwall, and at Allemont in France. It does not appear to have been accurately analysed.

The ores from which the silver of commerce is mostly obtained are the Vitreous Silver, Brittle, or Black Silver-Ore, Red Silver-Ore, and Horn Silver, in addition to Native Silver. Besides these, silver is obtained in large quantities from galena (lead-ore), and from different ores of copper; and some galenas are so rich in silver that the lead is neglected for the more precious metal. This metal occurs in rocks of various ages, in gneiss, and allied rocks, in porphyry, trap, sandstone, limestone, and shales; and the sandstone and shales may be as recent as the middle secondary, as is the case in Prussia. The silver-ores are associated often with ores of lead, zinc, copper, cobalt, and antimony, and the usual gangue is calc spar or quartz, with frequently fluor spar, pearl spar, or heavy spar.

The Silver of South America is derived principally from the Horn Silver and Brittle Silver-Ores, including Arseniuretted Silver-Ore, Vitreous Silver-Ore, and Native Silver. Those of Mexico are of nearly the same character. Besides, there are earthy ores called Colorados, and in Peru Pacos, which are mostly earthy oxide of iron, with a little disseminated silver; they are found near the surface, where the rock has undergone partial decomposition. The sulphurets of lead, iron, and copper, of the mining regions, generally contain silver, and are also worked. (Dana.)

The principal mines of silver in Europe are those of Spain, of Kongsberg in Norway, of Saxony, the Hartz, Austria, and Russia.

In England, argentiferous galena is worked for its silver. Forty thousand tons of this ore were reduced in 1837, which contained upon an average about six ounces of silver in a ton of lead.

The annual product of the several countries of Europe is thus estimated by Dana in his 'Manual of Mineralogy:'—

	Pounds Troy.
British Isles	7500
France	4150
Austria	63,000
Sweden and Norway	13,000
Spain	130,000
Saxony, the Hartz, and other parts of Germany	78,500
Belgium	440
Piedmont, Switzerland, and Saxony	1,560

making in all 298,150 troy pounds, or about 4,500,000 dollars annually. With the sum from Russia, about 730,000 dollars, it becomes 5,230,000 dollars a year. This is small compared with the amount from America, which at the beginning of the present century equalled 2,100,000 pounds, or 31¼ millions of dollars, nearly six times the above sum; and it is probable that these mines will again yield this amount when properly worked. The whole sum from Russia, Europe, and America, makes nearly 2,000,000 pounds avoirdupois.

SILVER-TREE, *Leucadendron argenteum.*

SILVER-WEED, a name for *Potentilla anserina.* [POTENTILLA.]

SI'LYBUM, a genus of Plants belonging to the natural order *Compositæ*, the tribe *Cynareæ*, and the section *Silybeæ*. It has an imbricated involucre with leafy scales at the base, narrowed into a long spreading spinous point. The receptacle is scaly. The fruit compressed, its terminal areola surrounded by a papillose ring.

S. marianum is the only species. It has a stem from 3 to 4 feet high, ribbed and furrowed. The leaves are very large, oblong-lanceolate, wavy, and clasping the radical leaves, pinnatifid, and usually variegated green and white. The involucral scales closely adpressed below. The florets are purple, with a very long tube. This plant is found in waste places in Great Britain.

(Babington, *Manual of British Botany.*)

SIMARUBA. [QUASSIA.]

SIMARUBA'CEÆ, *Quassiads*, a natural order of Plants belonging to the Gynobasic group of Polypetalous Exogens. The plants of this order are trees or shrubs, with alternate exstipulate usually compound leaves, and mostly without dots. The flowers are whitish-green or purple, on axillary or terminal peduncles, hermaphrodite, or occasionally unisexual; the calyx is 4-5-parted; petals 4-5, twisted in æstivation; stamens twice as many as the petals, arising from the back of an hypogynous scale; ovary 4-5-lobed; style simple; stigma 4-5-lobed. Fruit a drupe. Seeds pendulous, exalbuminous, with a superior short radicle drawn back within thick cotyledons. With one exception, they are all natives of Africa, India, and tropical America. This order was formerly included under *Rutaceæ*, but their differences from that order appear to many of sufficient importance to constitute a separate family. A. De Jussieu says, "They are known from all Rutaceous Plants by the coexistence of these characters, namely, ovaries with but one ovule, indehiscent drupes, exalbuminous seeds, a membranous integument of the embryo, and by the radicle being retracted within thick cotyledons."

The plants of this order are all intensely bitter. The Quassia on this account is used in medicine. [QUASSIA, in ARTS AND SC. DIV.] *Simaruba versicolor* is so bitter that no insects will attack it; and when all other specimens of plants in dried collections have been attacked by *Ptini*, &c., specimens of this plant have been left untouched. The Brazilians use an infusion of this plant in brandy as a remedy against the bites of serpents.

There are 10 genera and 35 species of this order.

Quassia amara.

a, branch, showing flowers and compound leaves; *b*, flower; *c*, stamens separated, attached to hypogynous scale; *d*, stamens surrounding ovary; *e*, ovary seated on a stalk, to which the stamens are attached.

SIMETHIS, a genus of Plants belonging to the natural order *Liliaceæ*, and the tribe *Anthericeæ*. The parts of the perianth are six, spreading, deciduous; the stamens are attached to the base of the perianth; the filaments bearded; the anthers incumbent; the capsules are 3-celled, and each cell contains two seeds.

S. bicolor is a recent addition to the British Flora. It is a native of the South of Europe, and is found on sandy heaths near the sea-shore. In England it was first found at Bournemouth, in Dorsetshire. It has also been found at Derrynane, Kerry, in Ireland. This plant has linear leaves, flat, or a little keeled upwards. The flowers are panicled, the petals are purple without, and white within. In Hooker and Arnott's 'British Flora' it is suggested that this plant may have been introduced with trees from France.

SI'MIADÆ, the name of a Quadrumanous family of Mammalian Animals. It embraces the most highly-developed forms of the Monkeys, and the relations of this family are more or less given under the following articles:—APE; ATELES; BABOON; CHEIROPODA; CHIMPANZEE; HYLOBATES; LAGOTHRIX; MACACUS; MYCETES; NASALIS; ORANG-OUTAN; QUADRUMANA; SAKIS; SAPAJOUS; and SEMNOPITHECUS.

These animals were known at a very early period. The Kophim of the Scriptures (1 Kings, x. 22; 2 Chron., ix. 21), the Ceph of the Ethiopians, the Keibi and Kubbi of the Persians, the Κῆβοι of the Greeks, and Cephi of the Romans, were clearly Apes. They are to be traced in some of the earliest paintings of the Egyptians. (Rosellini, &c.)

The Cephi exhibited by Pompey (Pliny, 'Hist. Nat.,' viii. 19), as well as those shown by Cæsar, appear to have been Ethiopian apes; and in the Greek name inscribed near the Quadrumanous animals, in the Prænestine pavement, the oriental origin of the word is apparent. It is remarkable that the name *Cebus* [SAPAJOUS] is applied by modern zoologists to a genus of monkeys which could not have been known to the ancients; for the *Cebi* of our present catalogues are exclusively American.

The following is a definition of the family *Simiadæ*, which embraces the animals to which the term Ape is most properly applied. They are all of them inhabitants of the Old World:—The nostrils are divided by a narrow septum; they possess opposable thumbs on their fore and hind feet; the callosities on the rump are generally naked. Some of the species only are furnished with cheek-pouches. They usually possess a tail. Their dental formula is as follows:—

$$\text{Incisors, } \frac{4}{4}\text{; Canines, } \frac{1-1}{1-1}\text{; Premolars, } \frac{2-2}{2-2}\text{; Molars, } \frac{3-3}{3-3} = 32.$$

The following definition of the second family of the *Quadrumana*, the *Cebidæ*, will afford the means of contrasting the two families:—The *Cebidæ* are natives of America. The nostrils are separated by a broad septum; the thumbs are sometimes absent on the fore feet; callosities and cheek-pouches absent; the tail is always present, and sometimes prehensile.

In the list of the specimens of *Mammalia* published by Dr. J. E. Gray, we find almost a complete representation of this family. They are as follows:—

SIMIADÆ.

The Chimpanzee (*Troglodytes niger*, Geoff.; *Homo Troglodytes*, Linn). West Africa. [CHIMPANZEE.]
The Orang-Outan, or Pongo (*Simia Satyrus*, Linn.; *S. Wurmbii*, Kuhl; *S. Agrias*, Schreb.). Borneo. [ORANG-OUTAN.]
The Siamang (*Siamanga Syndactyla*; *Simia Syndactyla*, Raffles, Horsf.). Java.

The Siamang (*Siamanga Syndactyla*).

The Hoolock (*Hylobates Hoolock*, Martin; *Simia Hoolock*, Harlan). [HYLOBATES.]
The Oungka (*H. agilis*, F. Cuv.; *Simia Lar.*, Vigors and Horsfield; *Pithecus agilis*, Desm.). Himalaya and Malacca.
The Gibbon (*H. Lar*; *Homo Lar*, Linn.; *S. longimana*, Schreb.). Malacca.
The Silvery Gibbon, or Wou-Wou (*H. leuciscus*, Kuhl; *Simia leucisca*, Schreb.). Malacca.
The Kalasie (*Presbytes rubicunda*). Borneo.
The Simpal (*P. melalophos*; *Simia melalophos*, Raffles). Sumatra.
The Tianac (*P. flavimana*; *Semnopithecus flavimanus*, I. Geoff.). Sumatra.
The Rufous Presbytis (*P. nobilis*, Gray; *Semnopithecus melalophos*, Desm.). Himalaya.
The Lutung (*P. Pyrrhus*). Java.
The Chingkau (*P. cristata*; *Simia cristata*, Raffles). Java and Sumatra.
The Dusky Presbytis (*P. obscura*). Singapore.
The Negro Presbytis (*P. maura*; *Simia maura*, Schreb.). China.
The Hooded Presbytis (*P. Johnii*; *Simia Johnii*, Fischer). India, Madras.
The Hoonuman (*P. entellus*). Bombay and Nepaul.
The Nestor (*P. cephalopterus*; *Cercopithecus cephalopterus*, Zimm.). Ceylon.
Pennant's Colobus (*Colobus Pennantii*, Waterh.). Fernando Po.
The Red and Black Colobus (*C. rufoniger*, Ogilby, Martin). Fernando Po.
Temminck's Colobus (*C. Temminckii*, Desm.). West Africa, Gambia.
The Black Colobus (*C. Satanas*, Waterh.). Fernando Po.
The King Monkey (*C. polycomos*, Geoff.; *Simia polycomos*, Schreb.). Fernando Po.
The Guereza (*C. guereza*, Ruppell). Abyssinia.
The Vervet (*Cercopithecus pygerythrus*, F. Cuv.). Cape of Good Hope.
The Grivet, or Tota (*C. engythithia*; *Simia engythithia*, Herm.). Abyssinia.
The Callithrix (*C. sabæus*, Erxl.; *Simia sabæa*, Linn.). West Africa.
The Talapoin (*C. Talapoin*, Erxl.; *Simia Talapoin*, Schreb.). West Africa.
The Mona (*C. mona*, Erxl.; *Simia mona*, Schreb.). West Africa, Guinea.
Burnett's Mona (*C. Burnettii*, Gray). Fernando Po.
The Red-Eared Monkey (*C. erythrotis*, Waterh.). Fernando Po.
The Hocheur (*C. nictitans*, Erxl.; *Simia nictitans*, Linnæus). Fernando Po.
The Diana (*C. Diana*, Erxl.; *Simia Diana*, Linn.). West Africa.
The Bearded Monkey (*C. Pogonias*, Bennett). Fernando Po.
The Patas (*C. ruber*, Kuhl.; *Simia rubra*, Gmel.). Africa, Senegal.
The White-Collared Mangabey (*Cercocebus collaris*; *Cercopithecus Æthiops*, Kuhl.). Africa.
The White-Crowned Mangabey (*C. Æthiops*; *Simia Æthiops*, Linn.). Africa.
The Sooty Mangabey (*C. fuliginosus*, Geoff.; *Cercopithecus fuliginosus*, Kuhl.). Africa.
The Zati, or Capped Macaque (*Macacus radiatus*, Desm.). India.
The Munga, or Bonnet-Macaque (*M. Sinicus*, Desm.; *Simia Sinica*, Linn.). India.
The Bruh (*M. nemestrinus*, Desm.; *Simia nemestrina*, Linnæus). Sumatra.
The Macaque (*M. cynomolgus*, Desm.; *Simia cynomolgos*, Linn.). India, Sumatra.
The Rhesus (*M. Rhesus*, Desm.; *Simia Rhesus*, Audeb.). India, Bengal.
The Oinops (*M. Oinops*). Nepaul.
The Brilliant Macaque (*M. speciosus*, F. Cuv.). Japan.
The Magot (*M. Inuus*, F. Cuv.; *Simia Inuus*, *S. vulgaris*, and *S. Sylvanus*, Linn.). Gibraltar Rock, Stora, North Africa.
The Black Macaque (*M. niger*, Bennett; *Cynocephalus niger*, Desm.). Philippines.
The Wanderoo (*S. veter*; *Simia Silenus*, and *S. Veter*, Linnæus). Ceylon, China, India.
The Gelada (*Gelada Ruppellii*). Abyssinia.
The Tartarin (*Cynocephalus Hamadryas*, Latr.; *Simia Hamadryas*. Linn). Abyssinia.
The Chacma (*C. porcarius*, Desm.; *Simia porcaria*, Bodd). South Africa.
The Baboon (*C. babouin*, Desm.; *Simia cynocephalus*, Fischer). West Africa.
The Papion (*C. Sphinx*, Latr.; *Simia Sphinx*, Linn.). Guinea.
The Mandrill (*Papio Maimon*, Latr.; *Simia Maimon*, and *S. Mormon*, Linn.). Africa.
The Drill (*P. leucophæa*). Africa.

CEBIDÆ.

The Chameck (*Ateles Chameck*; *Simia Chameck*, Humb.). Guiana.
The Black Spider Monkey (*A. ater*, F. Cuv.). Brazils.
The Coaita (*A. Paniscus*, Geoff.; *Simia Paniscus*, Linn.). Brazils.
The Marimonda (*A. Belzebuth*, Geoff.). Brazils.
The Chuva (*A. marginatus*, Kuhl.). Brazils.
The Five-Fingered Miriki (*Brachyteles arachnoides*; *Simia arachnoides*, Humb.). Tropical America.
The Black-Foreheaded Miriki (*B. frontatus*). Tropical America.
The Miriki (*B. hypoxanthus*). Tropical America.
The Caparro, or Negro Monkey (*Lagothrix Humboldtii*, Geoff.). Brazils.
The Araguato, or Brown Howler (*Mycetes ursinus*). Guiana, Brazils.
The Golden Howler (*M. Seniculus*, Kuhl.; *Simia Seniculus*, Linn.) Royal Monkey, Penn. (*Alouate*, Ruff.). Brazils.
The Caraya, or Black-Howler (*M. Caraya*; *Simia Caraya*, Humb.). Brazils.
The Guariba, or Yellow-Handed Howler (*M. Beelzebul*; *Simia Beelzebul*, Linn.). Brazils.
The Tufted Capuchin (*Cebus cirrifer*, Geoff.). Brazils.
The Kaite, or Horned Capuchin (*C. fatuellus*, Erxl.). Brazils.
The Capuchin (*C. Apella*, Erxl.; *Simia Apella*, Linn.). Brazils.
The Hierang, or Yellow-Chested Capuchin (*C. xanthosternon*). Brazils.
The Sai, or Weeper (*C. Capucinus*, Erxl.; *Simia Capucina*, Linn.). Brazils.
The White-Headed Sapajou (*C. hypoleucus*, Geoff.). America.
The Yellow Sapajou (*C. gracilis*, Spix). Brazils.
The Golden-Handed Sapajou (*C. chrysopus*, F. Cuv.). Brazils.
The Tee-Tee (*Callithrix sciurea*, Kuhl.; *Simia sciurea*, Linnæus). Brazils.
The Sahuassu, or Masked Tee-Tee (*C. personatus*, Kuhl). Brazils.
The Oiabassu, or White-Handed Tee-Tee (*C. Moloch*, Geoff.). Brazils.
The Collared Tee-Tee (*C. torquatus*, Hoffm.). Guiana, Brazils.
The Cuxio, or Bearded Saki (*Brachyurus Satanas*; *Cebus Satanas*, Hoffm.). Guiana.
The Yarke (*Pithecia irrorata*, Gray). Brazils.
The Black Yarke (*P. leucocephala*, Geoff.). Brazils.
The Whiskered Yarke (*P. pogonias*, Gray). Brazils.
The Douroucouli (*Nyctipithecus trivirgatus*, Gray). Brazils.
The Vitoe (*N. felinus*, Spix). Brazils.
The Marmoset (*Jacchus vulgaris*, Geoff.). Brazils.
The Gnick-Gnick, or Black-Eared Marmoset (*J. penicillatus*, Geoff.). Brazils.
The White-Eared Marmoset (*J. auritus*, Geoff.). Brazils.
The Tamarin (*J. Midas*; *Simia Midas*, Linn.). Brazils.
The Black Tamarin (*J. Tamarin*; *Cebus Tamarin*, Link.). Brazils.
The White-Whiskered Tamarin (*J. labiatus*, Desm.). Brazils.
The Marikina (*J. Rosalia*; *Simia Rosalia*, Linn.). Brazils.

The Pinche (*J. Œdipus*, Desm.; *Simia Œdipus*, Linn.). Brasils.

The following forms of *Simiadæ* and *Cebidæ* were existing in the Gardens of the Zoological Society, Regent's Park, between the years 1847 and 1852:—

Simiadæ.

Simia Satyrus, Hylobates Hoolock, Semnopithecus Entellus, Cercopithecus nictitans, C. petamista, C. melanogenys, C. cephus, C. albopilaris, C. Campbellii, C. Pluto, C. Mona, C. Pygerythrus, C. Sabæus, C. cynosurus, C. callithricus, C. Talaponi, C. niger, Cercocebus fuliginosus, C. Æthiops, Macacus sinicus, M. pileatus, M. cynomolgus, M. erythræus, M. nemestrinus, M. Silenus, M. niger, Inuus sylvanus, Cynocephalus Hamadryas, C. Sphinx, C. Babouin, C. Porcarius, C. leucophæus, C. Mormon.

Cebidæ.

Ateles Chamek, A. paniscus, A. ater, A. Beelzebuth, A. marginatus; Pithecia chiropotes; Lagothrix Humboldtii; Brachyurus Ouakari; Saimiri sciureus; Callithrix torquatus; Nyctipithecus trivirgatus; Cebus apella, C. capucinus, C. cirrifer, C. xanthosternum, C. hypoleucus; Hapale Jacchus, H. aurita, H. penicillata, H. (Midas) Œdipus, H. (Midas) rufimanus, H. (Midas) Tamarin.

Fossil Simiadæ.—Remains of *Simiadæ* have been discovered and described from the tertiary formations of India, France, England, and Brazil. These fossils are illustrative of four of the existing types of quadrumanous or rather Simious forms. Thus we have *Semnopithecus* from India; *Hylobates* from the south of France; *Macacus* from Suffolk; and *Callithrix*, peculiar to America, found in Brazil. Nor is it unworthy of remark, that we here have evidence that so high a quadrumanous form as the Gibbon, a genus in which the skull is even more approximated to that of man than it is in the Chimpanzee, was living upon our globe with the Palæothere, Elephants, and other Pachyderms. We say that the skull of the Gibbon comes nearest to that of man, because, though the cranium of the young Chimpanzee approaches that of the human subject, it is far removed from it when the permanent teeth are developed.

From these evidences we have also proof that *Simiadæ* lived in our island during the Eocene period; whilst the presence of fossil vegetables, abundant in the London clay at Sheppy, and the remains of serpents in the same locality, show the degree of heat that must have prevailed here during that period, when *Simiadæ* were co-existent with tropical fruits and Boa Constrictors.

But Dr. Lund's observations relating to the extinct quadrumanous form detailed in his 'View of the Fauna of Brazil,' previous to the last geological revolution, require special notice. He states that it is certain that the family of *Simiadæ* was in existence in those ancient times to which the fossils described by him belong; and he found an animal of that family of gigantic size, a character belonging to the organisation of the period which he illustrates. He describes it as considerably exceeding the largest Orang-Utan or Chimpanzee that has yet been seen. From these, as well as from the Long-Armed Apes (*Hylobates*), he holds it to have been generically distinct. As it equally differs from the *Simiadæ* now living in the locality where it was discovered, he proposes a generic distinction for it under the name of *Protopithecus*, and the specific appellation of *Protopithecus Braziliensis.*

The following is Professor Owen's account of the discovery and identification of the British fossil:—

"I have been so fortunate in my researches on the fossil *Mammalia* of Great Britain as to determine not only the remains of extinct Pachydermal animals (*Lophiodon* and *Hyracotherium*) in the Eocene beds called the London Clay, but likewise of a quadrumane, or monkey, in a sandy stratum of the same formation, the epoch of which had been shown by Mr. Lyell, from the evidence of other organic remains, to have had a temperature sufficiently high for arboreal *Mammalia* of the four-handed order. The fossils manifesting the quadrumanous character were discovered in 1839 by Mr. William Colchester in a bed of whitish sand, beneath a stratum of tenacious blue clay, situated by the side of the river Deben, about a mile from Woodbridge, in the parish of Kingston, commonly called Kyson, in Suffolk.

"The first of these fossils submitted to my inspection was the fragment of the right side of the lower jaw, including the anterior part of the base of the coronoid process, and the last molar tooth entire in its socket. This tooth is fortunately a very characteristic one; and after a comparison of it with the corresponding tubercular tooth in the lower jaw of the Coati (*Nasua*), Racoon (*Procyon*), Ratel, Opossum, Phalanger, and other small unguiculate quadrupeds of a mixed or partially carnivorous diet, I proceeded to an examination of the *Quadrumana*, and found in that order the desired correspondence. The extreme rarity of the fossil remains of such highly-organised animals in any part of the world, and the previous total absence of any in a land so far from the equator as England, prevented my examination, in the first instance, of the skeletons of the recent *Quadrumana;* and it was not until I had tried all the more probable analogues of the fossil fragment in the lower forms of the *Mammalia*, that I began to test it by the side of the jaws of the apes and monkeys. The grinding surface of the fossil tooth supports five tubercles, the four anterior ones being arranged in two transverse pairs, the fifth forming a posterior heel or talon. This conformation of the crown of the last molar in the lower jaw characterises two families of Catarrhine or Old-World Monkeys, namely, the *Semnopithecidæ*, including the genera *Colobus* and *Semnopithecus;* and the *Macacidæ*, including the genera *Macacus, Cynocephalus*, and *Papio*. The next step was to ascertain whether any special marks of resemblance would yield a further insight into the affinities of the fossil, and justify its reference to any of the genera of either family. A difference in the shape of the hinder tubercle of the tooth was first noticed in the recent *Quadrumana*. In the *Semnopithecidæ* it was large but simple; in most of the *Macacidæ* it was partially subdivided into two cuspe, the outer one being the largest. As this character was well marked in the fossil, it seemed decisive of its closer affinity to the *Macacidæ;* and as the smallest species in this family belongs to the typical genus, I referred the fossil to the *Macacus*, and now propose to designate the extinct species represented by it *Macacus Eocænus*, the Eocene Monkey, or Macaque. The portion of the fossil jaw is narrower from side to side, or more compressed, than in any of the existing Macaques; and the internal wall of the socket of the tooth in the fossil is fluted and thinner. The ridge on the outer side of the alveolus, which forms the commencement of the anterior margin of the coronoid process, begins closer to the tooth. These characters establish the specific distinction of the extinct Macacque to which the fossil fragment of the jaw belonged, and afford additional proof, if such were wanting, that it could not have been accidentally introduced in recent times into the stratum out of which it was disinterred." (Owen.)

Another tooth of the same species of *Macacus* was found in the same spot in 1838, but these teeth are the only remains of the *Quadrumana* which have been found in this country. In other countries larger remains have been found. Thus, in 1836, Lieutenants Baker and Durand discovered, in the Sub-Himalayan Hills, near the Sutlej, an almost entire right superior maxillary bone, containing the five molar teeth and part of the canine. The strata in which this fossil was found was tertiary, and consisted of a mixed calcareous sandstone and clay. In the year following, Colonel Cautley and Dr. Falconer discovered in the same formation a considerable portion of the lower jaw, with all the molars of the right side, and a part of the teeth of the left side, together with two middle incisors and the right canine. These remains belonged to a species of *Semnopithecus*, which must have existed with the *Sivatherium* and *Hippopotamus*, whose remains were found in the same formation.

SINA'PIS, the name of a genus of Plants belonging to the natural order *Cruciferæ*, or *Brassicaceæ*. All the species are known by the name of Mustard, a word derived from *Mustum ardens*, in allusion to their hot and biting character. The genus is known by its siliquose fruit, which is rather terete, with nerved valves; small short acute style; subglobose seeds disposed in one row in each cell, and spreading calyx. The leaves are of various forms, lyrate or deeply toothed; the flowers yellow, arranged on terminal bractless racemes; they are chiefly natives of the temperate parts of both hemispheres of the Old World. Between 40 and 50 species of this genus are enumerated. Of these, two species are well known and much cultivated in this country, *S. nigra* and *S. alba*, the Black and White Mustard.

S. nigra, Black Mustard, is known by its smooth, even somewhat tetragonal siliques closely pressed to the peduncle; lyrate lower leaves, and lanceolate upper leaves. It is found in cultivated fields, waste grounds, and roadsides throughout Europe.

S. alba, White Mustard. Siliques hispid, spreading, rather narrower than the ensiform beak; leaves lyrate, smoothish; stem smooth. It is a native of Great Britain and most countries in the south of Europe. It is frequently cultivated, and when young is eaten as a salad.

SINEW. [TENDON.]

SINTER. The silica deposited by hot-springs, as those of Iceland and the Azores, is called Sinter. [OPAL.]

SIPHONACEÆ. [ALGÆ.]

SIPHONA'RIA. [SEMIPHYLLIDIANS.]

SIPHONIA. [SPONGIADÆ.]

SIPHO'NIA, a genus of Plants belonging to the natural order *Euphorbiaceæ*, consisting of two species, but one may be only a variety of the other. This is celebrated as being the tree which yields the large quantities of caoutchouc, called 'cahuchu' by the native Americans, annually imported from Para in South America.

S. elastica is a tree 50 to 60 feet in height, common in the forests of Guiana and Brazil, and which has been introduced into the West Indies. Condamine frequently mentions it in his voyage down the Amazon. Caoutchouc is the milky juice of the plant, which exudes on incisions being made, and solidifies on exposure to the air. [INDIA RUBBER.]

SIPHONI'FERA, D'Orbigny, an order of Cephalopodous *Mollusca*.

SIPHONOBRANCHIA'TA, an order of *Mollusca*. [SIPHONOSTOMATA; ENTOMOSTOMATA; MALACOLOGY.]

SIPHO'NOPS, Wagler, a genus of Pseudophidian Apodal Batrachians.

The first sub-order of Batrachians, the Péromèles of Messrs. Duméril and Bibron, consists of but one family, the Ophiosomes (Snake-Bodied Batrachians), or Cœcilioidians. Their round elongated form, without either tail or feet, approximates so closely to that of the

Serpents, that the greater number of authors have arranged them in the order Ophidians.

The characters which lead to the classification of these reptiles into one family, and to their separation from all others, are, 1st, a body extremely extended in length, and of a cylindrical shape; 2nd, the absence of limbs or lateral appendages proper for locomotion; 3rd, a skin naked in appearance and viscous, but concealing between the circular folds which it forms many rows or rings of flat delicate imbricated scales, with free and rounded borders, resembling those of

Scales of *Cæcilia albiventris*.

the greater part of the fishes; 4th, the rounded orifice of their cloaca situated below, very near the posterior extremity of the body, which is sometimes truncated as it were, and rounded—sometimes obtusely pointed, as in the genus *Typhlops;* 5th, their head, as in all the Batrachians, is articulated to the spine by means of two distinct and separate condyles; 6th, their lower jaw moves upon the craninm without any separate articular bone, and the two branches which form it are short and very solidly soldered together towards the symphysis of the chin.

The bodies of the vertebræ of the Cæcilioidians are doubly excavated into cones, instead of being concave before and convex behind. Their tongue is large, papillose, fixed by its borders upon the gums in the concavity of the jaw, and not protractile, nor forked, nor susceptible of entering into a sheath.

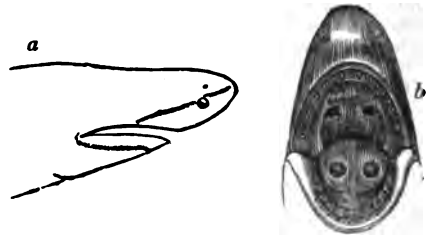
Professor Owen observes, that in the extinct family of the Labyrinthodonts, the Batrachian type of organisation was modified so as to lead directly from that order to the highest form of reptiles, namely, the Loricate or Crocodilian Saurians; that some of the existing edentulous genera of the *Bufonidæ* connect the Batrachian with the Chelonian order, and that the family founded upon the Linnæan genus *Cæcilia* forms the transition to the Ophidian reptiles. "The characters," says the Professor, "which retain the *Cæciliæ* in the Batrachian order are generally known, and may be briefly enumerated as the double occipital condyle, the biconcave vertebræ, the smooth mucous integument with minute and concealed scales, and the branchial apertures retained by the young some time after their birth. In the fixed tympanic pedicle, and the anchylosed symphysis of the lower jaw, the *Cæciliæ* are also far removed from the typical Ophidian structures; but the teeth, in their length, slenderness, sharp points, wide intervals, and diminished number, begin to exhibit the characters of the dental system of the Serpent tribe." ('Odontography.')

The departure in a degree of the Cæcilioidians from the Batrachians is marked by the presence of small scales; by ribs which are forked at their vertebral extremity, and much more distinct than in the genus *Pleurodeles;* by the absence of a sternum; and especially by the form and structure of the mouth, the aperture of which is small, the lower jaw being shorter than the upper, and the teeth long, sharp, and generally curved backwards.

The Cæcilioidians resemble many species of the osseous fishes of the division of the *Murænidæ* in the form and structure of the skeleton, the articulation of the jaws, the mode of implantation of the teeth, &c.; but the mode of junction of the head with the spine by means of two condyles, the presence of lungs and nostrils, which open distinctly within the cavity of the mouth, and the entire absence of branchiæ, remove these animals from that class. [CECILIIDÆ.]

With regard to the teeth of the Cæcilians, Professor Owen states that they are implanted in a single row upon the maxillary, intermaxillary, and palatine bones, the upper jaw being thus provided with two semi-elliptical and sub-concentric series; that there are also two rows of equal-sized teeth on the premandibular bones of the lower jaw in certain species. The *Cæcilia*, he remarks, is the last example in the ascending survey which he has taken of the dental system of this disposition of teeth, which was so common in the class of Fishes.

"There are," writes the Professor, "20 teeth in the anterior or outer premandibular row in the lumbricoid and white-bellied *Cæciliæ*, and 10 or 12 of much smaller size in the second row. There are 20 teeth in the outer row of the upper jaw, of which 6 are supported by the intermaxillaries, and 16 in the inner or palatine row. All these teeth are long, slender, acute, and slightly recurved. In the Rostrated *Cæcilia* the first two teeth of the maxillary and premandibular series are longer and stronger than the rest; they are succeeded by small and recurved teeth; the median margins of the palatal bones are bristled with small teeth; the second row in the lower jaw is represented by two small recurved teeth on the internal border of the premandibular bones. In the modification of the dental system presented by this species may be perceived a retention of the Batrachian type. The Annulated *Cæcilia* (*Siphonops annulatus*) has the maxillary and palatine teeth strong, pointed, and slightly recurved. In the Glutinous and Two-Banded *Cæciliæ* (*Epicrium*) the teeth are slender, acute, and more inclined backwards, thus approaching nearer to the Ophidian type; in the latter species (*Epicrium* (*Rhinatrema*) *bivittatum*) the palatal series, instead of ranging concentrically with the outer row, is chevron-shaped with the angle turned forwards and rounded off. The teeth of the *Cæcilia* are sub-transparent; their intimate structure corresponds with that of the frog's tooth; but their mode of implantation resembles that of the teeth of the Labyrinthodonts, the base being anchylosed to the parietes of a shallow alveolus." ('Odontography.')



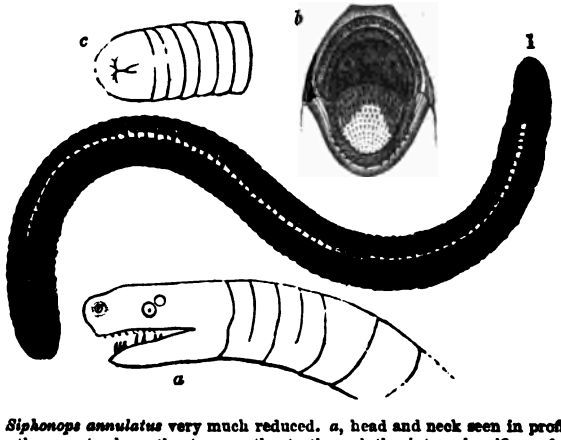
Head of *Cæcilia lumbricoidea*.

The genus *Siphonops* (Wagler) has the following generic character:—Head and body cylindrical; muzzle short; maxillary and palatine teeth strong, pointed, and a little recurved; tongue large, entire, adhering on all sides, with a surface hollowed into small vermiculiform sinkings; eyes distinct through the skin; a fosset or false nostril in front of and a little below each eye.

Only two species are known, and they are both American.

S. annulatus (*Cæcilia annulata*, Auct.) has the muzzle very short, very thick, very much rounded, hardly less than the back of the head; nostrils opening on the sides of the muzzle, entirely at the end and a little upward; false nostrils placed below each eye, and very slightly forward. Diameter of the body a sixteenth or seventeenth of its total length; it is rather strong, and perfectly cylindrical, of the same size throughout its extent. There are from 86 to 90 annular folds, slightly and equally separated from each other; these cease a little in front of the vent, so that the skin of the terminal extremity of the body, which is rounded, offers no wrinkles.

It is a native of Guiana and Surinam.



1, *Siphonops annulatus* very much reduced. *a*, head and neck seen in profile; *b*, mouth open, to show the tongue, the teeth, and the internal orifices of the nostrils; *c*, terminal extremity of its body seen below. (Duméril and Bibron.)

The genus *Ichthyophis* (Fitzing) has the head depressed, elongated; muzzle obtuse; maxillary and palatine teeth of loose texture (effilées), sharp, and couched backwards; tongue entire, with a velvety suface; eyes distinct through the skin, a fosset with a tentaculated border (? below the eye, near the border of the upper lip. Body subfusiform with numerous circular folds close-set one against the other. (Dum. and Bibr.)

I. glutinosum (*Cæcilia glutinosa*, Linn.), the only species known. The diameter of the body taken near the middle is the twenty-second or twenty-third part of the total length. There are about 325 folds, rather uniformly approximated. The scales which these folds hide are small, numerous, delicate, transparent, sub-circular, and offering on their superior surface a small figure in relief, representing a net with quadrilateral meshes. A yellowish band extends to the right and left all along the body, from the muzzle to the anal extremity; above and below the tint is slate-colour,

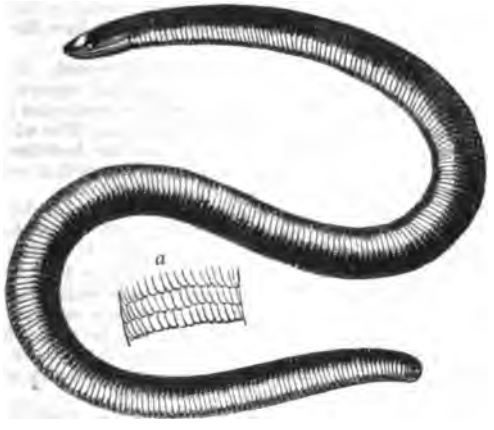
It is a native of Java and Ceylon.

The genus *Rhinatrema* (Dum. and Bibr.) has the head depressed, elongated; muzzle obtuse; maxillary and palatine teeth of loose structure (effilées), sharp, and couched backwards; tongue entire, of a velvety surface; eyes distinct through the skin; no fossets, neither under the muzzle nor below the eyes. Body subfusiform, with numerous circular folds.

R. bivittatum (*Cæcilia bivittata*, Auct.), the only species, has the head a little elongated and slightly depressed, bearing some resem-

blance in form to that of certain Ophidians, particularly of the *Coronella*. The teeth very loosely constructed (effilées), and very much couched backwards; the second row above, instead of forming a curved line like the first, makes an angle rounded at its summit. The diameter of the middle of the trunk is one twenty-sixth of the total length of the body, round which there are 340 perfectly annuliform folds.

It is a native of Guiana.



Rhinatrema bivittatum. *a*, its scales.

SIPHONOSTOMA, an order of Suctorial *Crustacea*. It was established by Latreille, and comprehends all the Suctorial Crustaceans whose thorax, composed of many distinct joints, is furnished with natatory feet.

M. Milne-Edwards describes these animals as having the body divided into three parts; the head, the thorax, and the abdomen. The first is large, and carries a pair of antennæ, a sucker furnished with styliform mandibles, and anchor-like or prehensile jaw-feet, generally three pairs in number. This cephalic portion of the body is, in general, more or less clypeiform, and is confounded with one or two of the first thoracic rings. The normal number of the constituent segments of the thorax is five, but in consequence of the soldering of the parts, this middle portion of the body offers mostly only two, three, or four distinct joints. The last thoracic ring is apod, and, in the female, carries two or three oviferous tubes. Finally, the abdomen is in general rudimentary, and is only furnished with a single pair of appendages, disposed so as to constitute ordinarily a small caudal fin. The general form of the body varies much, and sometimes departs considerably from that which may be considered as normal in this class of annulose animals.

The *Siphonostoma* undergo considerable metamorphoses in their youth, and do not become parasites till they have changed their skin once or many times; they swim at first with ease, but after having fixed themselves, they become more or less deformed, and do not quit their place except slowly and with difficulty.

M. Milne-Edwards divides the *Siphonostoma* into two families—the *Peltocephala* and the *Pachycephala*.

Peltocephala.—This family has less affinity with *Cyclops* than some of the *Pachycephala*, but they offer a more complicated structure, and consequently appear to M. Milne-Edwards to deserve precedence.

The head is very large, shield-like, and in general much larger than the thorax or abdomen; it resembles a disc slightly convex above, delicate on its edges, and truncated behind, where it is confounded with the first rings of the thorax. On its upper surface two small smooth eyes may be almost always distinguished; they are closely approximated to the median line. Forward it is continued with two frontal blades more or less distinct, and directed transversely. The thorax is composed of a variable number of joints; sometimes two only are distinguishable, sometimes three or even four may be counted, according as the three first segments are confounded with the head, or this soldering extends to but two of these rings, or even to one only. For the rest, the aspect of this portion of the body varies much, for sometimes the dorsal segment of these rings presents nothing remarkable, and sometimes it gives rise to great laminæ, which resemble the elytra of insects.

The abdomen is but little developed, and presents no appendage below, but terminates by two small natatory blades ciliated on the edges, or by a species of trifoliated fin.

The appendicular system presents, in all the animals of this division, the same essential characters, and is composed of a pair of antennæ, a buccal apparatus, and four pairs of feet.

The antennæ, two in number only, are inserted very far from each other, and are short, flattened, and directed outwards; they are always composed of two or three small lamellar joints, and are never setaceous nor annulated.

The buccal apparatus is composed of a sucker, of divers rudimentary appendages, situated on each side of its base, and of three pairs of anchor-like jaw-feet. The sucker is large, conical, and directed backwards; two unequal pieces are there to be distinguished, which are soldered by the edges throughout the greatest part of their length, but remain free towards the end, and leave between them, at the summit of this species of beak, a circular or triangular aperture; one of these laminæ is inserted between the mouth and the front, and represents the labrum, or upper lip; the other, situated backwards, is analogous to the lower lip of the masticating crustaceans. Between the base of these two lips springs, on each side, an appendage, which evidently replaces the mandibles of these last animals; but which, instead of being short, stout, and dentiform, is slender, very much elongated, and similar to a stylet with a dentilated point; these styliform jaws penetrate into the beak by means of a slit situated near its base, and advance into its interior, so as to come out by the terminating aperture, and serve as a pair of lancets when the animal wishes to suck its prey. A little outwards is found a second pair of appendages, which is reduced to a nearly rudimentary state, and seems to be the representative of the first pair of jaws of the ordinary *Crustacea*. In general there is to be distinguished near the same point a styliform, or forked horny piece, which seems to be the vestige of a third pair of buccal appendages, appendages which, in the masticating crustaceans, constitute the second pair of jaws. The jaw-feet, three pairs in number, offer considerable dimensions, and are ranged on each side of the siphon: the first pair seems to be reflected (refoulées) forward, for they spring in front of the edge of the upper lip, between the sucker and the antennæ, and by some naturalists they are considered as antennæ; they are stout, short, more or less misshapen, and each terminated by a hooked claw, by the aid of which the animal attaches itself to its prey. The second pair of jaw-feet are slender, and always composed of two principal joints of nearly equal length, the second of which carries, near its middle, a small appendage, and terminates by one or two hooks but little bent. The third pair of jaw-feet, situated more backward, are stout, in general short, and more or less completely sub-cheliform; the crooked claw which terminates them can be bent back on the penultimate joint, in manner of a claw.

The feet are four pairs in number, and are always more or less completely natatory; two pairs, and sometimes all, terminate by two oars, each composed of three joints, offering generally a very remarkable disposition of a nature to favour their action as natatory instruments, and which consist in a very considerable development of their basilary joint, and the soldering of that joint with an unequal sternal piece, so as to form, with the whole, a single transversal blade, as for the two feet. It is even to be remarked, that in general this basilary piece, which occupies the whole width of the corresponding ring, is much more developed than the terminal oars of those limbs, and constitutes by itself nearly the whole of the fin formed by the pair of feet thus modified. These four pairs of limbs belong to the first four thoracic rings, and spring, some from the cephalic buckler, others from the postcephalic portion of the thorax, varying in number according to that of the thoracic rings, which are confounded with the head. The last ring of the thorax carries none; but in general a pair of tubercles, or lobules, may be distinguished there, which appear to be the vestiges of a fifth pair of limbs reduced to a rudimentary state.

These Crustaceans live as parasites upon fishes, but they are not permanently fixed to them, and when they let go their hold, they can change their place either by crawling slowly or swimming. The male is in general distinguished from the female by some peculiarities of structure, and by a very inferior size. The female nearly always carries her eggs in cylindrical tubes, which spring near the posterior border of the last thoracic segment on each side of the abdomen, and which often attain a very considerable length. The young, at their birth, resemble the young of *Cyclops*, and must undergo many moults before they finish their metamorphosis; little however is known at present of these changes. It is also to be noted that one often finds in the neighbourhood of the vulvæ small ampullæ, which are fixed there by a very narrow neck, and which may be spermatic reservoirs analogous to those which M. Siebold made known in *Cyclops*.

M. Milne-Edwards divides this natural family into three divisions or tribes—the Argulians, the Caligians, and the Pandarians.

The Argulians consist of a single genus, *Argulus*, which infests fresh-water fish and the tadpoles of Batrachians, to which they adhere, but they are also found free, swimming about with vivacity.

A. foliaceus is known to most anglers: it is figured in Desmarest ('Crust.,' pl. 50, fig. 1), and there is a woodcut of it in Yarrell's 'British Fishes,' vol ii. p. 399. [ARGULUS.]

Caligians.—There is nothing abnormal in the conformation of the thorax of this tribe, the thoracic rings being simple, and without dorsal appendages. The cephalic buckler is large, more or less oval, delicate on its edges, and furnished anteriorly with very well-developed frontal laminæ, the lateral extremity of which covers the base of the antennæ. The posterior angles of this carapace are prolonged more or less far on each side of the thorax, and the portion of its posterior border comprised between these two prolongations is confounded with the first, or even the second or third first thoracic segments. The result is, that the thorax is only composed of two, three, or

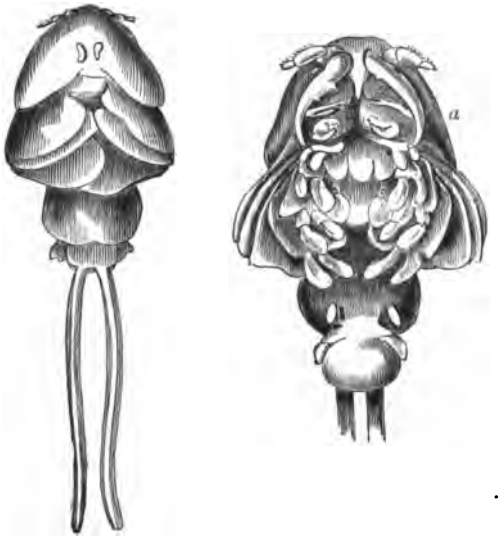
four distinct joints. The feet are furnished with long plumose bristles; and the abdomen is terminated by two small plates directed backwards, and carrying no lateral appendages. [CALIGUS.]

Pandarians.—The small Crustaceans collected by M. Milne-Edwards under this name, are remarkable for the lamellar prolongations with which the upper part of their thorax is furnished. These appendages, he observes, often resemble the elytra of insects, and their number is sometimes considerable; there may be as many as three pairs counted. In general the head is less enlarged and less clypeiform than in the *Caligians*, and the feet are only rarely furnished with plumose setæ; their terminal oars are often only represented by foliaceous sub-membranous lobes; and the abdomen frequently presents on each side of its terminal piece a more or less projecting lamellar appendage.

M. Milne-Edwards subdivides this tribe into two small groups, principally characterised by the general form of the body, and by the disposition of the oviferous tubes, which in the one are exposed and extended in a straight line behind the body, whilst in the other these tubes are coiled upon themselves, and hidden between the superior surface of the abdomen and a clypeiform lamina which springs from the last thoracic ring.

The genera *Euryphorus*, *Dinemoura*, *Pandarus*, and *Phyllophora*, form the first of these groups. *Cecrops* and *Læmarius* belong to the second.

Phyllophora is very remarkable from the lamellar appendages with which its back is covered. In its aspect it approaches the Anthosomes, but in the structure of its feet and in its general organisation it is not separable from the Pandarians. The only species known is *P. cornuta*. Length about ten lines. It is taken near Tongataboo.



Phyllophora cornuta (Milne-Edwards.)
a, seen from below.

Pachycephala.—In this division of the order *Siphonostoma* M. Milne-Edwards describes the head as not enlarged, but lamellar and clypeiform, as in the preceding family, and the antennæ, instead of being short, flattened, and biarticulate, are slender, cylindrical, elongated, and composed of five or six joints, the size of which diminishes gradually from the base towards the point of the organ. It is also to be noted that the apparatus of suction is in general less developed in these Crustaceans than in the *Peltocephala*, and the mode of conformation of these appendages, which would appear to represent the jaw-feet, is less constant; the feet are not soldered on the median line, and consequently do not constitute unequal fins, as is often the case in the preceding family.

M. Milne-Edwards divides the *Pachycephala* into two natural groups, the Ergasilians and the Dichelestians: the first, he observes, establishes the passage between *Cyclops* and the *Lernæidæ;* the second, between these last and the Pandarians.

Ergasilians.—This small group closely approximates to *Cyclops*, and is remarkable for the pyriform conformation of the body, the size of the head, and the development of the abdomen. The genera are—*Ergasilius*, *Bomolocus*, and *Nicothoa*. Species of *Ergasilius* are found attached to the gills of the pike and carp (*E. Sieboldii*); to those of the eel (*E. gibbus*); and to those of a *Silurus* (*E. trisetaceus*). The only species of *Bomolocus* known (*B. Belones*) is found attached to the branchiæ of the gar-fish (*Esox Belone*). *Nicothoa* includes but one species (*N. Astaci*) which is of a rosy colour, about a line in length, and is found upon the branchiæ of the lobster. The young *Nicothoæ*, on leaving the egg, resemble the young of *Cyclops*, and want the thoracic lobes, which, when they are adult, give so strange an aspect to these animals.

Dichelestians.—This tribe is easily distinguished from the Ergasilians by the elongated form of the body, the smallness of the head, and the frequently rudimentary state of the abdomen. It is also worthy of note that their feet are much less developed than in the Ergasilians, and that the organs by the aid of which they fix themselves on their prey are, on the contrary, more developed, announcing a more essentially parasitic life. The genera are—*Anthosoma*, *Dichelestium*, *Nemesis*, *Lamproglena*.

But one species of *Anthosoma* is known (*A. Smithii*), about ten lines long, and found upon a *Squalus*. M. Milne-Edwards remarks that the *Caligus crassus* of Abildgaard much resembles this species, but seems to be more stout about the head, and to have the cephalic buckler wider forwards.

Dichelestium comprises but one species (*D. Sturionis*). It is about one inch in length, and fixes itself on the branchial apparatus of the Sturgeons. The thorax is divided into four portions in the male, and into five in the female, by interannular divisions. The abdomen is very small in the female, about half as large as the last thoracic ring in the male. Neither does *Lamproglena* include more than one species (*L. pulchella*), which is found on the gills of the chub.

M. Milne-Edwards states that it is not without doubt that he has arranged the *Pycnogonidæ* in this place, with the *Siphonostoma*. Amongst the Suctorial Crustaceans, according to M. Milne-Edwards, are the *Pycnogonidæ*, or Araneiform Crustaceans, as they have been considered by the greater part of zoologists as belonging to the class of *Arachnida*, but which seem to him to have more analogy with the *Crustacea*, for they have no tracheæ nor pulmonary sacs for aerial respiration, and appear to respire oxygen beneath the water only by means of the general surface of the common teguments, as he had already pointed out in many inferior Crustaceans.

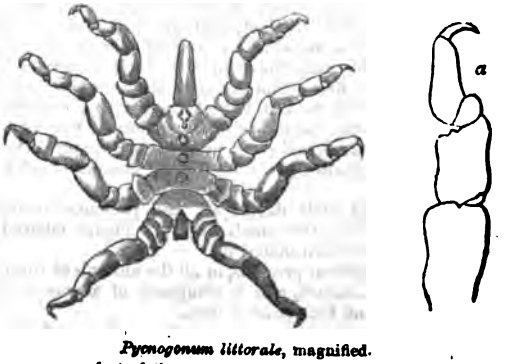
In the general form of the body these animals approach the *Læmodipoda*, and especially *Cyamus*. Their head is elongated, sometimes cylindrical, sometimes conical, and presents at its extremity a trilobated buccal orifice. The thorax is constantly divided into four segments, and the abdomen is only represented by a small tubular joint fixed to the posterior edge of the last thoracic ring. The head carries no appendages, and the eyes, four in number, are grouped on a small median tubercle, situated on the dorsal surface of the first joint of the thorax. This segment often carries at its extremity a pair of jaw-feet terminated by a well-formed pincer, and sometimes furnished with a palp, which is elongated, and composed of many joints. In the male the number of pairs of feet is equal to that of the joints of the thorax; but in the female there is a pair of pediform supplementary appendages fixed to the first joint of the thorax, bent back under the feet properly so called, much smaller than them, and serving to carry the eggs. The feet are very long, directed outwards, and composed of nine joints, the last of which constitutes a more or less sharp claw.

The digestive tube traverses the body in a straight line, and presents in one of the genera of this family (*Nymphum*) a very remarkable disposition; it gives origin, to the right and left, to a series of prolongations, which are tubular and closed above, which advance very far in the interior of the corresponding feet, and which are the seat of a peristaltic motion. There exists besides a vague circulation. No trace of respiratory organs is perceptible, and the disposition of the organs of generation is not known; it is only to be remarked, that in the *Pycnogonidæ* may be perceived, on the second joint of the posterior feet, a pore, which seems to be the orifice of this last apparatus.

The *Pycnogonidæ* are all of small proportions, and live in the sea; some are found under stones, others live, it is said, hooked on to fish or other marine animals; but otherwise nothing is known relative to their habits.

The genera are—*Nymphum*, *Pallene*, *Phoxichilidium* (*Orythia*, Johnston), and *Pycnogonum*.

Our limits will only allow us to illustrate this group, which still requires the close attention of the physiologist and comparative anatomist, by one genus. *Pycnogonum* is distinguished from its congeners by the stoutness of its form, and the size and shortness of its



Pycnogonum littorale, magnified.
a, foot of the same, more highly magnified.

feet, which are strongly contrasted with those of *Nymphum gracile*. Only one species appears to be known, *Pycnogonum littorale*. The

accessory feet of the female are very short. Length about 4 lines. This Araneiform Crustacean inhabits our seas and those of France, and is found on Ascidians and various fishes.

SIPHONOSTO'MATA, M. De Blainville's name for his first family of Siphonobranchiate *Mollusca*.

The forms comprised under this family are principally to be found under the extensive genus *Murex* of Linnæus. It is sometimes applied to several families forming a section of Prosobranchiate *Mollusca*. In Woodward's 'Manual' the following families are included :—

1. *Strombidæ*. [STROMBIDÆ.]
2. *Buccinidæ*. [BUCCINUM.]
3. *Conidæ*. [CONIDÆ.]
4. *Volutidæ*. [VOLUTIDÆ.]
5. *Cypræidæ*. [CYPRÆIDÆ.]

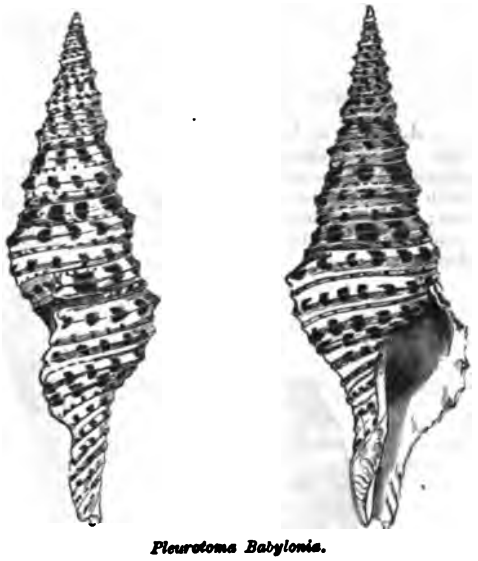
All the known animals belonging to it are carnivorous and marine, and all are furnished with a horny operculum. The *Siphonostomata* are thus subdivided by M. De Blainville :—

* No persistent bourrelet on the right lip.

Pleurotoma (Lam.).—Shell fusiform, slightly rugose, with a turriculated spire; aperture oval, small, terminated by a straight canal more or less long. The right lip trenchant and more or less incised. Operculum horny.

A. Species in which the incision is a little behind the middle of the lip, and the tube of considerable length.

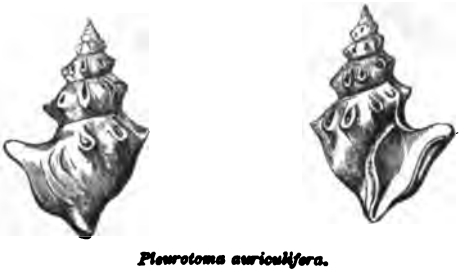
P. Babylonia. The shell fusiform-turreted, transversely carinated and belted, white, with black-spotted belts, the spots quadrate; whorls convex; tube or canal rather long. It is found in the East Indian Seas and the Moluccas.



Pleurotoma Babylonia.

B. Species in which the incision is entirely against the spire, and whose tube is short. (Genus *Clavatula*, Lam.)

P. auriculifera. This genus has been taken on different bottoms at depths varying from 8 to 16 fathoms.



Pleurotoma auriculifera.

The distribution of this genus is world-wide, and 480 recent species have been described. Those of which the localities are known are thus distributed :—

British Islands and Greenland	17
Mediterranean	19
Africa	15
Red Sea and India	6
China	90
Australia	15
Western America	52
West Indies and Brasil	20

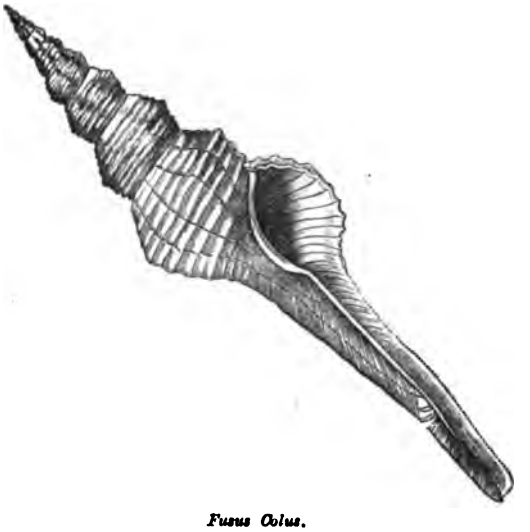
The fossil species are found principally in the chalk, and number about 300. Many sub-genera have been formed, as *Clavatula*, Lam.; *Turnella*, Swainson; *Mangelia*, Leach; *Bela*, Leach; *Daphnella*, Hind.

Fusus (Lam.).—Animal not differing much from that of *Murex*. Shell fusiform, often ventricose in the middle, rugose, thick, and with a very elevated spire; canal very straight and elongated; aperture oval; right lip trenchant, the left smooth. Operculum horny.

Animal of *Fusus*. *a*, operculum.

A. Turriculate or subturriculate, but not umbilicated species.

F. Colus (*Murex Colus*, Linn). Shell fusiform, narrow, transversely furrowed, white, the apex and base rufous; whorls convex, nodulously carinated in the middle; canal long and slender; the lip sulcated within, and denticulate on the margin. It is a native of the East Indian Ocean.



Fusus Colus.

B. Species subturriculated and umbilicated. (Genus *Latirus*, De Montfort.)

F. filosus. Shell fusiform-turreted, thick, knotty, but smooth to the touch, whitish-yellow girt with numerous orange-red lines; whorls knotty above, the knots hemispherical; the aperture white; the lip striated within. Found in the seas of Australia.

C. Subturriculate species, with the canal notched at the extremity.

F. articulatus. Shell fusiform-turreted, very delicately striated transversely, shining, saffron-coloured or violaceous-cœrulescent, girt with articulated bay lines; lip sulcated within; columella with one plait above; canal short and emarginate.

D. Species with the whorls of the spire rounded and convex.

F. Islandicus. Shell fusiform-turreted, ventricose below, not knobbed, transversely striated, white, the whorls convex; the lip thin, smooth within; the canal rather short and subrecurved. It is found in the seas of Iceland.

E. Muricoïd species.

Ex. *F. muricosus*.

F. Buccinoïd species.

Ex. *F. buccineus*.

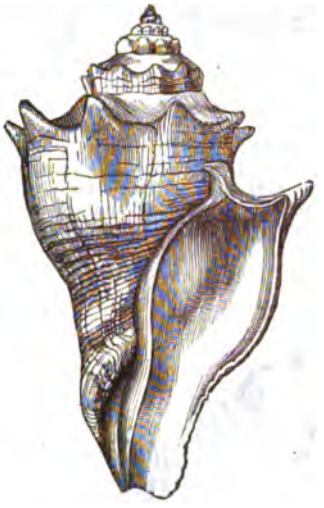
Fusi have been found on bottoms of mud, sandy mud, and sand, at depths ranging from the surface to eleven fathoms. They are found distributed all over the world. About 100 recent species and 320 fossil have been described. The latter have been found from the Gault to the Eocene Tertiary.

The sub-genera are—*Trophon*, Montfort; *Clavella*, Sw.; *Chrysodomus*, Sw.; *Fusionella*, Gray. *F. colopeus* and *F. proboscidialis* are two of the largest living Gasteropoda. *F. antiquus*, called the Red Whelk, on the coasts of the Channel, and Buckie in Scotland, is used for eating. It is the Roaring Buckie, in which the sound of the sea is said to be heard. In the Zetland cottages it is used as a lamp. *P. contrarius* has its lips reversed. It is found fossil in the crag of the counties of Suffolk and Essex in great abundance, and also recent in the Mediterranean Sea and on the coasts of Spain. *F. deformis* is also reversed.

Pyrula (Lam.).—Shell pyriform, in consequence of the lowness of the spire; the canal conical and very long or moderate, sometimes slightly notched; aperture oval, rather large; columella smooth and bent; right lip trenchant. Operculum horny.

A. Subfusiform species; the spire being slightly elevated.

P. carnaria (*P. Vespertilio*, Lam.; *Fusus carnarius*, Mart.; *Murex Vespertilio*, Gm.). Shell subpyriform, thick, ponderous, muricated anteriorly, of a rufous-bay colour; the last whorl crowned above with compressed tubercles; spire rather prominent; the sutures simple; canal sulcated and subumbilicated. It is a native of the Indian Ocean.



Pyrula carnaria.

B. Species with a long and rather narrow tube; spine very short.

P. spirillus. Shell ventricose anteriorly, the canal very long, delicately striated transversely, white, spotted with saffron-colour; body-whorl abbreviated; carinated in the middle, flattened above, tuberculated below the middle; spire very much depressed, its apex mamilliferous. It is a native of the East Indian Ocean and the coasts of Tranquebar.

C. Species with a long and rather narrow tube, but sinistrorsal or left-handed, and with the indication of a plait on the columella or pillar. (Genus *Fulgur*, De Montf.)

P. perversa. Shell sinistrorsal, pyriform, very ventricose, smooth, yellowish-white, ornamented with broad rufofuscous longitudinal lines; the last whorl crowned above with tubercles; the upper whorls tuberculiferous at the base; the canal or tube rather long and striated. It is a native of the Antilles and Bay of Campeachy.

D. Species more ventricose and delicate.

P. ficus. Shell fig-shaped, delicately decussated, cœrulescent-gray; sprinkled with variegated bay or violet spots; transverse striæ the largest and most crowded; the spire short, convex, mucronated at the centre; mouth cœrulescent-violaceous generally. It is a native of the Indian Ocean and the Moluccas.

Pyrula Ficus.

E. Ventricose species, with a short tube; aperture very large and wide, sensibly notched.

P. Melongena. Shell pyriform, turgidly ventricose, cœrulescent, glaucous, or rufous, banded with white; the whorls channelled at the sutures; the last sometimes unarmed, but more frequently muricated, with various sharp tubercles; spire short, acute; aperture smooth and white. It is found in the West Indian Seas and the Antilles.

F. Species still shorter; aperture very wide; the right lip subulated.

P. abbreviata. Shell subpyriform, very ventricose, rather rough-transversely sulcated, cinerescent-white; the spire rather prominent; the canal short, widely umbilicated; muriculated on the back with subechinate elevated furrows; outer lip striated within, and its margin denticulated.

Pyrulæ have been found on mud, sandy mud, and sand, at depths ranging from the surface to nine fathoms.

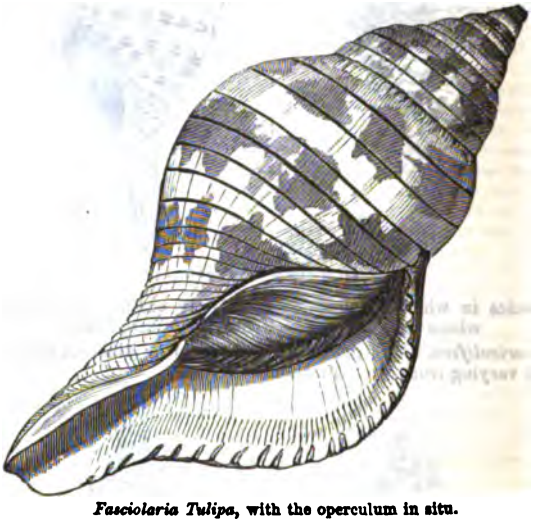
There are 39 recent species and 30 fossil. The recent are found in the West Indies, Ceylon, Australia, China, and West America. The fossil are found in the Neocomian beds of Europe, India, and Chile.

Fasciolaria (Lam.).—Shell fusiform, not very thick, rather convex in the middle, with a moderate spire; aperture oval; canal rather long; sometimes slightly bent; right lip trenchant, often wrinkled internally; columellar lip with some very oblique plaits. Operculum horny.

Animal of *Fasciolaria*. *a*, operculum.

A. Fusiform, but not tuberculous species.

F. Tulipa. Shell fusiform, ventricose in the middle, unarmed, smooth, sometimes orange-rufous, sometimes marbled with white and bay, girt with transverse brown lines unequally congregated; whorls very convex; sutures fimbriated at the margin; tube sulcated; outer lip white and striated within. It is a native of the West Indian seas and the Antilles.



Fasciolaria Tulipa, with the operculum in situ.

B. Fusiform and tuberculous species.

F. Trapezium. Shell fusiform, ventricose, tuberculiferous, rather smooth, white or rufescent, girt with rufous lines; the tubercles conical, subcompressed, and in a single series in the middle of the whorls; columella reddish-yellow; outer lip elegantly striated within, the striæ red. It is found in the East Indian Ocean.

C. Tuberculated and turriculated species.

F. flamentosa. Shell elongated, fusiform, turreted, transversely sulcated, white, painted with longitudinal orange-red stripes; middle of the whorls subangulated, and the whorls themselves crowned with short and compressed tubercles; the canal rather long; the outer lip striated within. It is found in the East Indian seas.

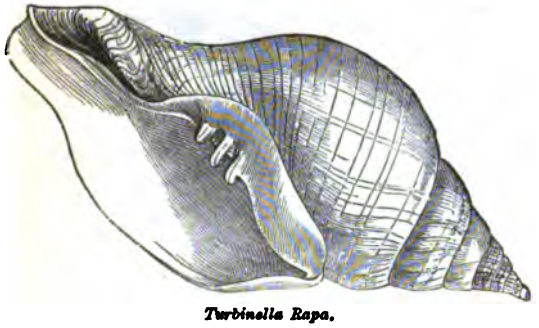
Fasciolariæ have been found on muddy bottoms, at depths ranging from the surface to seven fathoms.

There are 11 recent and 28 fossil species. The former are found in the West Indies, Mediterranean, West Africa, India, Australia, the South Pacific, and Western America. The latter are found in the Upper Chalk.

Turbinella (Lam.).—Shell ordinarily turbinated, but also sometimes turriculated, rugous, thick; spire rather variable in form; aperture elongated, terminated by a straight canal, often sufficiently short; the left lip nearly straight, and formed by a callosity hiding the columella, which has two or three unequal, nearly transverse plaits; right lip entire and trenchant.

A. Fusiform and nearly smooth species.

T. Rapa. Shell subfusiform, ventricose in the middle, thick, very ponderous, unarmed, white; the whorls above covering the base of the preceding one; canal rather short; columella subquadriplicated. It is found in the East Indian Ocean.



Turbinella Rapa.

B. Turbinaceous and spiny species.

T. Scolymus. Shell subfusiform, ventricose in the middle, tuberculated, pale yellow; spire conical, tuberculato-nodose; the last whorl crowned above with great tubercles; canal transversely sulcated; the columella orange-coloured and three-plaited. It is a native of the East Indian Ocean.

C. Turriculated, subfusiform species.

T. Infundibulum. Shell fusiform-turreted, narrow, many-ribbed, transversely sulcated, the ribs longitudinal and thick, the furrows smooth and red, and the interstices yellow; canal perforated, the aperture white.

Turbinellæ have been found on bottoms of sandy mud, at depths varying from the surface to 18 fathoms.

There are 70 recent species, chiefly tropical, and 20 fossil, from the Miocene Tertiary beds.

** A persistent bourrelet on the right lip.

Columbella (Lam.).—Shell thick, turbinated, with a short obtuse spire; aperture narrow, elongated, terminated by a very short canal slightly notched, narrowed by a convexity at the internal side of the right lip and the plaits of the columella. Operculum horny, very small.

C. mercatoria. Shell ovate-turbinated, transversely sulcated, white, painted with small, rufo-fuscous, transverse, subfasciculated lines, sometimes banded; outer lip denticulated within. Found in the Atlantic Ocean.

Columbella mercatoria.

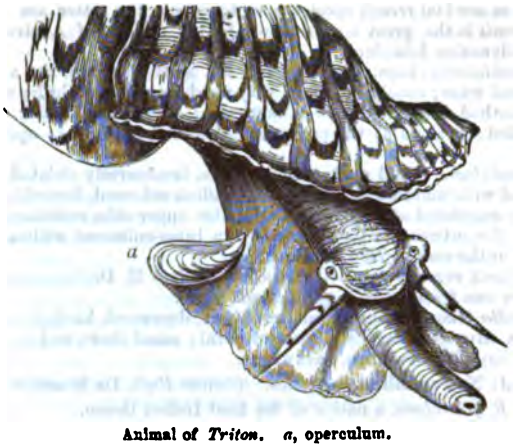
Columbellæ have been found on bottoms of sandy mud and mud at depths ranging from the surface to 16 fathoms.

The recent species are very numerous; they are chiefly subtropical: 200 species have been described. They are small prettily-marked shells, living in shallow water on sandy flats, or congregating about stones.

Triton (Lam.).—Animal a good deal resembling that of *Murex*. Shell oval, with the spire and canal straight and moderate; ordinarily rugose, furnished with few varices, which are scattered and arranged longitudinally; aperture suboval, elongated, terminated by a short open canal; the columellar lip less excavated than the right, and covered by a callosity. Operculum horny and inclined to oval.

A. Comparatively smooth species, with cordons slightly or not at all marked, with the exception of that of the right lip.

T. variegatus, the Marine Trumpet, or Triton's Shell. Shell elongated-conical, trumpet-shaped, ventricose below, girt with very obtuse smooth ribs, white, elegantly variegated with red and bay; the sutures crisped at the margin; the aperture red; the columella wrinkled with white and with a single plait above; the edge of the outer lip spotted with black, the spots bidentated with white. It is a native of the seas of the West Indies and the Asiatic seas, especially those of the torrid zone.



Animal of *Triton*. *a*, operculum.

Marine Trumpet or Triton's Shell (*Triton variegatus*).

B. Species more tuberculous, or spiny, whose aperture is more open, and terminated by a more or less ascending canal. (Genus *Lotorium* of De Montfort.)

T. Lotorium. Shell fusiform-turreted, distorted below, very much tuberculated, transversely rugous, and striated, rufous; the whorls above angulate-tuberculated; canal tortuous, the extremity recurved, the aperture trigono-elongated and white; the outer lip toothed within. It is a native of the East Indian Ocean.

C. Species with a shorter spire, always very tuberculous, most frefrequently umbilicated, a sinus at the posterior junction of the two lips. (Genus *Aquillus*, De Montfort.)

T. cutaceus. Shell ovate, ventricose-depressed, cingulated, tuberculato-nodose, yellow-rufescent; the belts rather prominent, separated by a furrow; the whorls above angulato-tuberculate, rather flattened above; canal short, umbilicated; the outer lip notched within. It is found in the Atlantic Ocean.

D. Species like those of section *C*, but whose aperture is closely narrowed by a callosity and irregular teeth. (Genus *Persona* De Montfort.)

T. Anus, the Grimace. Shell ovate, ventricose-gibbous, distorted, flattened beneath; nodulous above, subcancellated, white, spotted with rufous; the aperture narrowed, sinuous, irregular, ringent; the lip very much toothed; the canal short and recurved. It is found in the East Indian seas.

Tritons have been found on various bottoms at depths ranging from the surface to 30 fathoms.

There are 100 recent species, and 45 fossil: the latter are Eocene. *T. tritonis* is the great conch blown by the natives of Australia and the Polynesian Islanders.

Struthiolaria (Lam.).—Shell oval, the spire elevated, the aperture oval and wide; canal very short, very much notched; right lip sinuous, not toothed, furnished with a bourrelet; columellar border callous, extended; a sinus at the posterior union of the two lips; operculum horny.

S. nodulosa. Shell ovate-conical, thick, transversely striated, white, painted with undulated, longitudinal, saffron-coloured, flame-like lines; whorls angulated above, flattened on the upper side, nodulous at the angle; the sutures simple, the outer lip luteo-rufescent within. It is found in the seas of New Zealand.

Lamarck regards two living species; so does M. Deshayes, who also records one fossil, with a query, from Paris.

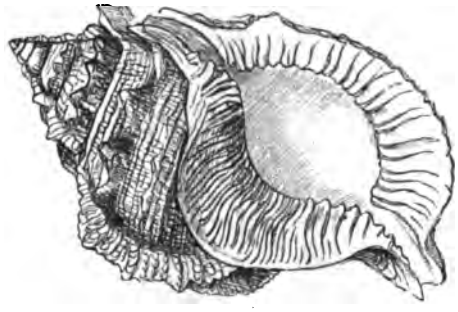
Ranella (Lam.).—Shell oval or oblong, depressed, having only two varices situated laterally; aperture oval; canal short, and a sinus at the union of the two lips, backwards.

A. Non-umbilicated species. (Genus *Bufo*, De Montfort).

Ex. *R. granulata*, a native of the East Indian Ocean.

B. Umbilicated species.

Ex. *R. foliata*, found in the vicinity of Mauritius.

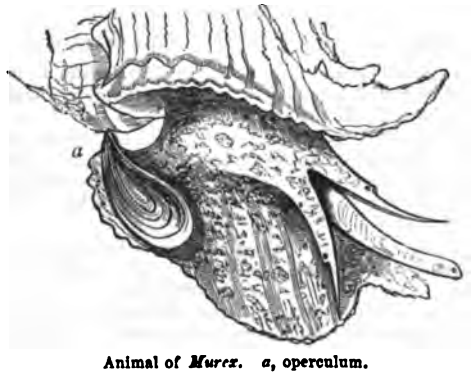


Ranella foliata.

Ranellæ have been taken on different bottoms at depths varying from the surface to 20 fathoms.

Fifty recent and 23 fossil species have been described.

Murex (Linn.).—Animal furnished with two long and approximated tentacles; mouth without jaws, but armed with hooked denticles in lieu of a tongue; foot rounded, generally rather short; mantle large, often ornamented with fringes on the right side only; branchiæ formed of two unequal pectinations; anus on the right side, in the branchial cavity; orifice of the oviduct on the right side, at the entrance of the same cavity; orifice of the deferent canal at the end of the exciting organ, on the right side of the neck; shell oval, oblong, more or less elevated on the spiral side, or prolonged forwards; external surface always interrupted by rows of varices in the form of spires or ramifications, or simply tubercles, generally arranged in regular and constant order; aperture oval, terminated anteriorly by a straight canal, which is more or less elongated and closed; right lip often plaited or wrinkled; columellar lip often callous; operculum horny.



Animal of *Murex*. *a*, operculum.

A. Species with a very long and spiny tube. (Thorny Woodcocks of collectors.)

M. Tribulus, Linn. (*Murex tenuispina*, Lam.).—Shell ventricose anteriorly, the tube very long, elegantly spired throughout its length, the spires set in triple order, each row at regular intervals, grayish or purplish gray; the spires very long, thin, rather closely set and somewhat hooked; body of the shell transversely sulcated and striated; the spire prominent. It is a native of the Indian Ocean and the Moluccas.

This is the Venus's Comb of collectors, and when perfect is a most delicate and striking shell.

Common Thorny Woodcock (*Murex Tribulus*, Linn.; *Murex tenuispina*, Lam.)

B. Species with a very long tube and without spines. (Genus *Bronta*, De Montfort.)

M. haustellum (Snipe's or Woodcock's Head of collectors). Shell anteriorly ventricose, naked, scarcely armed, fulvous inclining to red, lineated with bay; body of the shell rounded and furnished with three or more ribs between the varices; the tube very long and slender; the spire short; mouth rounded, red. It is a native of the East Indian Ocean and the Moluccas.

Snipe's Head, or Woodcock's Head (*Murex haustellum*).

C. Species with three elevated, flattened, and comparatively thin varices.

M. acanthopterus. Shell oblong, fusiform, trialated, transversely sulcated and striated, white; the alæ membranaceous; whorls angulated; aperture ovate-rounded. It is a native of the East Indian Seas.

D. Species with three ramified varices. (Genus *Chicoreus*, De Montf.)

Ex. *M. adustus.* It is a native of the East Indian Ocean.

E. Species which have a greater number of varices; tube nearly closed.

Ex. *M. regius.*

No description can convey an adequate idea of the splendid colouring of this species. It is a native of the western coast of Central and South America.

F. Subturriculated species.

Ex. *M. lyratus.*

G. Subturriculated species; the tube closed; a tube pierced towards the posterior extremity of the right side, and persistent upon the whorls of the spire. (Genus *Typhis*, De Montfort.)

Ex. *M. pungens*, fossil.

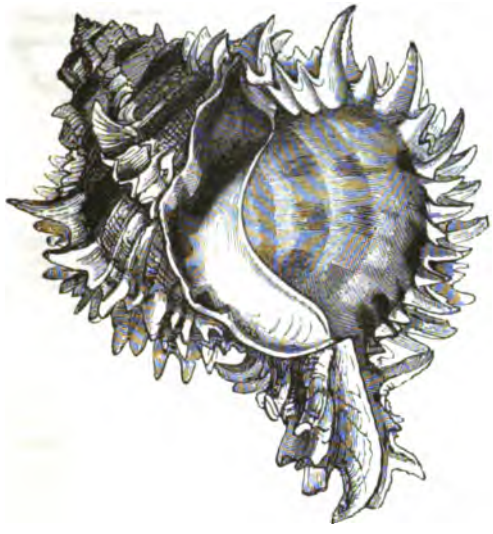
H. Species more globular; the spire and canal shorter, very open; the aperture rather wide.

Ex. *M. vitulinus.*

I. Species which have an oblique fold very much anterior to the collumella, and an umbilicus. (Genus *Phos*, De Montfort.)

Murices have been found on different bottoms at depths ranging from 5 to 25 fathoms; and species of *Typhis* on sandy mud at depths varying from 6 to 11 fathoms.

There are 180 recent species of *Murex* described. Their distribution is world-wide. All the species of *Murex* yield a dye, and many of them were used as well as *Purpura Lapillus*, for obtaining the Tyrian purple of the ancients. Heaps of the broken shells of *Murex trunculus* are still to be found on the Tyrian shore. On the coast of the Morea there is evidence of the employment of *M. brandaris* for the same purpose. *M. erinaceus*, a very abundant species on some parts of our coast, is called by fishermen Sting-Winkle. It makes holes in other shell-fish with its beak.



Murex regius.

The *Siphonostomata* and *Entomostomata* may be considered as the two great tribes of carnivorous gastropods or trachelipods appointed to keep down the undue increase of the *Conchifera* and Herbivorous Gastropods, whose shells the majority of those carnivorous testaceans penetrate by means of an organ which makes a hole as truly round as if it had been cut by an auger, and then feed on the juices of the included animal.

Dr. Buckland notices this habit with a view to the condition of the testaceous inhabitants of the earlier seas of our planet with his wonted felicity. "Most collectors," he says, "have seen upon the sea-shore numbers of dead shells, in which small circular holes have been bored by the predaceous tribes, for the purpose of feeding upon the bodies of the animals contained within them: similar holes occur in many fossil shells of the tertiary strata, wherein the shells of carnivorous trachelipods also abound; but perforations of this kind are extremely rare in the fossil shells of any older formation. In the green-sand and oolite they have been noticed only in those few cases where they are accompanied by the shells of equally rare carnivorous molluscs; and in the lias and strata below it, there are neither perforations, nor any shells having the notched mouth peculiar to perforating carnivorous species. It should seem from these facts that, in the economy of submarine life, the great family of carnivorous trachelipods performed the same necessary office during the tertiary period which is allotted to them in the present ocean. We have further evidence to show that in times anterior to and during the deposition of the chalk, the same important functions were consigned to other carnivorous molluscs, namely, the testaceous cephalopods: these are of comparatively rare occurrence in the tertiary strata and in our modern seas; but throughout the secondary and transition formations, where carnivorous trachelipods are either wholly wanting or extremely scarce, we find abundant remains of carnivorous cephalopods, consisting of the chambered shells of *Nautili* and Ammonites, and many kindred extinct genera of polythalamous shells of extraordinary beauty. The molluscous inhabitants of all these chambered shells probably possessed the voracious habits of the modern cuttle-fish; and by feeding like them upon young *Testacea* and *Crustacea*, restricted the excessive increase of animal life at the bottom of the more ancient seas. Their sudden and nearly total disappearance at the commencement of the tertiary era would have caused a blank in the 'police of nature,' allowing the herbivorous tribes to increase to an excess that would ultimately have been destructive of marine vegetation, as well as of themselves, had they not been replaced by a different order of carnivorous creatures, destined to perform in another manner the office which the inhabitants of the ammonites and various extinct genera of chambered shells then ceased to discharge. From that time onwards we have evidence of the abundance of carnivorous trachelipods, and we see good reason to adopt the conclusion of Mr. Dillwyn, that in the formation above the chalk the vast and sudden decrease of one predaceous tribe has been provided for by the creation of many new genera and species possessed of similar appetencies, and yet formed for obtaining their prey by habits entirely different from those of the cephalopods. The design of the Creator seems at all times to have been to fill the waters of the seas and cover the surface of the earth with the greatest possible amount of organised beings enjoying life; and the same expedient of adapting the vegetable kingdom to become the basis of the life of animals, and of multiplying largely the amount of animal existence by the addition of *Carnivora* to the *Herbivora*, appears to have prevailed from the first commencement of organic life to the present hour." ('Bridgewater Treatise.')

SIPUNCULOIDEA, an order of Echinodermatous Animals, embracing the families *Sipunculidæ*, *Priapulidæ*, and *Thalassemadæ*. This order is thus defined: The cutaneous envelope is coriaceous, and free from calcareous corpuscles; there is no calcareous ring about the œsophagus; the body is cylindrical; the digestive canal usually asymmetrical.

1. The *Sipunculidæ* (Syphon-Worms) have a retractile proboscis, at the base of which is placed the vent, and round the extremity of which there is a circle of tentacles. This family embraces the genera *Syrinx*, *Sipunculus*, and *Phascolosoma*.

Syrinx (Bohadsch) has a cylindrical proboscis shorter than the body, having a circle of short-fingered tentacles around its tip. In his 'History of British Star-Fishes,' Forbes refers three British species of *Sipunculus* of other authors to this genus—*S. nudus*, *S. papillosus*, and *S. Harveii*.

Sipunculus (Linnæus) has a cylindrical proboscis about as long as the body, and a circle of simple linear tentacles around its tip. The following are British species of this genus:—*S. Bernhardus*, *S. Johnstoni*, *S. saccatus*, *S. tenuicinctus*, *S. Forbesii*, *S. granulosus*, *S. punctatissimus*, and *S. Pallasii*.

2. The *Priapulidæ* (Tailed-Worms) have a retractile proboscis with no tentacles, and the vent at the end of a long thread-like tail.

Priapulus (Lamarck) has the body truncated behind, and the tail much branched and pointed.

The only British species is *P. caudatus*, which is only rarely taken.

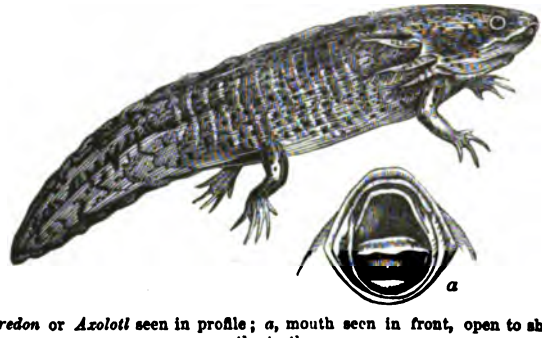
3. The *Thalassemadæ* (Spoon-Worms) have a body oval or oblong, a proboscis with a long fleshy appendage; vent at posterior extremity, tentacles none.

Thalassema (Cuvier) has a cylindrical body rounded and smooth behind; the proboscis retractile, short, furnished at one side with a long fleshy furrowed simple sheath, which is not retractile. *T. Neptuni* is a British species.

Echiurus (Cuvier) has a cylindrical body, set at its hinder extremity with circles of bony points, and a proboscis as in *Thalassema*. [ECHINODERMATA.] *E. oxyurus* is a British species.

(*Manual of Natural History*; Gosse, *Marine Zoology*; Forbes, *British Star-Fishes*.)

SIRE'DON, Wagler's name for the *Axolotl*. We subjoin an illustration of the *Axolotl* from Messrs. Duméril and Bibron's great work on Reptiles. [AXOLOTL; AMPHIBIA.]



Siredon or *Axolotl* seen in profile; *a*, mouth seen in front, open to show the teeth.

SIREN, a genus of Reptiles belonging to the Perennibranchiate Batrachians. [AMPHIBIA.] It has the following characters:—Form elongated, nearly like that of the eels; branchial tufts three on each side; no posterior feet, nor any vestige of a pelvis; head depressed; gape of the mouth not wide; muzzle obtuse; eye very small; the ear concealed; lower jaw armed with a horny sheath and several rows of small teeth; the upper jaw toothless; but numerous small pointed retroverted teeth occur on the palatal region.

Dr. Garden appears to be the first who called attention to this form, which is declared by Cuvier to be one of the most remarkable of the class of Reptiles, and indeed of the whole animal kingdom, from the anomalies of its organisation, and its apparent relationship with different families, and even classes. Dr. Garden (1765-1766) sent a description of this reptile to Linnæus and Ellis, and the former, relying upon Dr. Garden's assurance that the Siren did not change its form, established an additional order for it in his class *Amphibia*, with the name of *Meantes*.

Pallas, Hermann, Schneider, and Lacépède however saw, as Cuvier remarks, nothing more in the Siren than the larva of some large unknown Salamander; whilst Camper, followed by Gmelin, went so far as to give it a place among the fishes. The latter arranges it at

the end of the Eels, under the name of *Muræna Siren*. These differences of opinion sufficiently show the doubts which arose on the examination of this extraordinary form.

Cuvier in 1807 satisfactorily established, in a memoir read to the Institute of France, and inserted in the first volume of the 'Zoological Observations of Humboldt,' that whatever changes it might undergo, the Siren was a reptile sui generis, which never could have hind feet, and whose whole bony framework differed essentially from that of the Salamanders; that there was no probability that it ever changed its form or lost its branchiæ; and that the Siren is consequently a true Amphibian, which respires at will throughout its life, either in the water by means of branchiæ, or in the air by means of lungs. This conclusion rested upon that solid basis which has given such value—a value daily becoming more appreciated—to the views of this great zoologist—his personal observations made on the osteology and splanchnology of the animal.

That the Siren is a perfect animal belonging to the Perennibranchiate Batrachians is now admitted by all zoologists. Cuvier indeed remarks ('Règne Animal'), that the branchiæ of *Siren intermedia* and *S. striata* have been regarded as not participating in their respiration, and that in consequence Dr. J. E. Gray has formed them into the genus *Pseudobranchus*. Cuvier however adds that it is nevertheless not difficult to see on their lower surface folds and a vascular apparatus, the use of which does not appear doubtful to him; and that M. Leconte has satisfactorily demonstrated that both these species, as well as *Siren lacertina*, are perfect animals.

Cuvier remarks that the Siren should be judged of not after *Amphiuma*, but from itself. He accordingly procured some Sirens, and saw an osteology so finished and so firm, that it was impossible to believe that they were not adult. The branchiæ of these individuals were perfectly entire, and their lungs completely developed, and rich in well-filled vessels. No doubt therefore existed in his mind that the animals used both.

The simultaneous existence, he observes, of a larynx and a trachea with a branchial apparatus not only permanent, but perfectly ossified in many of its parts, is also worthy of especial attention, and proves, as is evident in the frogs and salamanders, that the branchial apparatus is no other than a more complicated os hyoides, and not a combination of pieces proceeding from the sternum and larynx. He adds, that it is to the Salamanders that the Sirens approach most nearly by the structure of the head, although neither the general form nor the proportions of the parts have so near similarity.

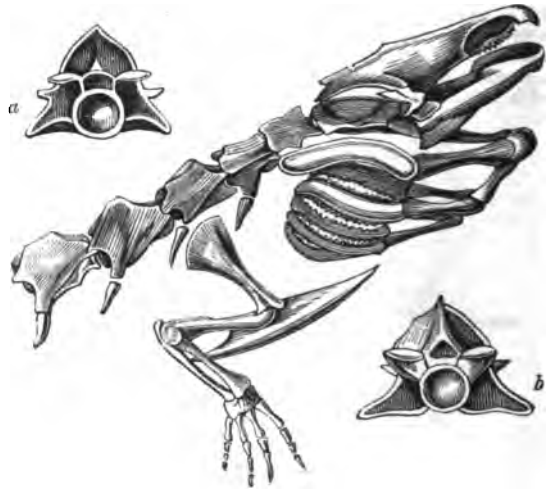
The skull of the Siren is narrowed in front by reason of the excessive reduction of the maxillary bones, which consist only of a very small osseous point. Behind there is a strong occipital crest on the parietal and petrous bones. The pieces which form the lower jaw, instead of being transverse like the branches of a cross, are directed obliquely forwards. The parietal bones occupy the greatest portion of the upper part of the cranium. They have each in front a point, expanding so as to lodge between them the posterior part of the principal frontal bones, which have each a groove for the lodgment of the posterior point of two slender bones, which proceed beside each other to the end of the muzzle. At their sides are attached two other bones, which are slender and pointed backwards, and which descend and widen far in order to raise the anterior edge of the jaw. Cuvier takes the first for the nasal bones, and the others for intermaxillary bones. These last are toothless, but their edge is trenchant, and furnished, when the animal is alive or well preserved, as well as the edges of the lower jaw, with a sheath which is nearly horny, is easily detached from the gum, and has its analogue in the tadpoles of the frogs. All the lower part of the cranium and the face is composed of a large and wide sphenoid, which extends from the occipital hole to the intermaxillaries. The sides of the cranium, in the orbital region and the front of the temporal bone, are closed by a single bone, in which are pierced, forward, the olfactory aperture; farther back, the optic hole, and another for the first branch of the fifth pair, and probably for the small nerves of the eye. To the palate, under the anterior and lateral part of the sphenoid and orbital bones, are fitted two delicate plates beset with hooked teeth.

The lower jaw of the Siren is composed of four bones on each side; one of which forms the symphysis and the trenchant border of the jaw, which it invests externally up to near its posterior extremity. The whole of this bone is beset with small pointed teeth disposed quincuncially like those of the palatal plates.

The os hyoides of the Siren is an os hyoides of the larva of a Salamander or of the Axolotl, but very much ossified in many of its parts.

The shoulder-blade of the Siren is slender, nearly cylindrical, narrowed in its middle, and augmented on the spinal side by a cartilaginous lamina. The clavicle and the coracoid are represented by two cartilaginous lobes, one directed forwards, the other much wider, proceeding upon the breast and crossing upon that of the opposite side. In the external border of this coracoid cartilage, near and a little behind the articular fossa, is a bony semilunar lamina, which is the sole representative of the bony coracoid; but there is nothing similar for the clavicle. The humerus, compressed laterally above, from before backwards below, and narrowed in its middle, has its extremities cartilaginous. It is the same with the two bones of the fore arm, both rather slender, and the internal bone or radius widened below. The bones of the carpus remain cartilaginous.

Each of the four fingers has a metacarpian, and two phalanges only.

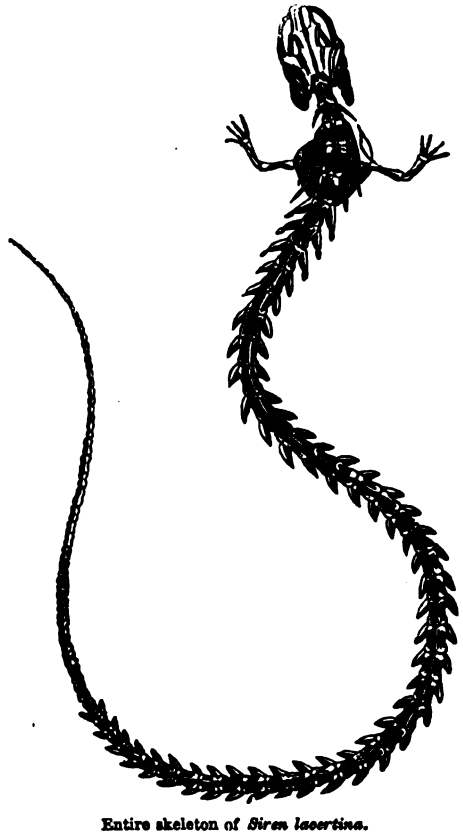


Anterior portion of the skeleton of *Siren lacertina*. *a*, dorsal vertebra seen behind; *b*, the same seen before.

There is no vestige of a pelvis, nor of any posterior extremity, either osseous or cartilaginous.

Cuvier did not find in a large individual more than 43 vertebræ in the trunk and 44 in the tail: but the individual which he described in 1807 had three more.

In the vertebræ which carry the ribs, the upper lamina of the transverse apophysis is but little marked, and the point is stout and divided into two lobes for the two tubercles of the rib, as in the salamanders. Cuvier only found eight of these vestiges of ribs on each side, commencing from the second vertebra. The two last have the head simple. At the tail, the transverse apophyses, which have already



Entire skeleton of *Siren lacertina*.

become rather small, promptly disappear; the articular apophyses diminish also by degrees. The body of the vertebra takes a very compressed form, and gives below two small laminæ, which intercept a canal for the vessels, like the chevron bones in the lizards.

John Hunter, in 1766, gave the following accurate and interesting description of the twofold respiratory apparatus of the Siren:—"On the posterior and lateral parts of the mouth are three openings on each side; these are similar to the slits of the gills in fish, but the partitions do not resemble gills on their outer edges, for they have not the comb-like structure. Above and close to the extremity of each of these openings, externally, so many processes arise, the anterior the smallest, the posterior the longest; their interior and inferior edges and extremity are serrated, or formed into fimbriæ: these processes fold down and cover the slits externally, and would seem to answer the purposes of the comb-like part of the gill in fish. At the root of the tongue, nearly as far back as these openings reach, the trachea begins, much in the same manner as in birds. It passes backwards above the heart, and there divides into two branches, one going to each lobe of the lungs. The lungs are two long bags, one on each side, which begin just behind the heart, and pass back through the whole length of the abdomen, nearly as far as the anus. They are largest in the middle, and honeycombed on their internal surface through their whole length." ('Phil. Trans.,' lvi., 1766.)

In the Museum of the Royal College of Surgeons in London this part of the organisation of the Siren is well illustrated.

John Hunter describes the heart of the Siren as consisting of one auricle and ventricle. "What answers," says Hunter, "to the inferior vena cava, passes forwards above, but in a sulcus of the liver, and opens into a bag similar to the pericardium: this bag surrounds the heart and aorta as the pericardium does in other animals; from this there is an opening into a vein which lies above and upon the left of the auricle, which vein seems to receive the blood from the lungs, gills, and head, is analogous to the superior vena cava, and opens into the auricle which is upon the left ventricle. The aorta goes out, passing for a little way in a loose spiral turn, then becomes straight, where it seems to be muscular: at this part the branches go off, between which there is a rising within the area of the aorta like a bird's tongue, with its tip turned towards the heart. This account of the venæ cavæ opening into the cavity of the pericardium may appear incredible; and it might be supposed that, in the natural state of the parts, there is a canal of communication going from one cava to the other, which, being broken or nipped through in the act of catching or killing the animal, would give the appearance above described. I can only say that the appearances were what have been described in three different subjects which I have dissected, and in all of them the pericardium was full of coagulated blood. But besides the smallness of the subjects, it may be observed that they had been long preserved in spirits, which made them more unfit for anatomical inquiries. They had been in my possession above seven years." ('Phil. Trans.,' lvi., 1766.)

The structure of the heart and other organs of this interesting animal, are illustrated in the preparations in the Museum of the Royal College of Surgeons of England.

The following remarks on the blood of the Siren, by Professor Owen, were published originally in the 'Penny Cyclopædia:'—

"Among the important generalisations which the numerous observations of recent microscopical anatomists have enabled the physiologist to establish respecting the form and size of the blood-discs in different classes of animals, the most interesting seems to be that which Professor Wagner has enunciated respecting the relation of the magnitude of the blood-disc to the persistence of the branchial apparatus in the Batrachian order of reptiles, on the occasion of his description of the blood-discs of the *Proteus anguinus*.

"The absolute size of these particles in that Perennibranchiate Reptile, in which they may be distinguished by the naked eye, renders them peculiarly adapted for minute investigations into the structure of the nucleus and capsule of the blood-disc: but the value of the relation between their size and the persistency of the external gills must depend upon the correspondence of other perennibranchiate reptiles with the Proteus in this respect. The superior size of the blood-discs of the Newts to those of the Land-Salamanders and Tailless Batrachians has been confirmed by Professor Van der Hoeven's observations on the blood-discs of the gigantic Newt of Japan [SIEBOLDIA], of which a fine specimen has been for several years kept alive at Leyden [AMPHIBIA]; and I have been able to add another instance of the still greater relative size of the blood-discs in the Perennibranchiate Reptiles by the examination of those of the largest existing species of that family, the *Siren lacertina*, of which a specimen, twenty inches in length, is now (October 15th, 1841) living at the Zoological Gardens. The blood was obtained from one of the external gills, and immediately subjected to examination. The blood-discs presented the elliptical form which hitherto, without exception, has been found to prevail among the air-breathing oviparous vertebrated animals: the ellipse was not quite regular in all the blood-discs; several were sub-ovate, a few slightly reniform and thicker at the more convex side: all were as compressed, or disc-shaped, as in other Batrachians, with the nucleus slightly projecting from each of the flattened surfaces.

"The nucleus did not partake in the same degree with these varieties of form, but maintained a more regular elliptical form; the varieties in question appearing to depend on pressure acting upon the capsule and the coloured fluid surrounding the nucleus. Yet when the ellipse of the blood-disc was, as it happened in a few cases to be, longer and narrower than the average, the form of the nucleus presented a similar modification of size.

"The following is a table of the averages of many admeasurements of these blood-discs, made with the screw-micrometer:—

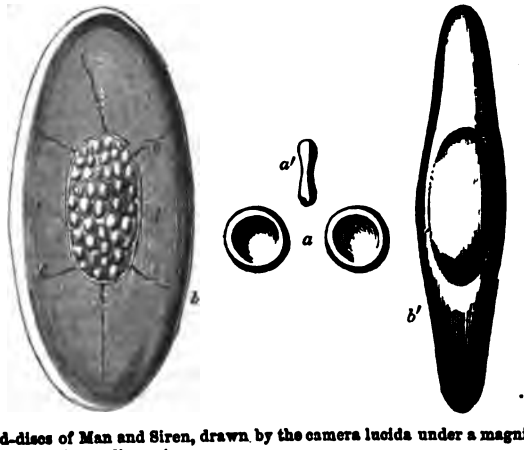
	English inch.
"Long diameter	1-450th
Short diameter	1-850th to 1-870th
Long diameter of nucleus	1-1000th
Short diameter of ditto	1-2000th
Thickness of ditto	1-3800th

(As viewed edgeways covered by the capsule.)

"The nucleus was circumscribed by a double line, the outer one more regular than the inner one, which appeared crenated. This appearance was due to the structure of the nucleus, or the contents of the nucleolar capsule, which was indicated by the outer line. These contents consisted, in every blood-disc examined, of a number of moderately bright spherical nucleoli, sufficiently distinct to be counted, when viewed by a Powell's 1-10th inch objective, with the eye-piece, magnifying 700 linear diameters: the ordinary number of nucleoli seen in one plane or focus being from twenty to thirty, the total number was of course much greater. The facility as well as certainty of the demonstration of such a structure in a good microscope of the present day will be readily admitted, when it is remembered that the nucleus of the blood-disc of the Siren is three times the size of the entire human blood-disc. These tuberculate nuclei, when removed from the capsule, were colourless; the component granules or cells have a high refracting power: viewed in situ they present a tinge of colour lighter than that of the surrounding fluid, and dependent upon the thin layer of that fluid interposed between the nucleus and the capsule.

"The external capsule of the blood-disc is smooth, moderately resisting, elastic, as was easily seen by the flattening of the parts of two blood-discs that might come in contact, and the recovery of form when they were floated apart.

"As the fluid contents of the blood-disc in part evaporated during the process of desiccation, the capsule fell into folds in the interspace between the nucleus and the outer contour, these folds generally taking the direction of straight lines, three to seven in number, radiating from the nucleus." (R. Owen, Sept. 25, 1841.)



Blood-discs of Man and Siren, drawn by the camera lucida under a magnifying power of 700 linear dimensions.

a, Human blood-discs; *a'*, ditto viewed edgewise; *b*, Siren's blood-disc; *b'*, ditto viewed edgewise; *c*, folds of external capsule, produced by desiccation; *d*, capsule of nucleus; *e*, nucleoli.

Siren lacertina grows to the length of three feet; its colour is blackish. The feet have four toes, and the tail is compressed into an obtuse fin.

This Siren inhabits the marshy grounds of Carolina, especially those where rice is cultivated. It lives in the mud, from whence it makes excursions, sometimes on land and sometimes in the water. From the swampy places by the sides of pools and under the overhanging trunks of old trees, where it is found, it was called by the inhabitants 'the Mud Iguana.' Garden was of opinion that it feeds on serpents, and that it uttered a cry similar to that of a young duck; but Barton contests these statements. Its food is generally believed to consist of earth-worms, insects, &c. Specimens have been occasionally kept in the Zoological Gardens, Regent's Park. One in 1841 was kept in a vessel of pond-water with a deep bottom of mud, in which it used to hide itself. It was twenty inches long, as large as the wrist of a stout child of six months old, and very eel-like in its movements and appearance. About a dozen and a half of earth-worms were supplied to it as food every other day.

S. striata is blackish, with two longitudinal yellow stripes on each side; has only three toes on each foot, and is about nine inches in length.

Siren striata.
a, head and anterior part seen in profile, showing the branchiæ and foot.

SISKIN. [CARDUELIS; ABERDEVINE.]

SISMONDINE, a Mineral of a deep-green brilliant colour. It cleaves readily, affording highly lustrous laminæ. Brittle, easily powdered; colour of the powder bright grayish-green. Scratches glass. Specific gravity about 3·565. It is found at St. Marcel in Piedmont. Its analysis by Delesse gives—

Silica	24·1
Alumina	43·2
Protoxide of Iron	23·8
Water; trace of Titanium	7·6
	98·7

SISON, a genus of Plants belonging to the natural order *Umbelliferæ*. It possesses the following characters:—calyx obsolete; petals broadly obcordate, deeply notched, and curved with an inflexed point; styles very short; fruit ovate, laterally compressed; carpels with five filiform equal ridges, of which the lateral ones are marginal; interstices with single short club-shaped vittæ; seed gibbous, convex, plane in front; universal and partial involucre of few leaves.

Several species were formerly referred to this genus which are now placed under various genera. The only species that is now decidedly referred to Sison is the *S. Amomum*, Hedge Bastard Stone Parsley. It is a native of France, Sicily, Italy, Greece, and Great Britain. It is not unfrequent in this country, especially in chalk soils in rather moist ground, under hedges, &c. It is known by its erect, terete, paniculately branched stem; pinnate leaves, the lower leaflets rather toothed and lobed, upper ones cut into narrow segments. The flowers are cream-coloured. The green plant when bruised has a peculiarly nauseous smell, something like that of bugs. The seeds are pungent and aromatic, and were formerly celebrated as a diuretic, but are now little used.

SISSOO. [DALBERGIA.]

SISY'MBRIUM (from Σισύμβριον), the name of a genus of Plants belonging to the natural order *Cruciferæ*. It possesses a roundish silique seated upon a torus; two stigmas, somewhat distinct, or connate into a head; calyx equal at the base; ovate or oblong seeds; flat, incumbent, sometimes oblique cotyledons; stamens not toothed. The species are mostly perennial or annual herbs, with yellow or white flowers, and leaves very variable on the same plant. About 58 species are enumerated, but comparatively few of these are cultivated. The genus, however, belongs to an order which possesses no injurious plants, and a few of the species are well known on account of their uses.

S. officinarum, Common Hedge-Mustard, has muricate pilose leaves, a pilose stem, and subulate pods pressed to the rachis. It is a native of Europe, and grows in waste places and way-sides, among rubbish, and along the sides of walls. It is plentiful in Britain, and also the north of Africa. The whole plant is warm and acrid, and is often cultivated for use as a pot-herb.

S. Irio, London Rocket or Broad-Leaved Hedge-Mustard. Stem and leaves smooth; leaves runcinate; lobes toothed; pod erect. It is a native of waste places throughout Europe, but especially about London. It is said to have entirely covered the ground in the following spring of the great fire of London in 1666. The former species is also remarkable for appearing on the ground where fires have existed.

S. Sophia, Five-Leaved Hedge-Mustard, or Flixweed. Leaves doubly pinnatifid, slightly hairy; lobes linear or oval; pedicels four times longer than the calyx; petals shorter. It grows on dry banks, waste ground, dung-hills, and among rubbish in most parts of Europe. It is frequent in Great Britain.

S. millefolium, Millfoil-Leaved Flixweed. Leaves somewhat tripinnate, hoary; lobules blunt, small; stems shrubby; petals larger than the calyx. A native of Teneriffe, on the rocks in the lower parts of the island. It is a small branched shrub, with corymbose flowers.

S. strictissimum, Spear-Leaved Hedge-Mustard. Leaves lanceolate, stalked, toothed, pubescent. It has intensely yellow flowers, with pods two inches long; the stem is erect, and branching at the top.

SISYRINCHIUM. [IRIDACEÆ.]

SITTA, a genus of Birds belonging to the family *Certhiadæ*. Mr. Swainson places the genus in the sub-family *Sittinæ*, being the second of his family *Certhiadæ*. Prince Bonaparte makes it the first sub-family of that family.

It has the following generic characters:—Bill straight, cylindrical, slightly compressed, subulated, acuminated. Tongue short, horny, and armed at the point. Nostrils basal and rounded, partly hidden by reflected bristles. Feet with three toes before and one behind, the outer toe being joined at its base to the middle one; hind toe of the same length as or longer than the middle one, with a long and hooked claw. Tail of 12 feathers. Wings rather short; the first quill very short, the third and fourth the longest. (Gould.)

S. Europæa, the Common Nuthatch, or Nutjobber. The plumage above is fine blue-gray; quills and base of tail-feathers, except the two middle ones, black, the outer tail-feather on each side with a black spot near the tip. A black band passes from the bill through the eye down the sides of the neck, ending abruptly near the shoulders; throat whitish; rest of plumage below rufous-brown blending into chestnut on the flanks; bill and feet black; iris hazel. Sexes alike.

Common Nuthatch (*Sitta Europæa*).

This bird is in all probability the Σίττη of the Greeks, and *Sitta* of the Latins. It is the Ziolo, Picchio Grigio, Raparino, and Picchio Formicajo, of the Italians; Muratore of Savi; Torchepot and Pic-Maçon of the French; Kleiber and Blauspecht of the Germans; Notwacka and Notpacka of the Swedes; Spœtt-Meise of the Danes; Nat-Bake of Brunnich: Klener Nusszhacker of Kramer; and Delor y Cnau of the Welsh.

Like the Woodpeckers and Creepers, the Nuthatch runs with facility upon and about the trunks and branches of trees; but the tail, which is short and rounded, is of no assistance to the bird in its progress. Unlike the Woodpeckers, however, the Nuthatch runs with the head downwards as well as upwards, and indeed the former position of the head appears to be the favourite one; it generally alights on a branch with the head in the downward position, and sleeps in that posture. It is almost constantly in motion. Its food consists of insects and their larvæ, berries, and nuts. The latter it fixes in some chink, and cracks them by repeated strokes of the bill. "It is a pretty spectacle," says Willughby, "to see her fetch a nut out of her hoard, place it fast in a chink, and then, standing above it, with its head downwards, striking it with all its force, break the shell and catch up the kernel." The same author found beetles in the muscular stomach or gizzard of one opened by him. The filbert gives the Nuthatch but comparatively little trouble; but the more

dense hazel-nut calls forth greater energies, and when employed upon one of those nuts, the bird makes the neighbourhood resound with the strokes of its bill. Its call-note in the spring is a clear shrill whistle. The nest is generally made with only a few dry leaves in the hole of a tree, and the eggs, which are from five to seven in number, are of grayish-white spotted with reddish-brown. If the hole selected be too large, the bird plasters up a part of it with mud, and will renew the plaster if destroyed, whence one of its French names.

The female, when surprised on the eggs or her young, makes a most determined defence with bill and wings, hissing at the intruder violently at the same time. It seems indeed to be a very attached bird. The old French quatrain says—

"Le Torchepot et sa femelle ensemble
Vivent en paix tout le long de l'Este.
Parquoy l'on dit, que qui est arresté
A son mesnage au Torchepot ressemble."

Of its bravery and courage when made captive, a painful story is told in the 'Magazine of Natural History.' A Nuthatch had been winged by a sportsman, and was put into a small cage made of oak and wire. During a night and day, the period of his confinement, his tapping labour was incessant, and at the end of that time the wood-work of his prison was pierced and worn like worm-eaten timber. His impatience of his situation was excessive; his efforts to escape were unremitted, and displayed much cunning and intelligence. He was fierce and fearlessly familiar, and voraciously devoured the food placed before him. His hammering is described as having been peculiarly laborious, for he did not peck as other birds do, but taking a firm grasp with his great feet, he turned upon them as upon a pivot, striking with his whole weight, and thus assuming with his body the appearance of the head of a hammer in motion. This unfortunate bird sank at the close of the second day under the combined effects of his vexation, assiduity, and voracity. The Rev. T. L. Bree mentions one which he caught in a common brick-trap: when the bird was found, the bill appeared to be truncated, and he inferred that it had been fairly ground down to about two-thirds of its original length by the pecking of the bird at the bricks in its efforts to escape.

This bird is an inhabitant of Europe generally.

Mr. Gould describes and figures two other species, *S. rupestris* and *S. Asiatica*, in his 'Birds of Europe.'

The genus is found in India and America; and there are closely allied forms in the Indian Archipelago and in Australia.

SIUM, a genus of Plants belonging to the natural order *Umbelliferæ*. The calyx possesses 5 teeth or is obsolete; petals obcordate, with an inflexed point, or entire and ovate; fruit laterally compressed or contracted, and subdidymous, crowned with the reflexed styles with their depressed bases; carpels with 5 equal filiform rather obtuse ridges, of which the lateral ones are marginal; interstices with one or many vittæ; seed subterete. The universal involucre varies; the partial one is composed of many leaves.

S. Sisarum, Skirret, is the best-known plant of this genus. The root is composed of fascicles of fusiform tubers; stem terete; leaves pinnate, upper ones ternate; leaflets ovato-lanceolate, acute, serrated; involucre of 5 reflexed leaves; commissure, according to Koch, with 4 vittæ. It has white flowers. The tubers of the root are about the size of the finger, and were formerly greatly esteemed in cookery, but are now gone much into disuse. The French call this plant Chervis, the Germans Zucker-Wurzel, and in the north of Scotland, where it is much eaten when cooked, it is called Crummock. It is a native of China.

S. nodiflorum, Fool's Water-Cress, or Procumbent Water-Parsnip, possesses a rooting, procumbent, striated stem; pinnate leaves, oblong equally serrated leaflets; umbels sessile, opposite the leaves. It is a native of Europe, in ditches and rivulets, and is common in Great Britain. A small and large variety are recorded, the one not attaining more than three or four inches in height, the other as many feet.

S. latifolium, Broad-Leaved Water-Parsnip, has oblong-lanceolate leaflets, equally serrate, pointed; umbels terminal. It is found in ditches and watery places in Great Britain.

S. angustifolium, Narrow-Leaved Water-Parsnip, has an erect stem; leaflets unequally lobed and serrated, umbels pedunculate, opposite to the leaves. It is common in Great Britain.

SIVATHERIUM (from Siva, an Indian deity), a genus of extinct animals belonging to the family *Elephantidæ*. The remains of species of this remarkable genus were found by Dr. Falconer and Colonel Cautley in the valley of Mackanda, in the Sewalik Hills of the Himalaya.

Two species of this genus, *S. giganteum* and *S. Perimense*, have been described. A cranium, lower jaw and teeth, and bones of the extremities of *S. giganteum* are now in the British Museum. The skull of this animal is nearly as long as that of the Elephant, the neck was shorter and stronger than in the Giraffe. The posterior portion of the skull is greatly developed, and formed of cellular cavities, as in the Elephant. "The face is short, and the nasal bones are remarkable for the manner in which they are prolonged into a pointed arch above the external nostrils, indicating a trunk, or proboscis. The very inclined direction of the front of the face in relation to the triturating surface of the teeth, imparts a physiognomy altogether peculiar. Two horns arise from the brow between the orbits, and diverge from each other, and it is probable that the posterior protuberances of the forehead also supported a pair of short massive horns." (Mantell.)

When living the Sivatherium must have resembled an immense Gnu, or Antelope, with a short thick head surmounted with two pairs of horns. The front pair of these horns were small, whilst those behind were probably palmated. The eyes were small, and it had a nasal proboscis, an organ unknown amongst the *Ruminantia*.

(Mantell, *Petrifactions and their Teachings; Journal of the Asiatic Society.*)

SKAPOLITH. [Scapolite.]

SKATE. [Raidæ.]

SKELETON (from σκελεω, 'I dry,') is the name applied to those harder parts of organised bodies which form the framework upon which the softer tissues are fixed. It is more particularly applied to the collection of bones which in an animal either serve as fixed points for the attachment of the soft parts, or form cavities for inclosing and protecting important organs, or constitute the apparatus of support and the passive instruments of voluntary motion.

In this article we shall confine ourselves to the description of the bones as they are found in the human body. In the article Vertebra will be found an account of the common plan of the Vertebrate Skeleton of Man, in relation to the lower animals, as well as of the plan on which the skeleton is constructed in the higher and lower animals.

The human skeleton is divided into three principal parts: the Trunk (2), the Head (1), and the Extremities (3 and 4). Neither the whole number of bones composing it nor that in each main division can be exactly stated, for many which are in early life separated, are subsequently united; but as an approximation, the following enumeration may be adopted:—Cranium, 8; face, 14; internal ears, 8; vertebral column, 24; chest, 26; pelvis, 11; upper extremities, 68; lower extremities, 64: in the whole, 223.

Fig. 1.

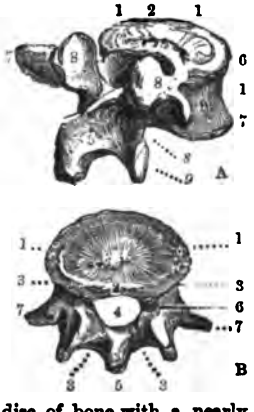
The Trunk is composed of the spine, or vertebral column (extending from *a* to *d* in the annexed *fig.* 2), the chest, including the ribs and sternum or breast-bone (*c*), and the pelvis, the circle of bones on which the spine rests. The spine is the column of bones which, in the erect posture, supports the head on its summit (*a*), and rests with its base (*d*) upon the sacrum. It consists of 24 bones, called vertebræ (from 'verto,' I turn), because it is their motion upon each other which enables the trunk to be turned round. Of the 24, the 7 upper (*a*—*b*) are called cervical, the 12 middle (*b*—*c*) dorsal, and the 5 lowest (*c*—*d*) lumbar vertebræ. With the exception of the

first two, they are all connected by interposed discs of a very elastic substance, the intervertebral cartilages.

Fig. 2.

The general characters of the Vertebræ may be best studied on one from the lumbar region; in which the following parts, common to nearly all of the 24, are well marked:—a body, a ring, a spinous process, two transverse processes, four articulating processes, and four notches. In the annexed plate two lumbar vertebræ are represented: that in the figure A, as seen obliquely from behind, from above, and from the right side; and that in the figure B, as seen from above and behind.

Fig. 3.



The Body (1) is a disc of bone with a nearly oval outline, larger above and below than at its middle, and having its greatest dimension from side to side. Its texture is spongy, invested with a thin layer of compact tissue. Its upper and lower surfaces, by which it is affixed to the two adjacent intervertebral cartilages, are nearly flat, and slightly marked by radiating lines. At its posterior border the oval outline is interrupted by a slight concavity (2), which forms a portion of the ring surrounding the spinal marrow, and in which there are several apertures larger than those on the rest of the body, for the exit of the veins from the interior.

To either side of the posterior part of the body, and near its upper border, is affixed one of the extremities of the arch (3) by which the

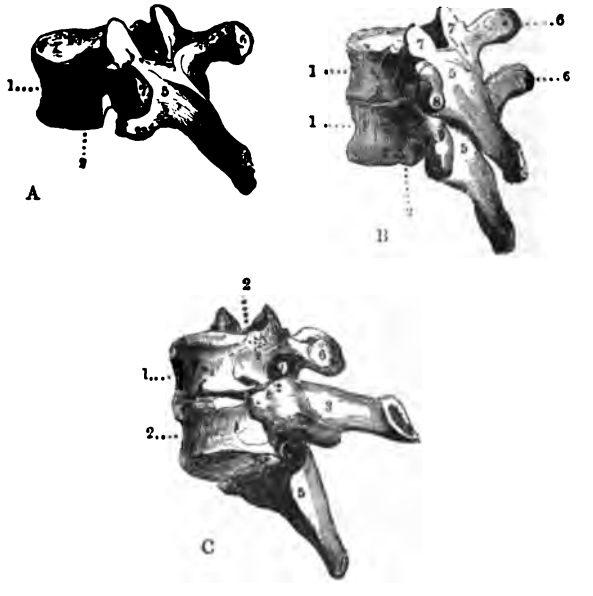
ring is completed behind. It is composed of two flat laminæ, which spring from the sides of the body, and meet at an obtuse rounded angle in the middle line behind, where they bear the spinous process (5). The space (4) included between the body and these laminæ is called the vertebral foramen; it is occupied by the spinal cord; it is of a somewhat triangular form, and in the lumbar vertebræ is of large size.

Close to the attachments of the laminæ to the body there is in each of their borders a rounded notch (6); and when the vertebræ are applied one on another, these notches form oval holes (the intervertebral foramina, see next figure (8), through which the spinal nerves pass, one pair going out between each two vertebræ. [Nervous System.] To the rest of the laminæ are attached the interlaminar ligaments, or ligamenta subflava, bands of very elastic tissue by which the spaces between the adjacent arches are filled up, and the spinal canal completed behind, as it is by the intervertebral cartilages before.

The Spinous Process (5) is a broad flat quadrilateral portion of bone directed horizontally backwards from the meeting of the laminæ. Its posterior border is thickened, and to it, as well as to the upper and lower borders, are attached strong ligaments binding the spinous process of each vertebra to those next above and below it. The transverse processes (7) project horizontally outwards on either side; they are thin and long, and are enlarged and rough at their ends, to which several strong muscles and ligaments are attached. The articulating processes are flat and oval; each has a smooth surface, by which it is connected with the corresponding part of the next vertebra above or below. The upper pair (8) are set most widely apart, and their articulating surfaces are concave and turned inwards; the lower pair (9) are nearer together, and have their articulating surfaces turned outwards. When the lumbar vertebræ are put together, the lower processes of each are locked within the upper processes of the one next below, so that scarcely any lateral or rotatory motion is in this part of the spine possible.

The Dorsal Vertebræ, which in the adjacent plate are drawn, as seen in A and B, from behind and from the left side, and in C from

Fig. 4.



before and from the same side, have the same general characters as the lumbar, but are distinguished from them by the following:—

The body (1) is small but deep, and longer from before backwards than in any other direction; its general outline is heart-shaped; it has at each border, just in front of the attachment of the laminæ, a shallow depression (2); and when the vertebræ are set together, the depressions on either side of each adjacent pair form one cavity, into which the head of one of the ribs (*O* 3) is received for articulation. The laminæ are broad and thick; the vertebral foramen is oval and small. The spinous process (5) is long and narrow, and projects obliquely downwards; those of adjacent vertebræ are imbricated at their bases (*fig. B*). The transverse processes (6) are long and directed backwards as well as outwards; each of them (except those of the two last vertebræ) has a smooth surface in front of its outer extremity, by which it articulates with the tubercle of the corresponding rib. The articulating processes (7), both superior and inferior, are equally wide apart; the former have their smooth surfaces turned backwards, the latter theirs forwards. The notches and foramina are smaller than in the lumbar vertebræ.

The Cervical Vertebræ, of which one is represented in the following cut, as seen from behind and above, are distinguished by the body (2) being small, broad, and shallow, and wider above than below. In its

upper surface also it has two elevations (1), between which the lower part of the vertebra next above is received. The laminæ (3) of the arch are long and narrow, and inclose a large somewhat triangular vertebral foramen (4). The spinous process is short and bifurcated. The transverse processes (6) are short, horizontal, and bifurcated; and each has a foramen at its base, through which the vertebral artery passes. The superior articular processes have their smooth oval surfaces directed backwards and inwards, and they receive between them the inferior processes of the vertebra next above, whose articular surfaces are turned in the opposite direction.

Fig. 5.

But these distinctive characters of the several sets of vertebræ are only general: they are merged at the extremes of each set, the lowest dorsal being very like the upper lumbar, and the upper dorsal like the lowest cervical. Some single vertebræ, moreover, have particular characters. The first of the cervical set, or Atlas, is scarcely more than a flat ring of bone with two long transverse processes, two superior articulating processes, with large oval concave surfaces opposed to those of the occipital bone, and two inferior, with large flat horizontal surfaces, which articulate with those of the second vertebra. By the former joint the chief movements of depression and elevation of the head upon the neck are permitted; by the latter, those of rotation. The second cervical vertebra (named Axis, or Vertebra Dentata) has a large pointed process, which rises from the upper part of its body, and is inclosed in a ring formed by the anterior half of the Atlas, and a transverse ligament passing from one side to the other of its body. In this ring the process of the Axis rotates freely; or rather, the Atlas, with the head supported on it, moves round that process, and upon the flat superior articulating surfaces of the Axis. The seventh cervical vertebra has a remarkably long spinous process, to which is attached the Ligamentum Nuchæ, a strong elastic band for the support of the head when inclined forwards, but which, as well as the spinous processes of all the adjacent vertebræ, is much more developed in animals that move horizontally and graze, than in man. This vertebra is also marked by having a small rib-like process in front of its transverse process; it is a rudimental rib, and is analogous to the cervical ribs of serpents and many other animals in whom the chest is more elongated than in man. The first and the last three dorsal vertebræ have each, at the upper borders of the body, surfaces for articulation with the whole head of the corresponding rib. The fifth lumbar has its lower surface cut obliquely upwards to articulate with the top of the sacrum and form the promontory of the pelvis.

Viewed as a whole, the human vertebral column forms a kind of pyramid with its base at the sacrum, and its truncated summit at the head. It is not however regularly pyramidal; for, as seen from the front, it becomes gradually smaller from the base to the fourth dorsal vertebra; then it widens to the seventh cervical, and then again becomes narrower to the second. In the adult it has well-marked curvatures. (Fig. 2.) From the head it is first curved slightly forwards to the last cervical vertebra; then its dorsal portion forms an arch with its convexity backwards and ending at the last dorsal; and then again in the lumbar region it arches forwards to the base of the last lumbar vertebra. These directions of the column have relations to the naturally erect posture of the human body [MAN]: in correspondence with them the bodies of the cervical and lumbar vertebræ, and their intervertebral cartilages, are thicker before than behind, and those of the dorsal thicker behind than before.

The Spine serves several offices in the economy. One is that of guarding the spinal marrow, which, with the roots of its nerves, is inclosed in the long canal formed by the superposed rings of the several vertebræ. The spini-cerebrate form of nervous system, which consists of a brain and longitudinal axis, both placed on the same side of the digestive canal, is intimately connected with all the rest of the organisation of the animals in which it exists; and being always inclosed in a skull and spinal canal, the vertebral column is taken as the most obvious character of the four classes of animals which have this plan of nervous system. These therefore, namely, Mammals, Birds, Fish, and Reptiles, are called *Vertebrata;* and the other portion of the animal kingdom, whatever be the plan of their nervous centres, *Invertebrata.*

The spine is also the main support of all the rest of the skeleton. The head, the ribs, and the pelvis directly articulate with it; and through the medium of the pelvis and sternum, it suspends both the lower and upper extremities. It is the passive instrument of all the motions of the trunk, and the centre about which each of the limbs as a whole is moved. For these purposes it is adapted by combining firmness with flexibility and lightness. Flexibility is obtained by its being composed of so many pieces separated from each other by layers of elastic tissue; and its strength is secured by these layers, which are at the same time firm bonds of union, and by numerous other strong ligaments passing from bone to bone. In its own movements, extent is combined with security by each vertebra (except the first) having but little motion on those next to it; the larger movements being the result of the combination of a number of such small ones. The directions of the processes and the diverse modes in which they are locked one within another, determine the degrees in which, in each part of the column, the several motions of flexion and extension in all directions, and of rotation, can be performed. The pyramidal form of the whole is adapted to the accumulated weight which the lower vertebræ have to bear. The curvature in the back increases the capacity of the chest. The spinous and transverse processes especially serve for the attachments of muscles of the head, chest, back, shoulders, and pelvis. The elastic cartilages interposed between the bodies break the shock of any violence upon one end of the body, and both they and the interlaminar ligaments tend to keep the spine straight, and so diminish the muscular action necessary to hold the body erect.

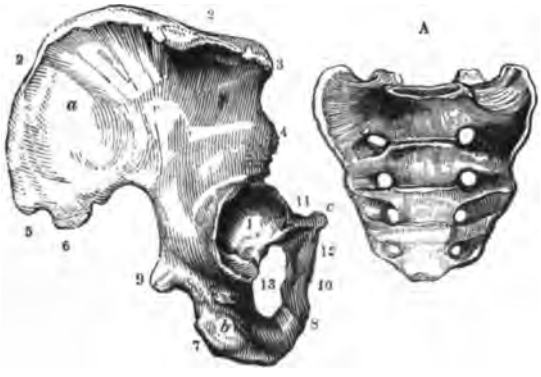
The base of the spinal column rests on the top of the Sacrum (*fig.* 2, 5), which, though commonly described as part of the pelvis, is indeed a continuation of the column, and is composed of five or six rudimental vertebræ, which after about the tenth year become consolidated. The Sacrum (*fig.* 6, A) has a triangular outline, the base being above; and it articulates with the last lumbar vertebra, so as to form an obtuse angle, the promontory, by means of an intervertebral substance and the other parts common to the rest of the vertebral joints. Its anterior surface, which in the erect posture looks obliquely downwards, is concave, and on it are four or five transverse lines, the traces of the divisions between the bodies of the original vertebræ. At each end of these lines are as many holes (the anterior sacral foramina), which give passage to the anterior branches of the sacral nerves. Outside these holes the Sacrum has a smooth surface composed of the coalesced transverse processes of its several vertebræ. Along the posterior convex surface the Sacrum presents corresponding traces of its composition. Its upper border is surmounted by two regularly-formed articular processes, which are connected with those of the last lumbar vertebra, and leading downwards from these, in converging lines on either side of the middle, is a series of slight elevations, the traces of other rudimental articular processes. Along the middle line are three or four higher ridges, the traces of spinous processes, and between these and the former are on either side four or five foramina, which give passage to the posterior branches of the sacral nerves. These and the anterior sacral foramina already mentioned are analogous to the intervertebral foramina; and they both lead into the sacral canal, which runs through the whole length of the Sacrum, and contains the cauda equina, or tuft of the last roots of the spinal nerves. The outline of the sacral canal is triangular; it grows smaller from above downwards, and is closed in behind by a layer analogous to the arches of the regular vertebræ. It is continuous above with the spinal canal, and below is, in the dry bones, open in the middle line, the arch of the last sacral vertebra being deficient; but in the recent subject is closed by dura mater and dense ligament. The sides of the Sacrum are thick above, and become gradually thinner below. In the former situation they are marked by large rough oval surfaces, directed backwards and somewhat outwards, by which the Sacrum is on either side articulated immoveably with the iliac bones to form the sacro-iliac symphyses. The lower end of the Sacrum has a plain oval surface, which is fitted to the upper surface of the first bone of the coccyx.

The Coccyx is the lowest part of the whole vertebral column. Its bones form the interior frame of the tail in brutes, but in man are small, short, and not more than four or five in number. The uppermost is by far the largest, and is surmounted by two processes called Cornua, the extremities of which are adapted to those of two similar processes by which the sides of the lower end of the sacral canal are bounded. The three or four lower pieces of the Coccyx have a somewhat oval outline, and are rather deeper than they are broad. Up to a late period of life they are articulated moveably with thin layers of interposed cartilage.

The Sacrum and Coccyx form the middle posterior part of the Pelvis; its sides and front are formed by the bones called Ossa Innominata (*fig.* 6, B). Each of these is in the young subject composed of three parts, which are usually described separately, as the Ilium, or Haunch-Bone (*a*), the Ischium (*b*), and the Pubes (*c*). These three meet at the acetabulum (1), the hemispherical cavity in which the head of the thigh bone is lodged, and of which the Ischium forms nearly three-fifths, the Ilium somewhat more than one-fifth, and the Pubes rather less than one-fifth.

The Ilium forms the upper broad and expanded part of the Pelvis. Its outline is somewhat fan-shaped, and in the greater part of its extent it is flat and thin. That surface which is directed forwards and inwards towards the cavity of the pelvis is slightly concave, and gives attachment to the strong iliac muscle by which the thigh is raised towards the pelvis. Its upper border has a thick strong rim (2), the crista ilii, to which parts of the three broad muscles of the abdomen are attached, and which serves for a fixed point towards

B Fig. 6.



which the ribs are drawn down by those muscles in strong expirations. The extremities of this rim, and the anterior and posterior edges of the ilium, into which it is continued, have at either end two strong projections for the attachment of muscles of the thigh, which are named Spinous Processes. In *fig.* 6, 3 is the anterior superior, and 4 the anterior inferior spinous process; 5 is the posterior superior spinous process, and 6 the posterior inferior. At the posterior part of the inner aspect of the Ilium is a rough oval surface, which is fixed behind that at the back of the sacrum, with which its fore part forms the sacro-iliac symphysis. (*Fig.* 2.) From the upper part of this symphysis a line, continuous with that of the top of the sacrum and the promontory of the pelvis, passes in a curve across the lower part of the ilium to the upper and inner edge of the pubes, along which it is continued to the middle line at the symphysis pubis. This line, by which the pelvis is divided into an upper and a lower cavity, is called the Brim, and the space it incloses is named the Upper Strait of the Pelvis. (*Fig.* 2.) At and just below the brim is the thickest part of the ilium; its inner surface, which is opposite the acetabulum, is smooth, and gives attachment to muscles of the pelvis and thigh. The outer and back surface of the Ilium (which is represented in *fig.* 6, B) forms the Haunch, that is, that expansion of bone which is felt above the hip-joint. It is marked by curved lines for the attachment of the strong glutei muscles of the buttock, and of the ligaments connecting it with the sacrum and last lumbar vertebra. At its lowest and narrowest part it swells outwards, and is then suddenly and deeply hollowed, to form the upper part of the wall of the acetabulum. In this cavity it is united with the pubes before, and the ischium behind, by flat surfaces, which in the adult bones are indicated only by slightly elevated lines tending to the deepest part of the cavity.

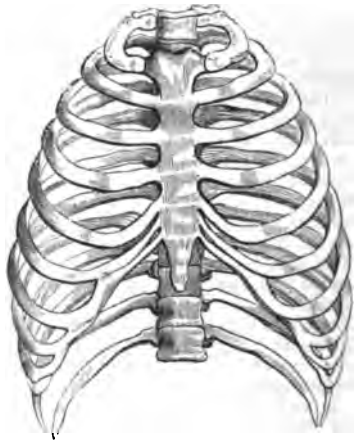
The Ischium is the bone on whose lowest part, or tuberosity, the body rests in sitting. It is described as composed of two principal portions: a body (7), consisting of the tuberosity and the thick strong part above it; and a ramus (8), which passes from the tuberosity obliquely upwards, forwards, and inwards. The upper part of the body is united to the lower part of the ilium, and its outer and anterior surface is deeply hollowed to form the lower and back part of the acetabulum. At its posterior and inner border there is a strong pointed process, the spine of the Ischium (9), to which one of the main ligaments of the pelvis, the lesser sacro-sciatic, is attached. Above the spine, the body of this bone and the adjacent posterior border of the ilium, as far as its posterior inferior spinous process, are cut out in a crescentic form; they thus form the ischiatic notch, and, with the ligament just mentioned and the outer border of the sacrum, inclose an oval aperture, the great ischiatic foramen, through which there pass from the pelvis to the thigh the pyriform muscle, and the gluteal, ischiatic, and pubic blood-vessels and nerves. Below the spine, another foramen, the lesser ischiatic, is inclosed between the same and another stronger ligament, the great sacro-sciatic, and the lower part of the body of the ischium; through this, together with some vessels and nerves, passes the internal obturator muscle, which, on its way to the femur, winds round a smooth oval surface on the back of the ischium directly below its spine. The posterior thick surface of the body is rough, for the attachment of muscles, especially those of the hamstrings, which form the greater part of the back of the thigh. From the lowest part of the tuberosity, and forming an acute angle with it, ascends the ramus, which at its anterior extremity (10) unites with the descending ramus of the pubes.

The Pubes forms the anterior part of each os innominatum, and is composed of a body (11), and a descending ramus (12). The body is the upper, anterior, and larger part. At its outer extremity it articulates with the ilium just below the anterior and inferior spine, from which it descends in an even gentle curve, over which the iliac and psoas muscles, the chief vessels, and one of the principal nerves of the thigh, pass beneath the crural arch. Its outer end is hollowed to form part of the acetabulum. The horizontal part of the body has a somewhat pyramidal form with three sides. Along its posterior and upper border is the line which forms part of the brim of the pelvis. Near the termination of this line is an elevation, the spine of the pubes, for the attachment of one end of the crural arch, the strong ligament already mentioned, whose other end is fixed to the anterior superior spine of the ilium. The inner ends of the bodies of the two pubic bones are opposed by flat oval surfaces, which, with ligaments and a strong intermediate cartilage, form the symphysis pubis. From below and on the side of this, the ramus descends outwards and backwards to meet the ascending ramus of the ischium, with which it forms one flat and thin beam. Between these rami below, the body of the pubes above and on the inner side, and the meeting of the pubes and ischium at the acetabulum on the outer side, is an oval aperture, the foramen ovale or obturatorium (13), which in the recent body is nearly closed by the obturator ligament, and of which the borders, as well as the surfaces of the ligament, give attachment to the two obturator muscles, which thence proceed to the back of the thigh-bone, which it is their office to rotate outwards. The space included between the rami of the pubes and ischia on either side and in front, and the great sacro-sciatic ligaments, passing from both borders of the sacrum and coccyx to the tuberosities of the ischia, behind, is named the Lesser Aperture, or Strait of the Pelvis. The meeting of the two rami in the middle line makes the angle of the pubes.

The general purposes served by the pelvis are—to support the abdominal viscera, to inclose and guard those in its own cavity, to give insertion to muscles of the abdomen, back, and thighs, and to be such an intermedium between the rest of the trunk and the lower limbs that the latter may move freely and yet firmly support the body. In all its dimensions it is larger in women than in men.

The last main division of the trunk is the Chest, or Thorax, composed of the dorsal vertebræ behind, the sternum in front, and the twelve ribs and their cartilages on either side. (*Fig.* 7.) All the Ribs articulate with the Spine, but only the seven uppermost on each side have distinct connections with the sternum; these are therefore called True Ribs, and the five lower on each side False Ribs. Of these last the three upper have their cartilages united before they reach the sternum; and the two lower, which are sometimes called Floating Ribs, have short cartilages, which are not attached to the sternum at all.

Fig. 7.

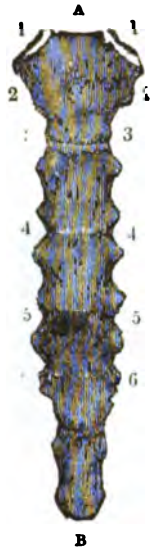


In each of the greater number of the Ribs there are a head, a neck, a tuberosity, an angle, a body or shaft, and a cartilage. The head is that part which articulates with the vertebral column. It is larger than the neck, and its articulating surface has a somewhat oval outline, and is divided into two parts by a transverse elevation. This elevated line corresponds to the intervertebral cartilage, to which it is affixed by a ligament. The motion permitted at the joint between the head of the rib and the border of each of the vertebræ next above and below it is not extensive; but it is sufficient to give the body of each rib, which has the relation of a long lever to the joint as a fulcrum, a wide sweep outwards and upwards in the act of deep inspiration. Proceeding onwards from the head, and passing over the neck, which is the smallest and roundest part of the rib, the next object is the tubercle, an elevation on the posterior surface, by which the rib is articulated with the end of the transverse process of the vertebra next below it. Farther outward is the angle, an oblique projecting line at which each rib turns somewhat more upwards and becomes flatter. The remainder of the rib is its shaft. This is thin and flat; its surfaces are both nearly smooth, the outer being slightly convex, the inner as slightly concave; the upper edge is rounded; the lower (which is also directed somewhat outwards) is sharp, and, from the angle inwards, is grooved on its inner aspect, where the intercostal vessels and nerves lie. The end of the osseous part of each rib has a rough surface, to which is adapted one end of the costal cartilage, of which the other end (except in the instances already mentioned) is attached to the sternum. The costal cartilages have each the same general form and direction as the part of the rib to which they are

appended; they may be regarded as mere prolongations of the ribs, the purpose of their being cartilaginous instead of bony being that of giving more elasticity to the walls of the chest. Each of them, except the first, is articulated with a slight capacity of motion to a depression on the border of the sternum.

The Sternum, or Breast-Bone, is single only in the adult; in youth it is composed of at least two pieces (of which the upper, *fig.* 8, A, is named Manubrium), and in the fœtus of many more. Considered as one bone, its form is elongated, broader and thicker above than below, where it terminates in a long narrow process, which is generally carti-

Fig. 8.



laginous, and is named the Ensiform or Xiphoid Cartilage (B). The anterior surface of the sternum is marked by four transverse lines (3, 4, 5, 6), which indicate the divisions between the five principal parts of which it is composed. These marks are repeated on the posterior surface. Along its borders, there are (proceeding from above downwards), first, at each of the angles between its upper and lateral edges, a shallow depression (1), into which the extremity of the clavicle is received; then immediately below this an oval depressed surface (2), to which the cartilage of the first rib is fixed; and lastly,

Fig. 9.

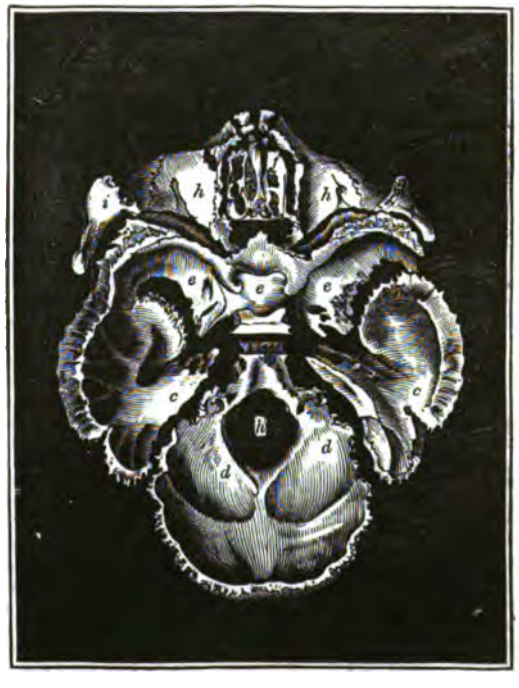
along each side six other similar surfaces separated by notches, with which the cartilages of the six following ribs articulate. Of these six, the upper four are placed at the ends of the transverse lines; so that each of these ribs articulates at its sternal end with two pieces of the sternum, just as, at its other extremity, it articulates with two vertebræ. [Respiration; Lungs.]

The Bones of the Skull are divided into two chief sets—those of the Cranium, or case for the brain, and those of the Face. They are represented in the annexed sketches separated, yet in their natural relative positions, in three different aspects: in *fig.* 9, as seen from the front; in *fig.* 10, as seen in profile; in *fig.* 11, as seen when, after removing the top of the skull, one looks from above upon the bottom of its interior.

The Bones of the Cranium are—the Frontal (*a*), the two Parietal (*b*), the two Temporal (*c*), the Occipital (*d*), the Sphenoid (*e*), and the Ethmoid (*f*); those of the face are—the two Nasal (*g*), the two Superior Maxillary, or Upper Jaw-bones (*h*), the two Palate, the two Malar (*i*), the two Lachrymal (*j*), the two Inferior Turbinated, the Vomer (*k*), and the Inferior Maxillary (*l*).

Fig. 10.

Fig. 11.

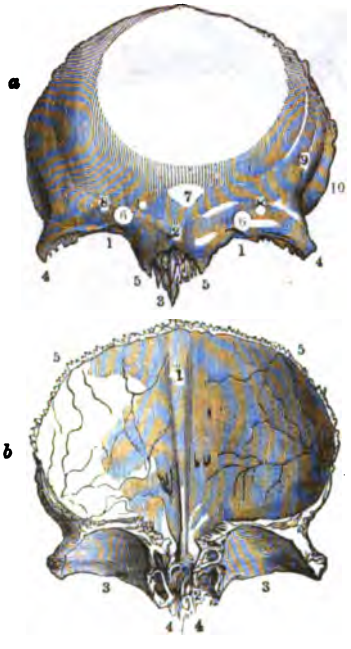


The Frontal Bone (*fig.* 12, *a*, *b*) forms the Forehead and the roof of the Orbit. The front or frontal portion is the larger. Its anterior surface, which is represented in *fig.* *a*, is convex and smooth; it is bounded below by two arched, thick, and rounded borders, separated by a rough notch in the middle line. The borders (1, 1) are called

the orbital arches or ridges, and they form the front and prominent part of the orbits. The notch (2) is named the nasal notch; on either side of it are fixed parts of the upper jaw, and in the middle the nasal bones, which rest behind on a process called the nasal spine (3). At the outer extremity of each orbital arch is the external angular process (4, 4), and at the inner extremity the internal angular process (5, 5); the former is articulated with the malar, the latter with the upper jaw and lachrymal bones. Near the internal process is the Supra-Orbital Foramen, or notch (6, 6), through which the frontal vessels and nerve pass from the orbit to the forehead. Just above it, and by its side, is a rounded elevation, the frontal protuberance (7), which marks the situation of the subjacent frontal sinuses, air-cavities, between the two layers of which the bone is composed. They vary much in size in different persons, and communicate with the interior of the nose. On either side of the middle line, and extending above the orbital ridge, the surface of the bone is again elevated in the superciliary ridge (8, 8), an arched prominence behind the eyebrow. The rest of this anterior surface is smooth and even, but in different persons its form is as varied as that of any other feature. On either side it terminates rather abruptly with a curved border (9), which forms the front boundary of the temporal fossa (10), and behind which there is a smooth surface, to which the fore part of the temporal muscle is attached.

The posterior or cerebral surface of the Frontal bone (*fig.* 12, *b*) is concave. Along the middle line there is a broad groove (1), in which a part of the longitudinal sinus [BRAIN] lies; and at the fore and

Fig. 12.



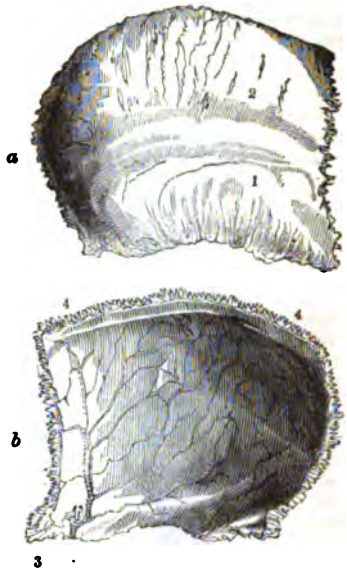
lower end of this a ridge, to which a process of dura mater called the Falx is attached. The ridge ends at a hole named the Foramen Cæcum. The rest of this surface is marked by depressions and ridges fitting to the convolutions of the surface of the brain.

The orbital portions (*b*, 3, 3) of the frontal bone are thin plates extending almost horizontally backwards from the orbital arches. Between their inner borders is a space, the ethmoid notch, into which the ethmoid bone fits, and just anterior to which are the apertures (4, 4) leading into the frontal sinuses. The under surface of each plate is concave, smooth, and even; and has at its outer and fore part a shallow depression, in which the lachrymal gland is lodged, and at its inner and fore part a mark to which the pulley of the trochlearis muscle of the eye is attached. The upper surface is marked in correspondence with the irregularities of the under part of the anterior lobe of the brain, which rests upon it.

The posterior and upper margin of the frontal bone (*b*, 5, 5) is joined by the coronal suture to the two parietal bones; and it is cut obliquely in such a manner that its edges rest upon theirs above, and theirs overlap its below. The lower part of this margin is covered by the ala of the sphenoid, where they rise into the temporal fossæ. The frontal is usually in the adult only a single bone, composed (as all the bones in the middle plane of the skeleton are) of two equal and similar halves: these are developed separately, and they sometimes remain undivided by a continuation of the sagittal suture which passes from between the two parietal straight down the middle of the frontal.

The construction of the Parietal Bones, which form all the upper and middle part of the skull, is very simple. In *fig.* 13, at *a* the exterior, and at *b* the interior, of the right parietal is represented. They are quadrilateral, and of nearly equal thickness throughout. The outer convex surface is everywhere smooth, except at its lower border (1), where it is overlapped by the temporal bone in the squamous suture, and just above this part, where there is a slight arched ridge (2) for the attachment of a portion of the temporal

Fig. 13.



muscle. The inner concave surface has impressions of the cerebral convolutions, and a deep branching groove, which, beginning at the fore and lower angle (3), thence ramifies diffusely. It lodges the middle meningeal artery of the dura mater. [BRAIN.] Along the upper border is a broad shallow groove (4), which lodges part of the longitudinal sinus, and is continuous with that on the interior of the frontal bone. The borders of the parietal bones are all, except the lower, deeply and irregularly indented; and by the dove-tailing of such irregular teeth they form, with the frontal bone in front, the coronal suture, with the occipital behind, the lambdoidal, and, in the middle line at their own meeting, the sagittal.

The Temporal Bones (*fig.* 14, as seen from without) are placed in the middle, lateral, and inferior parts of the skull. They present each three distinguishable parts, which in the fœtus are separated—namely, a Squamous portion (1), which forms the middle of the side of the skull; a Mastoid portion (2), which forms the thick protuberance that may be felt behind the ear; and a Petrous portion (not visible in *fig.* 14, but in *fig.* 11 marked *c*), which passes from the lower part of the squamous forwards and inwards in the base of the

Fig. 14.

skull. The squamous bone or portion has a roundish form. Its upper edge covers in the lower border of the parietal. Its exterior surface is smooth, and gives attachment to some of the temporal muscle. At the hinder part of its lower border is an oval aperture (3) leading to the Meatus Auditorius Externus [EAR], a passage which goes forwards and inwards to the tympanum in the interior of the petrous portion. Immediately anterior to this, and under the fore part of the bone, is the Glenoid Cavity (4), a deep transversely oval hollow, with which the condyle of the lower jaw is articulated, and behind which is a narrow chink, the Fissura Glaseri, separating it from a strong ridge which runs along the upper surface of the petrous bone. In front of the glenoid cavity is a prominence, which forms its border, the Tuber Articulare (5); and from its outer part there proceeds horizontally forwards, as if springing from the tuber and two other slightly elevated lines running backwards, a long narrow portion of bone, the Zygomatic Process (6), the enlarged end of which joins a short process of the malar bone to form the Zygoma, an arch beneath which the temporal muscle plays, and whose size and strength are generally in direct proportion to those of that muscle, and to the force with which the lower jaw is worked in gnashing with the teeth.

Behind the meatus auditorius is the Mastoid portion. It is prolonged downwards in a strong conical projection, the mastoid process (7) giving insertion to muscles upon and just above it, and of which the interior is occupied by numerous cells communicating with the cavity of the tympanum. Behind and within the mastoid process is the digastric groove, to which the muscle of the same name is attached; and farther back another more shallow groove for the trachelo-mastoid muscle.

The cerebral surface of the Squamous Portion has a very obliquely cut and grooved upper border, which articulates with the lower border of the parietal bone. On the same surface of the mastoid portion is a deep fossa, which lodges part of the lateral sinus. Both are marked by the impressions of the brain.

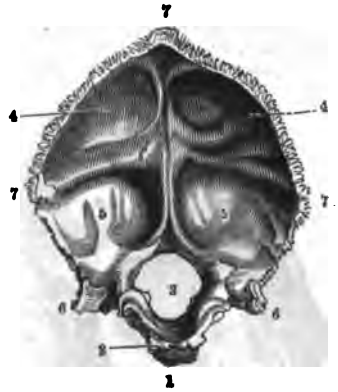
The Petrous Process or portion of the temporal bone (*fig.* 11, *c*) has received its name from the peculiar hardness of its tissue. It has the form of an irregular three-sided pyramid, directed from either side forwards and inwards, and fitting, at the base of the skull, into the angle left between the sphenoid and the occipital bones (*e* and *d*). Its base is affixed to the interior and lower part of the squamous bone; its summit fits in the apex of the angle just mentioned. On its posterior surface the most prominent object is the oval aperture of the meatus auditorius internus, the passage leading to the internal ear, and traversed by the auditory and the facial nerves. On the anterior surface there are a shallow groove leading to a small hole, through which the Vidian nerve and bloodvessels pass, a slight hollow on which the Gasserian ganglion of the fifth pair of nerves lies, and a prominence which indicates the position of the superior semicircular canal of the ear. On the inferior surface, which is placed outside the skull, there are seen, at the posterior and outer border, a deep fossa (the Jugular), in which the upper part of the internal jugular vein is lodged; before and on the inner side of this, and separated from it by a prominent ridge, a large oval aperture, through which the internal carotid artery passes into a tortuous canal, whose other extremity is at the very apex of the bone; between the jugular fossa and the mastoid process a hole, the Stylo-Mastoid Foramen, through which the facial nerve passes on its way to the face, after penetrating the bottom of the meatus auditorius internus; and just anterior to this, a long pointed process, the Styloid (8), to which several muscles and ligaments are attached, and whose base is surrounded by an irregular sharp-edged elevation, the Vaginal Process (9).

The anterior border of the Petrous Bone is articulated with the posterior part of the ala of the sphenoid, leaving an intermediate space, named Foramen Lacerum Medium; the posterior border is similarly united with the side of the basilar process of the occipital bone, leaving another space, the Foramen Lacerum Posterius, through which the internal jugular vein and the nerves of the eighth pair pass. Near the angle where the anterior border joins the squamous bone is an irregularly-shaped aperture, to which the cartilaginous part of the Eustachian tube is affixed.

The small bones of the internal ears, and all the other parts of the organ of hearing, which lie within and near the petrous bone, are described in the article EAR.

The Occipital Bone (*fig.* 15 is a view of the internal surface) forms the posterior and lower part of the middle of the skull, a portion being at the outer wall and a portion at the base. Its lower and

Fig. 15.



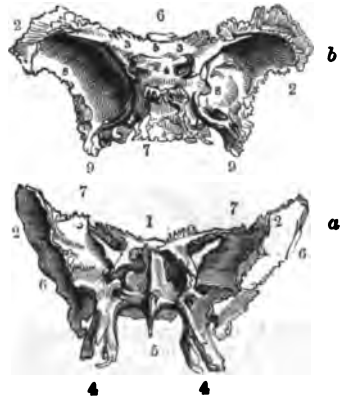
anterior part is narrow, and has a rough surface (1) in front, which is united with the body of the sphenoid bone. Viewing it at its internal surface, it presents, as one proceeds from this surface backwards and upwards, a smooth hollow surface, which gradually widens, and is limited behind by a large oval opening. The surface 2 is that of the Basilar Process, in which the medulla oblongata and pons varolii [BRAIN] rest; the aperture 3 is the Foramen Magnum, through which the medulla passes into the spinal canal, where it is continued into the spinal cord. By the sides of this foramen, near where the basilar process joins the back and expanded part of the bone, there are four foramina, two on either side—the anterior and posterior Condyloid Foramina, of which the anterior transmit the hypoglossal nerves, on which the motions of the tongue depend, and the latter give passage to veins communicating with the vertebral veins. Opposite the fore part of the foramen magnum the basilar process suddenly widens into the greater portion of the occipital bone, which forms the back of the head. In this part are four large hollows (4, 4, 5, 5), of which the two upper lodge the surfaces of the posterior lobes of the cerebrum, the two lower those of the lobes of the cerebellum. They are separated by two ridges, which bisect each other at nearly right angles. The upper part of that which runs vertically has attached to it a portion of the falx major, and to its lower part is affixed the falx cerebelli; that which runs transversely gives insertion to the back part of the tentorium cerebelli, whose anterior borders are fixed to the upper angles of the petrous bone. By these ridges are broad shallow grooves, which lodge parts of the sinuses of the brain. By the upper half of the vertical ridge is the extremity of the longitudinal sinus, the grooves for which, in the frontal and parietal bones, have been already mentioned, and which, at the internal occipital spine, where the ridges bisect each other, meets the inferior longitudinal and other sinuses, to form what is named the Torcular Herophili, their common point of meeting. From this there proceed the two lateral sinuses, which run above the transverse ridge on either side, then cross over the posterior inferior angle of each of the parietal bones, then lie for a short distance on the inside of the mastoid portion of the temporal, from which they pass through the foramen lacerum posterius by a special aperture, marked by a deep notch in the border of the occipital bone, near the angle (6), which separates the basilar from the other portion.

The inferior and outer surface presents on the Basilar Process numerous irregularities, from which the back part of the pharynx is suspended, and into which certain muscles and ligaments of the front of the spine are inserted. The Foramen Magnum has here an even and grounded border; and by its sides two elevations, each with a smooth convex oval surface, whose larger axis is directed forwards, inwards, and downwards; these are the Condyles, by which the occipital bone articulates moveably with the first vertebra of the spine. Near these also are the outer orifices of the anterior and posterior condyloid foramina, and around them very rough surfaces for the insertion of ligaments and muscles. On the outer surface of the expanded posterior portion of the bone are three ridges, one of which passes from the border of the foramen magnum backwards and upwards in correspondence with the internal vertical ridge, and is crossed on its way by two transverse arched ridges. At the crossing of the upper of these two is a sharp prominence, the occipital spine or protuberance. The two transverse ridges and the spaces below them give attachment to muscles; the spine, to the ligamentum nuchæ. Above the upper ridge the surface is smooth.

The upper and lateral borders (7) of the Occipital Bone are deeply toothed, and form the Lambdoidal Suture, with the parietal bones above and the mastoid below. In the course of this suture there occur, more often than in that of any other, insulated portions of bone, of various size and form, called Ossa Wormiana, surrounded by margins toothed as in the regular line of suture.

The Sphenoid Bone (*fig.* 11, *e*) is placed in the middle of the base of the skull, and has a very complicate form. *Fig.* 16, *a*, gives a front,

Fig. 16.



and *b*, a back and upper view of it. Its principal parts are described as a body (1, 1), two Greater Alæ (2, 2), two Lesser Alæ (*b*, 3, 3), and, on each side, two Pterygoid Processes (*a*, 4, 4). The body is the central part, and has somewhat the form of a hollow cube. The chief part of its upper or cerebral surface is hollowed, forming what is called the Sella Turcica (*b*, 4), and lodging the pituitary gland. [BRAIN.] It is bounded at its four corners by bluntly pointed prominences called Clinoid Processes (see *fig.* 11), to which prolongations of dura mater are attached. Between, and a little in front of the two anterior of these, is a level surface (*b*, 5) on which the commissure of the optic nerves rests, and which has behind a slight elevation, the

Olivary Process, and in front a pointed one, the Ethmoid Spine (*b*, 6) which fits into the Ethmoid Bone. The sides of the body slope obliquely downwards towards the great alæ, and the cavernous sinus and internal carotid artery of each side rest against them. The posterior surface (*b*, 7) of the body is rough, and unites with the end of the basilar process of the occipital. The anterior presents the openings of large cells which occupy the whole interior. These are divided by a middle septum (*a*, 5), and are partly closed in by two small portions of bone called Sphenoidal Cornua; where not thus closed, they open into the posterior ethmoidal cells. The under surface of the body is chiefly flat, but has a ridge called the azygous process along the middle line, which nts to the Vomer.

The Greater Alæ (2) are affixed by the sides of the body, and project from it outwards, upwards, and forwards. On each there are three principal surfaces, turned towards the brain, the temple, and the orbit, respectively. The inner or cerebral (*b*, 8) is concave, supports part of the middle lobe of the brain, and presents three particular orifices, namely, the foramen rotundum, near its anterior and inner margin, through which the superior maxillary nerve passes from the Gasserian ganglion of the fifth pair; the foramen ovale, much larger and near the posterior and inner border, through which the inferior maxillary nerve goes from the same ganglion; and the foramen spinosum, near the outer and posterior angle, which transmits the middle meningeal artery. This outer angle (*b*, 9), which fits in between the petrous and squamous parts of the temporal bone (see *fig.* 11), is named the spinous process. The outer or temporal surface (*a*, 6) is slightly hollowed, and forms part of the temporal fossa, rising up at the lower part of the side of the skull as far as the anterior inferior angle of the parietal bone. At its lower border it turns abruptly inwards at a slight ridge, below which it is continued to the pterygoid processes, and forms part of the zygomatic fossa; its posterior border articulates with the squamous, its anterior with the frontal bone. The anterior or orbital surface (*a*, 7) is flat and smooth, and forms part of the outer wall of the orbit, where it articulates with the malar, frontal, and upper jaw bones.

The Lesser Alæ (*b*, 3, 3) are long, narrow, sharp-pointed processes projecting horizontally outwards from the front and upper part of the body. Internally and behind they bear the anterior clinoid processes, beneath which are the optic foramina for transmitting the ophthalmic arteries and the optic nerves from the commissure to the orbit. The upper surface of these alæ is flat, and supports part of the brain. The anterior border is articulated with the orbital plates of the frontal bone on either side, and in the middle, where the ethmoidal spine projects, with the ethmoid bone. The posterior border lies in the Fissura Sylvii, between the anterior and middle lobes of the brain. The under surface is smooth: between it and the anterior edge of the great alæ is a gap, the foramen lacerum anterius, transmitting nerves and a vein to the orbit.

The Pterygoid Processes (*a*, 4, 4) are directed downwards from the under and outer part of the body. On each side there are two lamellæ, an external and an internal; they are long and narrow quadrilateral plates nearly meeting in front, where they articulate with the palate bone, and diverging behind so as to leave a space, in which the internal pterygoid and circumflexus palati muscles are attached. The internal and longer of the lamellæ has at its lowest extremity a hook, the Hamular process, round which, as on a pulley, the tendon of the last-mentioned muscle plays. At the upper part, where the pterygoid processes join the body, is a canal, the Vidian, running from before backwards and transmitting the Vidian nerve.

The Ethmoid Bone (*fig.* 11, *f*) is situated in the front and middle part of the base of the skull, between the orbits. *Fig.* 17 gives a profile view of it from the left side. It presents six different aspects,

Fig. 17.

and for the most part is of a very light spongy texture. Its upper surface, which is presented to the brain, has in front and in its middle line a strong triangular process, the Crista Galli (1), to which the front of the falx cerebri is attached. The apex of this process is directed straight upwards; the base is continuous below with the perpendicular or nasal plate (2), which divides the ethmoid bone into two equal lateral halves, and which, with the Vomer, which it joins below, forms the greater part of the Septum of the nose. The Crista Galli, sloping downwards and backwards, is gradually lost behind, where the Ethmoid bone receives the spine of the sphenoid. On either side of it is a narrow quadrangular plate (the Cribriform Plate), on which the bulb of one of the olfactory nerves rests. Each is perforated by a number of holes through which the branches of the olfactory and another smaller nerve pass to the interior of the nose. In front, and along part of the border of each plate, are the orifices of numerous cells, which, in the entire skull, are closed in by the frontal bone and its orbital plates, and communicate with the frontal sinuses.

The surface of the upper part of each side of the ethmoid bone is formed by a thin smooth quadrilateral plate, the orbital plate (3), which forms great part of the inner wall of the orbit, and unites above with the corresponding plate of the frontal (leaving two small apertures, the anterior and posterior internal orbital foramina, for the passage of small nerves and vessels), in front with the lachrymal, below with the orbital portions of the upper jaw and palate bones, and behind with the sphenoid. Between the orbital and nasal plates, each half of the bone is formed of cells and folds of very thin lamellæ, which form part of the chambers of the nose, and have the olfactory membrane and nerves spread out upon them. [Smell.] The principal parts are the middle turbinated or spongy bone (4), a roll of thin bone, which forms the lower border of the cells; and a smaller but similar roll higher up, and confined to the back part, called the superior turbinated or spongy bone (5). Under each roll at its posterior part is a passage to the cells, called respectively the Superior and the Middle Meatus of the nose. The ethmoidal cells communicate in front with the frontal, and behind with the sphenoidal cells or sinuses.

The six bones just described inclose the Brain, forming a cavity whose size, compared with that of the crania of brutes, is one of the most distinguishing marks of the human species. [Brain.]

The formation of the sutures seems to have the same end. The outer tables of the exposed bones have their edges finely dovetailed, and are thus so immoveably held together that none but a violently expansive force exercised at once on the whole interior of the cavity can separate them. The inner tables are simply apposed with a very thin intermediate layer of cartilage; an arrangement which, as Sir Charles Bell (who has written most ingeniously on this subject in his 'Animal Mechanics'), says, is often imitated in works of art, in which tough materials, such as wood, are joined by mutually fitting dentations; and brittle ones, such as glass or marble, by smooth edges and a layer of cement. A similar mode of opposition is seen between all the bones of the skull that are not exposed to direct violence.

The top of the skull presents transversely an arched formed by the two parietal bones (*fig.* 9), whose most prominent parts, like those of the frontal, occipital, and others, are stronger and thicker than any others; a circumstance adapted for greater resistance to force, whether applied directly against those parts, or to the summit of the arch, from whence it would fall chiefly on them. The strength of this arch is further secured by the lower parts of the parietal bones being held in by the overlapping upper borders of the temporal and sphenoidal bones, other parts of which, passing across the base of the skull, hold the parietal bones, which by pressure from above might be made to start outwards or pushed inwards, as beams hold the walls of a house from being driven either in or out by the weight of the roof. Taking the whole upper part of the skull as a dome, the same strength of resistance to superincumbent pressure is obtained at every part by nearly similar means, especially at the coronal suture, where, as has been already said, the parietal bones overlap the frontal at the supports of its arch, and are themselves overlapped by it at the summit of their own. In this regard also may be noticed the strength and thickness of the angular processes, and of the orbital arches extended between them (*fig.* 11), which serve as supports for the front of the dome; and the thickening of the bones along the course of the longitudinal and lateral sinuses, resembling groins in masonry.

The second chief division of the Skull includes the bones of the Face, the principal of which are represented in *figs.* 9 and 18.

The Nasal Bones (*figs.* 9, 10 18, *g*) form the upper part of the bridge of the nose. They are narrow and quadrilateral; thick above, where

Fig. 18.

they fit into the nasal notch of the frontal bone; broad and thin below. The outer border of each articulates with that of the ascending process of the upper jaw-bone; the inner is in contact with that of the

other; the lower are in contact with the cartilages that form the rest of the groundwork of the nose. The anterior surface is concave from above downwards, and convex from side to side; the posterior has opposite directions, and in the middle line, where the two bones are in contact, is applied on the nasal spine of the frontal, and the edge of the perpendicular plate of the ethmoid bone.

The Superior Maxillary or Upper Jaw Bones (*figs.* 9, 10, 18, *h*) form the greater part of the front of the face. *Fig.* 19 gives a view of the outer part of that of the left side. This surface is bounded below by a narrow border, the Alveolar Border or Process (1), in which the upper teeth are set in their sockets. Its outline is an elliptical arc, and from it the outer surface ascends to the orbit, of which it forms the inner and great part of the lower margin (2). It is unevenly depressed in two or three places for the attachment of muscles of the face. At the outer part, near the orbit, it presents a rough surface, the Malar eminence (3), by which it is united with the cheek-bone. Below and in front of this is a depression called Fossa Canina, and on its inner side, just below the orbital margin, is the infra-orbital foramen, through which the superior maxillary nerve passes to the face. The anterior border of this external surface first ascends vertically where the two bones are in contact in the middle line (*fig.* 9); then is suddenly cut out in a crescentic arch (4), so as to leave between the two the large aperture into the nasal cavities, and then again ascends where the upper maxillary bone unites with the nasal of the same side. This ascending part is called the Nasal Process (5); its summit is fixed in the nasal notch of the frontal bone; its outer surface looks towards the orbit, is deeply grooved, and with the lachrymal bone, to which its posterior border is attached, forms a channel for the lachrymal duct; its inner surface is directed towards the cavity of the nose, has an oval roughness which is united with the inferior turbinated bone, and above closes some of the anterior ethmoidal cells. Below and behind the malar eminence the surface is excavated to form part of the zygomatic fossa; and above this it swells out, and is perforated by numerous foramina, through which the nerves of the upper teeth pass.

Fig. 19.

The upper, or orbital, surface (6), consists of a thin plate, forming the floor of the orbit, and presenting a groove which leads to the infra-orbital canal, and a depression for the insertion of the inferior oblique muscle of the eye. The under or palatine surface is rough and concave, and forms part of the roof of the mouth. Its outer border is arched, and bounded by the alveolar process; the inner is straight, and is set against that of the opposite side in the middle line; the posterior is united with the corresponding process of the palate bone. The inner or nasal aspect presents below a rough surface, by which the bone is united to its fellow on the opposite side, and which is deeper in front than behind. It is surmounted by a ridge which extends from before backwards, and between which and that of the other bone is a narrow groove to receive the vomer. The anterior part of the ridge (7) is called the Anterior Nasal Spine, and close by it is the Foramen Incisivum, which leads down to the roof of the mouth, and transmits the anterior palatine nerve. On the outer side of the ridge is a concave smooth surface, the upper surface of the palatine process, of which the lower surface forms, as already said, the roof of the mouth. From the outer part of this surface, which forms part of the floor of the nostrils, the bone rises almost vertically towards the nasal spine and the inner edge of the orbital plate, and, at about its middle, presents a large aperture leading into the Antrum Highmori, a cavity occupying the whole interior of the body of the bone.

The Palate Bones (*fig.* 20) are placed backward between the superior maxillary and the pterygoid processes of the sphenoid. The lower horizontal or palatine portion (1) of each is attached behind the palatine process of the upper jaw, to which it is similar in form, and it completes the back part of the roof of the mouth, or hard palate, and of the floor of the nostrils. Its posterior border has the Velum Palati [Palate] attached to it: its under surface presents two foramina, through which the posterior palatine nerves pass. From its outer border a thin plate (2) ascends vertically; where it commences there is, behind, a rough process (3), articulating with and filling up the gap between the pterygoid processes of the sphenoid. (*Fig.* 16, *a*, 4, 4.) The nasal or inner surface of this ascending portion articulates with the inferior turbinated bone, and forms part of the outer wall of the nostrils; the outer surface articulates with the back and inner part of the superior maxillary bone, and forms with it the posterior palatine

canal. The upper border has a notch, which, in the entire skull, is completed by the sphenoid bone into a hole, called the Spheno-Palatine, for the transmission of nerves of the same name: behind it is a triangular process (5), of which one surface articulates with the body of the sphenoid; and before it is another (4), of whose surfaces one closes some of the ethmoid cells, and another forms a small part of the back and floor of the orbit.

Fig. 20.

The Malar, or Cheek Bones (*figs.* 9, 10, 18, *i*) form the most prominent part of the cheeks. The form of each is quadrangular. The front surface is slightly convex, and has small apertures for vessels and nerves: the back covers the front of the zygomatic fossa; the upper surface is the narrowest, and forms part of the floor of the orbit, of which also part of the front border is formed by the upper margin of this bone. By its posterior surface and inner border the malar is united to the upper jaw-bone, as already described; and by its posterior and outer angle to the zygomatic process of the temporal bone (*fig.* 14, 6), with which it forms the zygoma.

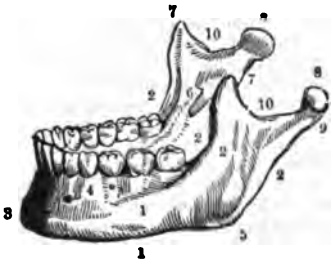
The Lachrymal Bones (*fig.* 10, *j*) are two small thin lamellæ of bone at the fore part of the inner wall of the orbit. Each of them in some measure resembles a thumb-nail, whence they are also called Ungual Bones. Each is composed of two parts: the anterior is deeply grooved on the surface turned towards the orbit, and contributes to the formation of the lachrymal canal with the nasal process of the upper jaw-bone, with which its anterior margin articulates. The posterior part is flat, and closes those of the ethmoidal cells which lie anterior to its orbital plate. The posterior margin of this part articulates with the ethmoid bone, the upper with the orbital plate of the frontal, and the lower with that of the upper jaw-bone.

The Inferior Turbinated or Spongy Bones are thin rough lamellæ, whose lower border is rolled up somewhat like a scroll. They lie within the nasal cavities, and, except in being larger, they closely resemble the bones of the same name which are appended to the ethmoid. They are attached at either end to the inner surfaces of the nasal processes of the upper jaw and palate bones, and, in the middle, to the lachrymal and the lower portion of the orbital plate of the ethmoid bone: upon these they are suspended before the aperture of the Antrum, which, in the entire skull, they nearly conceal. Like all the bones which form part of the cavities of the nose, they are covered by mucous membrane. Beneath their outer concave surface runs the inferior meatus of the nose.

The Vomer (*fig.* 9, *k*) is a thin quadrilateral plate which forms a considerable part of the middle partition of the nose. Its upper border is the thickest, and is articulated with the azygos process and under surface of the sphenoid bone; the lower border fits into the groove between the ridges in the apposed surfaces of the palatine processes of the upper jaw and palate bones; the anterior joins the vertical part of the ethmoid above, and the cartilaginous part of the septum of the nose below: the posterior is free, and divides the passage from the nostrils into the pharynx behind.

The Inferior Maxillary, or Lower Jaw-Bone (*figs.* 9, 10, *l*, and *fig.* 21), has a form something like that of a horse-shoe. It is made up of a

Fig. 21.



body or horizontal portion (1), and a ramus or ascending portion (2). The former is convex anteriorly, and on its very front presents the prominence which contributes to form the chin (3). This is marked in the middle line by the Symphysis, at which the two portions of which the jaw was first composed are united. On either side of this is a slight depression, the Fossa Incisiva; and farther out a hole, the mental (4), through which branches of the inferior dental nerve and vessels pass to the chin. A raised line, giving insertion to muscles, passes hence obliquely outwards to the upper border; and on the

inner surface there is another line corresponding to this, and giving origin to the mylo-hyoideus muscle, whence it is called the Mylo-Hyoidean ridge. On the inner surface there are also prominences near the symphysis for the insertion of muscles. The lower border is smooth and rounded; the upper, or alveolar process, is marked by notches corresponding with the sockets of the lower teeth, which are set in it.

The rami ascend almost vertically from the ends of the two parts of the body. They are broad, flat, and quadrilateral. At the angle (5), where each joins the body, there are on both surfaces rough prominences; the external gives attachment to the masseter, the internal to the internal pterygoid muscle. The internal surface has also, near the end of the mylo-hyoidean ridge, a hole, the inferior dental (6), through which the nerve of the same name passes into the interior of the jaw, from which it again emerges at the mental hole (4). Leading from the dental foramen is a small groove for a branch of the dental nerve. The anterior border of the ramus terminates in a sharp projection, the Coronoid Process (7, 7), to which the temporal muscle is attached; the posterior, in a transversely oval process, with a smooth summit, the Condyle (8, 8), which articulates with full freedom of motion in the glenoid cavity of the temporal bone. Below this is the Neck (9), to which the external pterygoid muscle is in part attached; and the space between the condyle and the coronoid process is the Sigmoid Notch (10, 10).

The bones of the face serve as a groundwork to many parts whose structures and functions are already described in separate articles; and since, in each case, the parts which the bones take are at the same time considered, an account of their adaptation to the several offices performed by the different portions of the face is not here necessary. Their relations to the features are described in the article MAN.

The last main division of the Skeleton consists of the Upper and Lower Extremities (*fig.* 1; 3, 4). The upper are composed of the Scapula, Clavicle, Humerus, Radius, Ulna, Carpus, Metacarpus, and Fingers. The scapula and clavicle are analogous to the Ossa Innominata in the lower extremities.

Fig. 22.

The Scapula, or Shoulder-Blade, of which in *fig.* 22 the back is represented, with parts of the clavicle and humerus, is triangular in its outline, and flat, being formed of two compact layers, and an intermediate diploe, varied in thickness. It has three borders, or Costæ; a superior (1), posterior (2), which lies nearly parallel with the spine, and an inferior (3), which is also the longest. They are all thicker than the body of the bone, and give insertion to various muscles moving the shoulder. From the posterior border, about one-third from the upper and two-thirds from the lower angle, there commences a ridge called the Spine (4), which, as it passes along the back of the scapula towards the outer angle, gradually increases in depth, and at its end, projecting beyond and above the angle, bears a strong arched process, called the Acromion (5), which articulates with the clavicle, overhangs the shoulder-joint, and gives attachment to some of its muscles and ligaments. The spine divides the back of the scapula into two parts, of which the lower is much the larger, and which are named, according to their position, Supra- (6) and Infra- (7) Spinous Fossæ. They give origin to muscles of the same names. The anterior surface, or belly of the scapula, is slightly concave, and gives insertion to the subscapularis muscle, for the attachment of whose several parts it is marked by alternate longitudinal elevations and depressions. At the outer angle the bone is terminated by the Glenoid Cavity (8), an ovate surface slightly hollowed, narrower above than below, and with which the head of the humerus (9) articulates with very extensive freedom of motion. Its border is thick, and is rendered deeper in the recent subject by a rim of fibro-cartilage, the glenoid ligament, similar to that which borders the acetabulum. Between this border and the base of the spine the scapular is narrower than elsewhere; and this part is called the Neck. From the superior costa, near this neck, a long and strong curved process, the Coracoid, projects forwards, and gives attachment to several muscles and ligaments; and at its root there is in the superior costa a hole, or a notch, through which the supra-scapular nerve (and sometimes its accompanying vessels) pass.

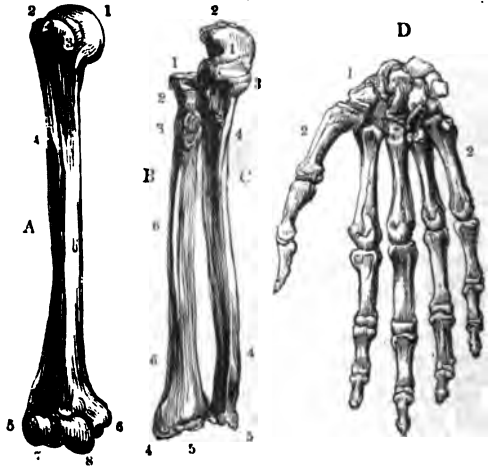
The scapula is attached to the trunk only through the medium of the clavicle, and by the muscles which connect it to the spine and ribs. It can therefore slide freely on the back of the chest; and, to a certain extent, it follows all the larger movements of the humerus, so that its glenoid cavity, and the head of that bone, which have but a small surface of mutual contact, almost always preserve the same relation to each other, and are less likely to be dislocated than they would be if the scapula were more closely fixed.

The Clavicle, or Collar-Bone, extends transversely from the notch in the upper angle of the sternum to the anterior and outer margin of the acromion (*fig.* 22). With both of these its ends are articulated with a moderate extent of mobility; with the sternum, by the apex of a broad triangular surface; with the acromion, by a small flat oval surface on its posterior edge. The clavicle has nearly the directions of the double-curved line of beauty, being slightly arched forwards at the sternal, and backwards at the scapular, half. At the former it is thick, strong, and triangular; in the latter, broad and flattened. On the upper surface, which lies just under the skin, it is smooth; on the lower it has, near its sternal end, a mark where a ligament fixing it to the first rib is attached; farther out a larger elevation, to which the subclavian muscle is fixed; and near the acromial end, other prominences, to which the ligaments connecting it with the coracoid process of the scapula (which projects just below it) are affixed.

The chief purpose of the clavicle is to keep the arm at a distance from the trunk for all its outward motions; and in adaptation to this, its length and strength form one of the most characteristic features of the human skeleton.

The Humerus, the bone of the upper arm (*fig.* 23, A), is articulated above with the scapula by a hemispherical smooth portion called the

Fig. 23.



Head (1), which is bounded at its outer and lower part by a narrow groove called the Neck. The axis of the head forms, with that of the shaft or body of the bone, an angle of about 130°. Close by the neck, the upper and outer part of the shaft is surmounted by two Tuberosities: the larger and posterior (2) has three flat surfaces, to each of which a muscle from the scapula is attached; the lesser (3) gives attachment to the subscapularis muscle. The rest of the upper part of the shaft is round and nearly smooth; but just above the middle of its outer surface is a rough elevation (4), to which the deltoid, the chief muscle of the shoulder, is attached. About half-way down the shaft begins to be flatter and wider, and at either border of it commence sharp ridges, which, as they descend, become prominent, and which terminate below at the External (5) and Internal (6) Condyles. Each of the condyles gives insertion to a ligament and several muscles of the fore arm; the inner is the more prominent, but the outer is the larger. Between the condyles is the inferior articular surface, which is composed of two parts for articulating separately with each of the bones of the fore arm. On the outer side, just within the external condyle, the surface has a smooth rounded prominence or tuberosity (7), against which the summit of the head of the radius is apposed; more inwards there is a deep groove (8), separated from the tuberosity by a slight ridge, and from the inner condyle by one much more prominent, in which the raised portion of the sigmoid cavity of the ulna moves as in a hinge-joint. This part of the joint is named the Trochlea. Both before and behind it is bounded above by a depression: into that on the posterior surface, which is the deeper, the olecranon of the ulna is received when the fore arm is extended; and into the anterior, the coronoid process of the same bone, when the fore arm is much bent.

The Fore Arm contains two bones, the Radius and the Ulna (*fig.* 23,

B, C): the former being that with which the movements of rotation are effected, the latter that which takes the chief part in flexion and extension. The radius (B), when the palm of the hand is turned forwards, is on the outer side of the arm; and it is the shorter of the two bones. At its upper end it has a circular disc, the Head (1), hollowed on its upper surface, where it articulates with the tuberosity on the lower end of the Humerus (A, 7), and smooth on its circumference, where it is encircled by a ring, within which it rotates, and which is formed in part by the ulna, and in part by a ligament. Just below this is the Neck (2), of which the upper part is similarly encircled; and below it, on the anterior and inner surface, is a knob, the Tubercle (3), to which the tendon of the biceps, the chief flexor muscle of the fore arm, is attached. Yet lower, the shaft (6, 6) of the radius becomes three-sided, and as it descends grows wider. At its lowest part it is much expanded, is flattened before and behind, and terminates with a prominent border, to which ligaments of the wrist-joint are attached. The posterior and outer surfaces of this lower end are deeply grooved for the passage of tendons; and the latter is prolonged into a blunt-pointed process, the Styloid (4), to which the external lateral ligament is attached. The inner surface has a small smooth cavity, the Semilunar, which articulates with the outer part of the lower head of the Ulna. The terminal surface (at 5) is smooth, somewhat triangular, and slightly hollowed; it articulates with the carpus, and is continuous over the inner border with that which articulates with the ulna.

The Ulna (C) is situated on the inner side of the fore arm. At its upper and larger extremity it has a broad and deep crescentic notch, the Greater Sigmoid Cavity (1), whose smooth surface is divided into two parts by a middle ridge, and which is received in the trochlea of the humerus. It is bounded at either end by a sharp process. The upper and posterior is the larger, and is named the Olecranon (2); it forms the rough prominence behind the elbow; and when the arm is extended, its point, which is curved forwards, rests in the fossa at the back of the humerus. The lower and anterior (3) is the Coronoid Process, whose point, when the arm is fully bent, rests in the anterior fossa of the humerus. On the outer side the smooth surface of the great sigmoid cavity is continued over a small oval concave portion of the side of the bone just behind the coronoid process. This is the Lesser Sigmoid Cavity; upon which the side of the head of the radius rotates, and to whose borders the coronary ligament by which that head is encircled is attached. The body or shaft (4, 4) of the ulna grows smaller from above downwards, and is for the most part three-sided; its external and sharp margin giving origin to the interosseous ligament, which, being attached also to the opposed margin of the radius, fills up the space between these bones. At its lower end the ulna becomes nearly cylindrical, and then is a little enlarged: at its termination it presents a double articular surface; one, on the end, which is nearly circular, and (through the medium of a fibro-cartilage) articulates with part of the carpus; the other, on the outer border, which is narrow and convex, and is received in the semilunar cavity of the radius. The inner border of this lower extremity bears a short and blunt process, the Styloid (5), to which the internal lateral ligament of the wrist-joint is fixed.

The motions of which the Fore-Arm is capable are Flexion and Extension, and Rotation on its axis. The two former are effected at the hinge-like joint between the greater sigmoid cavity of the ulna and the trochlea of the humerus; the head of the radius moving at the same time forwards and backwards on the lower tuberosity. The elbow affords the best specimen of a hinge-joint in the body, for no lateral motion is permitted in it, the ulna being locked in the groove between the two side-ridges of the trochlea. Rotation, by which also the rotation of the hand is effected, is performed by the upper head of the radius moving round in the ring formed by the coronary ligament and the lesser sigmoid cavity of the ulna; and by its lower head at the same time being carried round on the outer border of the lower head of the ulna. In this movement the ulna is almost fixed, its lower end only being carried outwards as that of the radius is moved far inwards, when in extreme pronation of the hand the two bones are made to cross each other.

The Hand (23, D) consists of the Carpus, Metacarpus, and Fingers. The Carpus (1) is composed of eight small bones arranged in two rows, and so nearly immoveably united by ligaments, that, except in being more elastic, they serve the purpose of a single bony arch. Those of the first row, which lie nearest to the fore arm, are (from the outer to the inner side) the Scaphoid, Lunar, Cuneiform, and Pisiform bones: those of the second row, following the same order, are named Trapezium, Trapezoid, Magnum, and Unciform. The three first-named articulate with the radius directly, and with the ulna indirectly; the trapezium has a surface of peculiar form, concave from side to side, and convex from before backwards, by which the thumb, articulating with it, is permitted to have a very wide extent of motion.

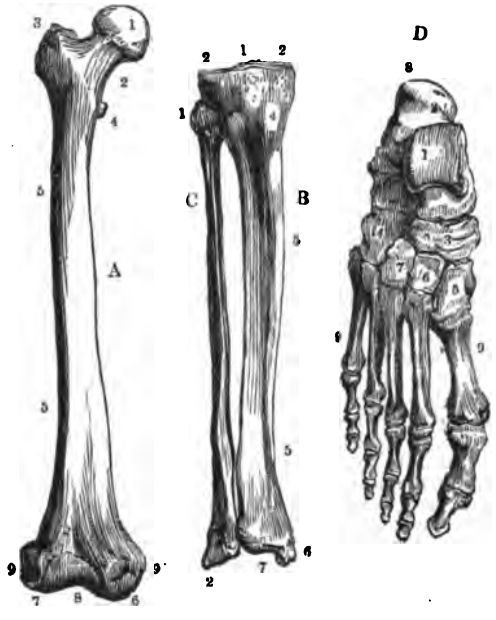
The Metacarpus (between 2 and 2) is composed of five bones, which are called by number according to the order in which they stand, that of the thumb being taken as the first. Each is described as consisting of a body and an upper and lower heads. The form of the upper head is adapted to one or more of the bones of the carpus; that of the lower is in all very convex, and rather narrow. The body is compressed from side to side, and is broader behind than before, and on its dorsal than on its palmar aspect. The first metacarpal bone only has free mobility.

The bones of the fingers are called Phalanges. The thumb has two, each of the fingers three. Their form and proportionate sizes are plainly exhibited in *fig.* 23, D. They are articulated with each other, and with the metacarpal bones, so as to permit free extension and flexion; and at the joints between the phalanges and metacarpus there is also permitted a certain extent of lateral motion. At that between the carpus and fore arm there is a very extensive hinge-like motion of flexion and extension, as well as a wide lateral motion.

The general arrangement of the bones of the human upper extremity is adapted to a far more extensive and varied set of movements than exists in the corresponding member of any other animal; they have all relation to the office of the hand, as an instrument not of support, but of prehension, and that in its most perfect form. In this view they are fully considered in the article MAN.

Each of the Lower Extremities is formed by a Femur, Tibia, Fibula, Patella, Tarsus, Metatarsus, and Toes.

Fig. 24.



The Femur, or Thigh-Bone (*fig.* 24, A) is the largest of the body. It articulates with the acetabulum of the Os Innominatum by its head (1), which forms rather more than half a sphere, and is smooth, except at its summit, where there is a depression for an interarticular ligament. It rests upon a narrower part, the Neck (2), which descends obliquely to the summit of the shaft, and is at its base somewhat expanded. It is here set between two strong processes called Trochanters, by which the shaft is surmounted; and its base is bordered by two oblique lines, named Intertrochanteric, which pass on either surface of the bone, from one to the other Trochanter. The Greater Trochanter (3) is the uppermost, and lies at the outer part of the bone; it is thick, rough, and strong, and gives attachment to the great muscles of the buttock. Behind it is a deep depression, the Digital Fossa, in which the obturator and other muscles to rotate the thigh outwards are attached. The Lesser Trochanter (4) is on the inner aspect of the femur, and also gives a point of insertion for muscles. At the level of the Trochanters the shaft is flattened both behind and before, but below them it is round and nearly cylindrical, till, within one-fourth of its length from the lower end, it expands, and again becomes flattened. The shaft (5, 5) of each femur is directed rather inwards, and is slightly arched forwards; its axis makes, with that of the neck and head, an angle of about 120°; its surface is everywhere smooth, except behind, where there is a prominent line, the Linea Aspera, running along the middle, and at either end dividing into two, which above go each to one of the trochanters, and below each to one of the condyles. These condyles are the processes in which the lower expanded part of the femur terminates. The inner condyle (6) is the narrower, and descends lower than the outer (7), which is the broader and stronger. Their articular surfaces are united in front at a concave pulley-like surface (8), over which the patella lies: below it they diverge, and at the back of the femur are separated widely on two very convex prominences, between which there is a deep and rough fossa, in which the crucial ligaments of the knee-joint are fixed. On the sides of the femur, just above the lower border of the condyle, are eminences, the Tuberosities (9, 9), to which the external and internal lateral ligaments respectively are attached.

The Tibia, or Shin-Bone (*fig.* 24, B), is placed on the front and inner

part of the Leg. Its upper part, or Head (1), is far larger than any other. Its upper surface is nearly oval, its greatest diameter being transverse; and it presents two slightly concave oval smooth surfaces (2, 2), on which the condyles of the femur rest. Between them is an eminence, named the Spine, which fits in between the condyles, and to which, as well as to rough surfaces before and behind it, the crucial ligaments and semilunar cartilages are fixed. Below and on the sides of the head are tuberosities, on which the lateral ligaments are inserted, and behind the external tuberosity is a smooth surface which articulates with the head of the fibula. In front, and a little below them, is the tubercle (4) to which the ligamentum patellæ is attached. Below this the body (5, 5) is triangular, and as it descends, becomes smaller; its outer surface is hollowed; its inner, which forms the skin, slightly convex; its posterior rounded. The outer border gives attachment to an interosseous ligament, which fills up the space between it and the opposed part of the fibula: the anterior is sharp and prominent, and is named the Crest. The lower or tarsal extremity is a little expanded, and has a somewhat quadrilateral form. Its outer aspect has a slightly concave surface, which is articulated immoveably with the fibula; the inner is prolonged into a bluntly pointed process, the internal malleolus (6), which has the internal lateral ligament of the ancle fixed to its extremity, and a smooth surface on its outer side, which articulates with the astragalus. The anterior surface of this extremity is smooth where tendons pass over it; the posterior is flat; the lower or terminal surface (7) is quadrilateral and slightly hollowed; it rests on and is articulated with the astragalus.

The Fibula (*fig.* 24, B) is situated at the outer part of the leg, and is fixed immoveably by the side of the tibia. It is long, very slender, for the most part three-sided, and enlarged at either extremity. The upper extremity or head (1) is the smaller; it is rounded, and on its upper and inner part has an oval smooth surface, with which it articulates with the outer tubercle of the tibia; the rest of its surface is uneven, for the attachment of ligaments and a tendon. The lower extremity (2) is longer and more pointed than the upper; it forms the external malleolus, or outer ancle, to whose extremity the external lateral ligament of the joint is attached, and whose inner surface is articulated with the astragalus; behind it is a deep groove, over which the tendons of some muscles of the leg pass to the sole of the foot. Above the malleolus, and on the inner aspect of the fibula, is a smooth surface, where it is united with the tibia.

The Patella, or Knee-Pan, has a somewhat triangular outline. Its narrowest part is below, and is fixed by the ligamentum patellæ to the tubercle of the tibia. Its anterior surface is slightly convex, and looks fibrous, being marked by the insertions of the tendons of the extensor muscles of the leg; the posterior is smooth, and divided by a ridge into two parts, of which the outer is the larger, and which are adapted to the pulley-like surface between the condyles of the femur.

The Tarsus is composed of seven bones, namely, the Astragalus (1), Os Calcis (2), Navicular (3), Cuboid (4), Internal (5), Middle (6), and External (7) Cuneiform Bones. These are set together so that they cannot be moved by any slight force, and yet are possessed of considerable elasticity. The Astragalus is that on which, through the Tibia, which rests upon its upper quadrilateral surface, the weight of the body first falls. With the Tibia above, and the two malleoli on either side of it, it forms the ancle-joint, a hinge with a limited lateral motion. Its lower part rests, with two surfaces of contact, on the os calcis, whose hinder prominent part (8) forms the heel; and its anterior portion, or head, is received in a cavity, formed by the navicular bone in front, part of the os calcis behind, and a very strong ligament below and between them. This cavity is at the summit of an arch which the tarsus and metatarsus together contribute to form, and of which the supports are the os calcis behind and the ends of the metatarsal bones before. It is indeed a double arch, for it has at the sole a concavity, both from before backwards and from side to side; and the strength with which its several parts are joined is so great, that few accidents are rarer than a fracture or dislocation of any of the bones of the tarsus.

The rest of the bones of the Foot, including those of the Metatarsus (9, 9) and the Toes, are in number, arrangement, and form very similar to the Metacarpus and the Phalanges of the Fingers. The metatarsal bones however are longer, more slender, and set more closely side by side than the metacarpal; and the Phalanges are all much shorter, and (except the two of the great Toe) smaller. Their movements are in general the same as those of the fingers, but less extensive; neither is there any adaptation for so free a movement of the first toe as of the thumb.

There are some supplemental bones of the skeleton, which need but just be mentioned. These are the Sesamoid and the Hyoid Bones. The former occur within the substance or in the course of tendons which are much exerted; the patella is the largest of them; the number and existence of the others are not certain, but there are almost always two at the first joints of each of the thumbs and great toes; they are small, oval, or round, and rough on all their surfaces, except that by which they articulate with the bone on which they lie. The Hyoid Bone is that on which the larynx is suspended, and the base of the tongue fixed; it is not articulated, except by long ligaments, with any other of the bones. [Larynx; Tongue.] In relation to many points in this article, the following articles may be consulted: Articulation, Bone, Vertebra, Locomotion in Animals, Man.

SKENEA, a genus of Gasteropodous *Mollusca*, named after Dr. Skene. The shell is very small, flat, and with few whorls. It is deeply umbilicated; the mouth is entire, circular, not quite connected with the body whorl; operculum rather spiral. The animal is nearly like that of *Rissoa*, and has large eyes. The species are few, and are found generally on the roots of *Corallina officinalis*.

SKIMMER. [Rynchops.]

SKIN. The Skin, or Derma, is the outer covering of the body; and having to serve at once as a defence for the more deeply seated structures, as an organ of touch, and as an apparatus for secretion, it is one of the most compound of all the tissues.

It is composed of two chief parts:—a vascular basis named Cutis, and a superficial layer named Epidermis, or Cuticle, which is not vascular. The cutis is made up for the most part of fibres and laminæ, like those of common cellular tissue. They are much more densely woven near the surface than in the deeper part of the skin: in the former they constitute a very tough and elastic compact membrane; in the latter they are arranged in irregular large cells, which in moderately stout persons are filled with fat, but in the emaciated are collapsed, and form a loose flocculent white tissue. This general form of structure prevails through the whole skin; but in different parts of the body, and still more in different persons, the density and thickness of its layers, the size of the cells, the quantity of fat which they contain in the deeper parts, and the fineness or coarseness of the tissue composing them, vary considerably.

The external surface of the skin presents a variety of wrinkles. The larger of these are produced by the action of muscles, which in many parts throw the skin into folds; others result from its loss of elasticity in old age, and the removal of the fat beneath it; and again others, which are seen most plainly on the palms and the balls of the fingers, and on the corresponding parts of the foot, run in very close parallel arches, and indicate the arrangement of subjacent rows of sensitive papillæ, with which the whole surface of the skin is beset, and which in the parts just named, and in some others, are arranged in regular double lines. In their most developed state, on the balls of the fingers for example, the papillæ are very fine conical processes, standing somewhat obliquely, and so densely set, that their summits form a seemingly smooth surface. On these parts each elevated line which one sees on the surface has beneath it two rows of papillæ; for when looked at closely, each such ridge shows on its summit a little furrow dotted with minute apertures, and which fits into the space between the rows of papillæ. Over the rest of the body the papillæ are much smaller, and are irregularly arranged. Everywhere, however, they are the most vascular part of the skin, each papilla receiving a distinct loop from the subjacent network of bloodvessels. It is in them also that the greater part of the very numerous nerves of the skin terminate; for though every part of the skin be sensitive, yet the papillæ are so in the highest degree, and are the chief instruments by which the sense of touch is exercised. [Senses; Nervous System.] It is through their being so much developed, that the tips of the fingers are adapted for the perception of the finest impressions of the sense; though even they have less delicate perception than the tip of the tongue, on which similar but larger and more pointed papillæ are set.

The chief secretory apparatus of the skin consists of the perspiratory glands, which are disposed over its whole extent, but, like the papillæ, are largest and most numerous in the palms and soles. By looking on the surface of the cuticle covering these parts, one may see, especially on a warm day, or when perspiring freely, a number of minute orifices between and upon the tops of the arched ridges already described. These are the orifices of the glands by which the perspiration is secreted, and sometimes one may squeeze through them a drop of the clear crystal fluid which the glands produce. Each orifice leads to a fine tube of somewhat less diameter than itself, which passes down through the epidermis, and into the deeper parts of the skin, making on its way several spiral turns, and ending in a slightly enlarged closed sac. In the sole, each such tube makes from 15 to 20 spiral turns; in the palm, from 6 to 10; in other parts, fewer: in the right hand the spiral turns are made from left to right; in the left, from right to left. There are about 25 of these orifices in a square line of the surface of the tip of the fore-finger; and about 75 in the same space between the bases of the fingers: taking therefore the whole superficies of the body at 14 square feet, it is probable that, as Eichhorn calculated, there are not less than ten millions of these glands scattered through the skin.

It is in them that the perspiration is being constantly formed, though it most generally passes away as fast as it is produced in an invisible vapour, and during health collects in the form of sweat only when it is very rapidly formed, as during active exercise, or when the surrounding atmosphere is already saturated with moisture. The fluid of the perspiration is composed of water, with very small quantities of animal and saline matter, some free lactic acid, nitrogen, and carbonic acid. By thus removing carbonic acid from the blood, the skin is, next to the lungs, the most important and essential excretory

organ of the body. Experiments have in fact proved that animals prevented from perspiring die of suffocation as certainly, though not so rapidly, as when their respiration is obstructed. The quantity of perspiration secreted amounts to about two pounds in 24 hours; but it is liable to considerable variations, according to the habits of the individual, the state of the atmosphere, the activity of other glands, such as the lungs and kidneys, and other circumstances.

Another secretion from the skin is that of the oily sebaceous matter by which its surface is always kept in a slight degree greasy, so that water adheres to it only in drops, and does not easily soak into the substance of the epidermis. The sebaceous glands by which this secretion is produced, as well as the hair-follicles on which they are almost always attendant, are described in the article HAIR.

The loss of fluid by these secretions from the skin is in some measure compensated by the absorption which it also exercises. It is uncertain how much, if any, of the vapour of the atmosphere around us is thus imbibed; but it is certain that the skin absorbs fluids placed for a short time in contact with it, and this so rapidly, that (especially after long fasting) a perceptible increase of weight is observed after a person has been immersed in a bath. The obstacle to a more constant and considerable absorption of fluid is the nearly impenetrable layer of epidermis; and hence the substances most rapidly absorbed are those which most easily pass through it, such as water, after having been imbibed into its deepest layers, vapours of sulphureted hydrogen, hydrocyanic acid, &c., oils rubbed upon it, or corrosives which destroy its texture.

Besides its secretions, there are produced from the vessels of the skin materials of which are formed certain appendages for its protection and other purposes, such as the cuticle, the hair, and the nails.

The cuticle, or epidermis, is an insensible and non-vascular membrane, which is laid over the whole of the external surface of the body in a layer, the thickness of which is varied according to the protection required for the wellbeing of the subjacent cutis. The under surface, which lies next to the cutis, is accurately fitted into all its irregularities, and sends prolongations down into the interior of all its glands and follicles; the outer surface, which is exposed to friction, is comparatively smooth. The epidermis is composed of several layers of cells: of the two layers into which it may commonly in an ordinary dissection be split, the lower is called Rete Mucosum, or Rete Malpighii; the upper and outer, more particularly, Epidermis. In the deeper layers the epidermis is composed entirely of minute polygonal cells, adhering by their edges, and containing nuclei and a thin fluid; in the layers nearer the surface are cells of the same kind, but larger and flatter; and those on the very outer surface are dry and scale-like; they have lost almost all trace of form, and becoming loose, are removed by friction at exactly the same rate as, under ordinary circumstances, new cells are produced at the surface next the cutis. Thus the epidermis is subject to constant and rapid change: its cells, as fast as they dry and are removed in the form of scurf from its exterior, being replaced by new ones at its interior; and thus, whatever waste (within certain limits) it is subject to, its thickness is not diminished, but rather, as the waste is increased, so is its thickness, till it attains that degree, which is competent to the protection of the subjacent cutis; as any one may see in the palms of his hands, soon after he has begun to occupy himself in a more than usually laborious handicraft.

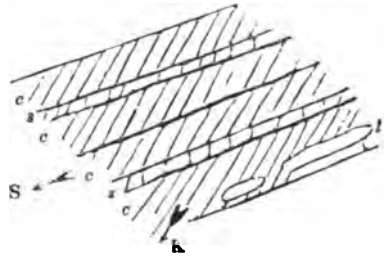
The epidermis is the seat of the characteristic national colours of the skin, as well as of the colours of freckles and other superficial marks. In dark-complexioned races, especially in negroes, it is very thick, and its cells are filled with minute black or otherwise coloured pigment-granules, many of which also lie loose among them. [ALBINO; PIGMENT.] The thickness of the epidermis in these tribes renders it less penetrable by the rays of heat; and it is hence (and not on account of its colour, which would have an opposite effect) that a negro can bear the exposure of his skin to a degree of solar heat which blisters that of a European.

The nails are thin laminæ of horny tissue, produced by the cutis on the back of the ends of the fingers and toes. Under each of the more perfect of the nails, such as those of the fingers and the great toe, the cutis has a peculiar structure, called the matrix of the nail, composed of large sharply-pointed and very vascular papillæ, which at the root are arranged irregularly, but at the body of the nail are placed in close-set rows or longitudinal ridges. By all this vascular surface the substance of the nail is produced in minute cells, which subsequently coalesce and form the dense, obscurely fibrous, and transparent mass of the body of the nail. The crescentic opaque part at the root of the nail owes its whiteness in part to its own substance, which in the deeper layers is softer and more opaque than in those of the body, and in part to the surface beneath it being less vascular than the rest.

The under surface of the nail is grooved or otherwise marked in correspondence with the matrix, to which it closely fits; the outer surface, exposed to friction, is comparatively smooth, though still it presents traces of the ridges in which, when it was at the under surface, it was formed; for the nails are produced in the same method as the cuticle; as fast as their exposed surfaces or their ends are worn away, they are replaced by layers growing from the matrix; and the whole mass of the nail, growing at once from below its body and from its root, is constantly pushed forwards and thickened, at the very same rate as its free extremity is cut or worn down, and its body thinned by friction.

SKIN-MOTHS. [DERMESTIDÆ.]
SKINK. [SCINCIDÆ.]
SKIPPER. [HESPERIDÆ.]
SKIPPER, a Fish. [SCOMBERESOX.]
SKIRRET. [SIUM.]
SKORODITE, a Mineral. [IRON.]
SKULL. [SKELETON.]
SKULL-CAP. [SCUTELLARIA.]
SKULPIN. [CALLIONYMUS.]
SKUNK. [MUSTELIDÆ.]
SKYLARK. [ALAUDA.]

SLATE. By some geological writers the laminar structures which prevail in many stratified and in some metamorphic rocks are called slaty or schistose; but, in consequence of the progress of investigation, one of these structures, locally superinduced in deposited strata, which is characterised by planes of cleavage generally meeting those of deposition at considerable angles, is specially called the slaty structure. If, in the diagram below, *c*, *s*, *l*, represent in section a series of



deposited beds of clay (*c*), sandstone (*s*), and nodules of limestone (*l*), all dipping, as the arrow S (south) indicates, at 20°: the lines which cross these beds at oblique angles, and are more highly inclined, as in the arrow K = 60°, are the edges of innumerable parallel planes of cleavage, which are continuous through the finely argillaceous beds *c*; more or less twisted in and about the limestone nodules *l*; more or less interrupted by the arenaceous beds *s*, or represented therein by lines more nearly rectangled to the plane of deposition. The law here indicated of the want of coincidence in the planes of cleavage and deposition is almost universally observed in nature. Nearly horizontal strata are crossed by inclined cleavage; highly inclined strata are traversed by nearly vertical cleavage. In strata which dip different ways from an axis or to an axis, the cleavage planes are sometimes found to be parallel throughout the mass on both sides of the axis; and even where strata are variously contorted, they are frequently dissected through a great part or the whole of their mass by cleavage planes passing in one direction. Hence the conclusion is obvious that this slaty structure, this monohedral symmetry (if we may not call it crystallisation), is the fruit of a general cause acting subsequently to the deposition and disturbance of the strata, capable of pervading and re-arranging the particles so as to polarise and systematise their mutual attractions, but not to fuse them together, destroy their original distinctness, or obliterate the evidence of their original condition. This force was so general, that along many miles of country, as, for example, in the whole Snowdonian chain, one particular direction (north-north-east), in North Devon and Pembrokeshire another (nearly east and west), is found to prevail more or less distinctly in all the rocks; though, as before observed, arenaceous and pebbly beds are least influenced by it, and limestones are unequally and variously affected.

This dependence of the slaty structure on the nature of the rock is sometimes very positively pronounced, as in some classes of rock the cleavage does change and even reverse its inclination where contortions prevail. (This is very observable in some cases of cleavage in the old red-sandstone of Pembrokeshire.) On a first view it appears to be equally dependent on geological time, since it is principally among the older strata that it is well exhibited on a large scale; but on this head doubt arises, when we find the Silurian rocks, which are not slaty at Ludlow, become so near Llandovery; the old red-sandstone slaty in Pembrokeshire and not so in Monmouthshire; the mountain limestone shales slaty near Tenby and not so in Yorkshire; the lias shales slaty on the northern slopes of the Alps, but not so in England.

There are then local conditions which influence the development of slaty cleavage, and it is essential to a general solution of the problem which this structure involves, that these conditions should be determined. Proximity to rocks of igneous origin has been freely appealed to for this purpose; but this appears an insufficient and not often applicable cause. The most general condition which has occurred to our observation is the fact of remarkable displacement of the strata on one or more antiolinal or synclinal axes; and it is of consequence to this inference to remark that very often, approximately or even exactly, the horizontal edge ('strike') of the inclined cleavage planes coincides with the axis of movement (and therefore with the strike) of the stratification. Pressure in some peculiar application appears to us to

be indicated by all the phenomena as the grand agent in the production of slaty cleavage. Only one tolerably successful effort has been made experimentally to reproduce this structure by art. Mr. R. W. Fox has caused electrical currents to traverse a mass of moist clay, and has observed in consequence the formation of numerous fissures, more or less similar to slaty cleavage, in planes parallel to the vertical bounding surfaces of the mass, and at right angles to the electrical currents. The exact application of this experiment is not understood. Perhaps however, conjoined with the admission that the great movements of strata, by which apparently slaty cleavage was determined, depended on disturbed equilibrium of internal heat, which might, or rather must, have developed electrical currents, this solitary experiment may be the commencement of a right mode of more extensive inquiry embracing the many circumstances of chemical nature, stratified arrangement, disturbed position, and proximity of igneous rocks, which must all be included in a good theory of slaty cleavage.

For economical purposes there appears little chance of obtaining in the British Islands good Slate (properly so called) from any but the ancient argillaceous strata superposed on mica-schist and gneiss, and covered by old red-sandstone or mountain limestone. From these strata in Scotland, Cumberland, Westmoreland, Yorkshire, Charnwood Forest, North Wales abundantly, South Wales, Devonshire, Cornwall, the north and south of Ireland, slates of various value are dug. The thin flagstone of the coal formation in many parts of England and Wales the laminated sandy limestone of Stonesfield, Collyweston, &c., which are often called slates, and are extensively used in roofing, are all obtained by natural partings parallel to the stratification. True slate is split by wedges from the apparently solid rock along planes often no more discoverable than those of a real crystal. In colour it is purple, blue, green, yellowish, or almost white, or striped across the planes. In some slates (west of Scotland, Ingleton, &c.) crystals of cubical iron pyrites are scattered. Much of the Cumberland slate appears full of fragments (Borrowdale), and some contains chiastolite (Skiddaw).

In the United States, a good material is obtained in Maine at Barnard, Piscataquies, Kennebec, Bingham, and elsewhere; also in Massachusetts, in Worcester county, in Boylston, Lancaster, Harvard, Shirley, and Peperell; in Vermont, at Guilford, Brattleborough, Fairhaven, and Dummerston; in Hoosic, New York; on Bush Creek and near Unionville, Maryland; at the Cove of Wachitta, Arkansas. At Rutland, Vermont, is a manufactory of slate pencils, from a greenish slate.

These slate rocks are also used for gravestones in New England cemeteries. It is however liable to fall to pieces.

Drawing Slate is a finer and more compact variety, of bluish and purplish shades of colour. The best slates come from Spain, Italy, and France. A good quality is quarried in Maine and Vermont, United States.

Novaculite, Hone-Slate, or *Whet-Stone,* is a fine grained slate, containing considerable quartz, though the grains of this mineral are not perceptible. It occurs of light and dark shades of colour, and compact texture.

Argillite is a general term given to argillaceous or clay-slate rocks. Many shales or argillites crumble easily, and are unfit for any purpose in the arts, except to furnish a clayey soil.

Alum Shale is any slaty rock which contains decomposing pyrites, and thus will afford alum or sulphate of alumina on lixiviation.

Bituminous Shale is a dark coloured slaty rock containing some bitumen, and giving off a bituminous odour.

Plumbaginous Schist is a clay slate containing plumbago or graphite, and leaving traces like black lead.

The *Pipestone* of the North American Indians was in part a red claystone or compacted clay from the Coteau de Prairies. It has been named *Catlinite.* A similar material, now accumulating, occurs on the north shore of Lake Superior, at Nepigon Bay. Another variety of pipestone is a dark grayish compact argillite; it is used by the Indians of the north-west coast of America. (Dana.) [AGALMATOLITE; MICA-SCHIST.]

SLEEP, the periodical repose of the organs of the senses, and of the greater number of the intellectual faculties and voluntary movements. The above indeed is by no means a satisfactory definition; but it is, as with life, far easier to describe its phenomena than to define its nature.

True sleep is peculiar to the *Mammalia* and to Birds. The lower animals indeed rest from time to time, and withdraw themselves from the external world, but having no external eyelids, they cannot exclude all influence from without. Fish conceal themselves behind a stone or near the bank of a river; crocodiles hide themselves in the mud; and tortoises creep into holes. The higher animals likewise usually seek out some place of retirement to sleep in, and dispose themselves in a posture which either is maintained with little muscular effort, or is favourable to the preservation of warmth.

The approach of sleep is announced by diminished activity of mind and loss of the power of attention. The senses become blunted to external impressions, and we feel an unconquerable desire for stillness and repose. Our ideas grow more confused—our sensations more obscure—our sight fails us—and if our ears still perceive sounds they are indistinct, and seem as though distant. The eyelids close, the joints relax, we instinctively assume an easy position, and fall into a sleep, which at first is deep, then soft and gentle, and becomes gradually less sound as the time for waking approaches.

Physiologists are accustomed to distinguish what are termed the organic or vegetative from the animal properties of living beings. By the former are understood development, growth, excitability, &c., those powers in short which are common to plants and animals; by the latter, those properties which are peculiar to animals, such as sensation and voluntary motion. During sleep the organs of vegetative life continue to discharge their functions with scarcely less activity than in the waking state. Their repose is independent of sleep, and occurs at very different times. The heart rests between each pulsation, the muscles of expiration and inspiration are in a state of alternate action and repose, and the peristaltic motions of the intestines have their distinct periods of remission. The pulse and respiration however become slower during sleep, and digestion seems to go on then less perfectly than in the waking state. The temperature of the body sinks during sleep, owing to the diminished nervous energy, and to the same cause may be ascribed the increased susceptibility of persons to rheumatism and other effects of cold when asleep.

Not only are the functions of organic life little affected by sleep, but even those of animal life are not in a state of complete repose. It would not be possible to make a dead body remain in those postures which we assume when asleep, and our eyelids are not closed except by muscular action. Some animals sleep standing, as the horse; birds do so also, sometimes standing on one leg. When very weary, we sleep even in the most constrained positions; soldiers have been known to sleep while marching, postillions on horseback, and fiddlers at a fair have continued to play even when through weariness they have fallen asleep. The numerous instances of somnambulism on record show how high a degree of activity of the animal functions is compatible with sleep.

Animals in general require less sleep than man: thus, for instance, four hours are sufficient for the horse. Those animals whose blood circulates very rapidly, whose motions are peculiarly energetic, and their senses very acute, usually sleep more lightly, and for a shorter time than others. The timid herbivorous animals sleep less, and less profoundly than the bolder *Carnivora.* In man the want of sleep varies at different ages; the new-born infant sleeps almost continually, while persons in middle life can do with less sleep than children or very old persons, and women require less sleep than men. From six to eight hours a-day are usually passed in sleep, but habit exercises a great influence in determining the amount of repose required. John Hunter and Frederick the Great did not sleep more than four hours daily, while some sluggish persons spend nearly half their time in sleep. In extreme old age much sleep sometimes becomes necessary. De Moivre, when eighty-three years old, was awake only during four hours out of the twenty-four; and Thomas Parr, towards the close of his life, was almost constantly asleep. Children sleep very soundly, old persons are easily disturbed, men sleep more profoundly than women, and sleep is always sounder after considerable weariness.

There are some conditions which favour the occurrence of sleep. Stout and full-blooded persons, and those of an excitable but easily exhausted frame, require more sleep than such as are thin, or who, though equally excitable, are more energetic, and less easily tired. Abundant food induces sleepiness, and also wine and other stimulants. A class of medicines are known by the name of narcotics, whose peculiar action is to induce sleep. Ease and quiet of mind conduce to it, but the weariness of hopeless grief is likewise followed by sleep. Certain external causes favour sleep, such as the warm bath or friction of the surface of the body. Extreme cold is a powerful and most dangerous narcotic; it induces a sleep from which there is no waking. Such a sleep it was which nearly proved fatal to Dr. Solander, when with Sir J. Banks in Tierra del Fuego.

We have not yet noticed one very important character of sleep—its periodical return once in every twenty-four hours. The idle person sleeps as well as the diligent who has passed his time in exerting his powers of mind or body. Sleep usually occurs at night-time, and we are awake during the day; but the day may become the time for sleep, and night for watching, if a person's occupation so require. Many animals sleep during the day, and watch or pursue their prey at night. We cannot then regard the periodical return of sleep as dependent on the simple alternation of day and night, or merely as the result of bodily fatigue, since it is known that extreme weariness will prevent sleep. The alternation of sleep and waking is essentially connected with something in the nature of animals, to which there are many analogies. The succession of the seasons and of day and night, the ebb and flow of the sea, the daily variations in the electricity of the air, in the rise and fall of the barometer, and the regular declination of the magnetic needle eastward and westward, at different hours, illustrate the same law of periodical action which is displayed in the unvarying alternation of sleep and waking. "We may," says Müller, "regard sleep and the waking state as the result of a species of antagonism between the organic and the animal life, in which the animal functions, governed by the mind, become free to act, while at other times they are repressed by the organic force acting in obedience to a law of creative nature. In sleep, when the animal functions entirely or for the most part cease, the organic processes are almost

the only ones which continue, and during that state even the organs of animal life are rendered capable of renewed action by the organising force which proceeds without the consciousness of the animal, though accordant with a well-constituted plan and with reason."

Little need be said of the uses of sleep. 'Nature's soft nurse,' it invigorates body and mind when worn out by toil, and the occurrence of sleep in the course of a disease is one of the most favourable signs of returning health. After a night's sleep we are nearly an inch taller than before; the intervertebral cartilages, which had been compressed by bearing the weight of the body during the day, having regained their natural form and proportions. The powers exhausted by our intercourse with the external world, recover themselves during sleep, and our senses in the morning are alive to all impressions. It is however pre-eminently the rest of the brain, which, when fatigued by the constant action of the mind, becomes incapable of continuing that action, just as the eye, if long fixed upon one spot, ceases to perceive any object distinctly. [NERVOUS SYSTEM.]

Since then sleep is not a mere torpor of the system induced by fatigue, long watching, or any external cause, but a natural state whose periodical recurrence is essential to the harmonious performance of our functions, it need excite in us no surprise to find that in certain animals this condition lasts for a long time, even for months; and that in it the activity of the organs of animal life is suspended more completely than in diurnal sleep. To this state the name of Winter Sleep, or Hybernation, is applied. Hybernation occurs in some *Mammalia*, in all the *Amphibia*, and in some of the Molluscous and Insect tribes. Birds do not hybernate, and the vulgar notion with reference to the sleep of the swallow in winter is erroneous. Hybernation is either perfect or imperfect. In the former, of which the marmot affords an instance, the lethargy is profound and undisturbed by any sense of thirst or hunger, and the animals do not awake until the period of sleep is completely past. In the latter, intervals of wakefulness occur, during which the creatures rouse themselves and seek for food, as in the case of many insects and spiders, also the hedgehog, bat, and dormouse. The time during which hybernation continues varies much: in some animals it lasts only four months, in others for five or six; but almost all awake either in March or April. The situations which animals select for hybernation, and the position in which they await it, differ, as might be expected, in accordance with their various habits, but all seem to subserve one great purpose—the preservation of a moderate and equable temperature. Most creatures hybernate in solitude, but some, as the marmot, pass the winter in company.

The approach of winter-sleep is not sudden, but it comes on gradually; the activity of the animals diminishing as their sense of hunger grows less keen. In some animals, as in the hedgehog, a diminution or total loss of appetite precedes hybernation for some weeks. When hybernation is perfect, the senses become so completely blunted, that severe wounds and electric shocks are insufficient to rouse the animal.

The phenomena of organic life go on far more sluggishly during hybernation than in diurnal sleep. The pulsations of the heart sink to a fourth or even a tenth of their natural frequency. The respiration becomes slow, intermits frequently and for a long time, or even becomes altogether imperceptible. An animal in this condition, if placed in a pneumatometer, will produce no change in the air which it contains, or may be kept for a considerable time in irrespirable gases without sustaining any inconvenience. The temperature of the body depends on the activity with which respiration and circulation are carried on; hence, during hybernation it sinks greatly, and in some animals is not higher than that of the surrounding atmosphere.

Hybernation is not mere stupor from cold; all animals may be benumbed by cold, but those which hybernate are comparatively few in number. A moderately low temperature indeed is favourable to hybernation, but instinct teaches the animals to defend themselves from the cold, and their death results from exposure to its severity. Suspended animation from cold is a morbid state; hybernation and sleep are preceded by similar phenomena, and both terminate alike, after a certain time, in renewed activity.

If, lastly, we inquire what uses are answered by winter-sleep, we shall see that it is a provision for the maintenance of life at a season when those animals in which it occurs would be unable to obtain their natural food. It serves likewise for their protection against a degree of cold to which they could not bear to be exposed. Nor is it merely against extreme cold that annual sleep and the instinctive preparations of animals for that condition supply a defence, but extreme heat is followed in some animals by a lethargy similar to hybernation. Thus the Tanrec, or Rat of Madagascar, sleeps during the height of summer. Changes in the system generally, and renewed activity of the various functions, follow hybernation, as they do diurnal sleep. It would lead us into discussions beyond our limits, if we were to examine the various peculiarities of hybernating animals, or to inquire into what may be termed the proximate cause of annual sleep. [HEAT, ANIMAL.]

The revolutions of the seasons produce changes in Plants not unlike those which we have just noticed in hybernating animals. There is however a still closer analogy between diurnal sleep and the so-called Sleep of Plants, a condition first discovered by Linnæus to be general, though some of the phenomena had long been noted in the tamarind-tree, and in some leguminous plants with pinnated leaves, natives of Egypt.

The attention of Linnæus was called to this phenomenon by the following circumstance:—Having sown some lotus seeds, he watched the progress of the plants, and at length discovered upon one of them two flowers. When evening came, he could not find the flowers again, and supposed that some one had plucked them. On the following morning he again observed them, and they once more disappeared at evening. He then examined the plants with care, and saw that at evening the leaflets had approached each other, and thus concealed the flowers from view. Struck by this fact, he took a lantern in his hand and visited the flower-beds, when to his surprise he found the appearance of all things changed, and thus discovered the sleep of plants.

As night approaches, flowers close, the leaves of plants become more erect and fold themselves together, while vitality seems to retire from the periphery. Thus, during sleep the leaves of the sensitive-plant lose their peculiar sensibility, which retires to the petiole. With the approach of night too an important change takes place in the functions of plants, for instead of exhaling oxygen and absorbing carbon from the atmosphere, as in the daytime, their action at night is directly the reverse.

The sleep of plants usually occurs at night time, owing to the withdrawal of the stimulus of light, to which they are subjected during the day. The experiments of De Candolle indeed have proved that by producing artificial day and night it is possible to change the time for the sleep and waking of plants. There must however be some cause of sleep more intimately connected with their organism than the mere withdrawal of light; for not only are there plants which, like certain animals, sleep through the day and are awake at night, but it has been ascertained that the leaves of plants kept constantly in the dark open and close at regular intervals, as during sleep. [MOTIONS OF PLANTS.]

SLEEP OF PLANTS. [SLEEP.]

SLEEPER. [ELEOTRIS.]

SLO'ANEA, a genus of Plants belonging to the natural order *Tiliaceæ*, named by Plumier in honour of Sir Hans Sloane. The leaves are large and alternate, the flowers are large, and the fruit as big as chestnuts. The trees are not known to be applied to much use, with the exception of *S. dentata*, of which the wood is sometimes employed for making canoes of a single piece. The inner bark is astringent, and prescribed in dysentery. The fruit is eaten.

SLOE. [PRUNUS.]

SLOTH. [BRADYPUS.]

SLOW-WORM. [BLIND WORM; ORVET; SAURIANS; SCINCIDÆ.]

SLUG. [LIMAX; GASTEROPODA.]

SLUGS, SEA. [NUDIBRANCHIATA.]

SMARAGDITE, an impure variety of Augite.

SMEATHMA'NNIA, a small but beautiful genus of Plants belonging to the natural order *Passifloraceæ*. The genus possesses a 1-leaved nectarium, which is urceolate and surrounding the base of the stamens; the stamens are numerous, distinct, and seated on a short column with incumbent anthers; the stigmas are peltate and 5 in number; the capsule is inflated, and 4-5-valved. The seeds are dotted. All the species are upright shrubs, with white showy axillary flowers, and are natives of Sierra Leone. Three species are recorded, *S. pubescens*, *S. lævigata*, and *S. media*.

SMELL. The essential part of the organ of smell consists of the expansion of the olfactory nerves, the first or most anterior of the nerves from the brain, whose minutest branches are distributed just beneath the mucous membrane of part of the nose. [NOSE.]

The olfactory nerves descend from the under surfaces of the olfactory bulbs [BRAIN] through the foramina of the cribriform plate of the ethmoid bone. They are very numerous, and are densely distributed in bundles and tufts in the mucous membrane covering the upper part of the septum, the under surface of the cribriform plate, and the inner surfaces of the superior and middle turbinated bones, and of the cells immediately adjacent to them.

All that is necessary for the perception of an odour is that the scented particles (without undergoing any such changes as light does in arriving at the retina, or sound on its way to the auditory nerve) should come in contact with the surface under which the olfactory nerves lie, with the force of rather more than an ordinary inspiration. If the medium containing the odour be at rest, or be only gently forced against the membrane, no impression is produced.

In different animals the sense of smell is adapted chiefly to that class of substances on which they feed. The *Carnivora*, for example, have an acute sense of the odour of animal substances, but, so far as we can discern, none for that of vegetables; and, on the other hand, *Herbivora* are as clear in their perception of the latter, and as nearly insensible to the former. Man, as his food is mixed, so also is his sense of smell adapted to both classes of substances, though for each less acute than that of the animals that feed exclusively on the one or the other. In the choice of food, which is the main object of the sense of smell, man generally, though almost unconsciously, and animals always, exercise the precaution of smelling, and they instinctively form a judgment according to the impression received. In eating also, much of that which is commonly attributed to the

sense of taste depends on the odour of the food carried from the mouth to the nose. In eating cinnamon, for example, or any similar aromatic substance, if we close the nostrils, we perceive no flavour, and, except for the stinging of the tongue, might imagine ourselves eating a tasteless wood. And, in like manner, we often mistake for those of odour the impressions made by substances on the nerves of common sensation with which the lining membrane of the nose is abundantly supplied; for example, in smelling ammonia, vinegar, and other acrid substances, the impression which we regard as their odour is compounded of that and of the irritation of the nerves of common sensation; and the nose of an animal whose olfactory nerves are destroyed is hardly less sensible to this latter irritation than that of one in which the nerves are entire. Facts of this kind have led to the error of supposing that the olfactory are not the only nerves of smell; they only prove that the sense of smell has a more limited range than is commonly supposed. The same substances, ammonia and the like, which irritate the common sensitive nerves of the nose, act in the same manner on the eye or any equally delicate part; but in the nose alone is this irritation accompanied by any peculiar sensation of odour by which one such substance can be distinguished from another. This perception of odour, independently of irritation, is the proper function of the olfactory nerves, which are thus strictly nerves of peculiar sensation, of the same class with the optic, auditory, and gustatory. [NERVOUS SYSTEM.]

SMELT. [SALMONIDÆ.]

SMERDIS. [ERICHTHUS.]

SMEW. [DUCKS.]

SMILACEÆ, *Sarsaparillas*, a small natural order of Plants belonging to Lindley's class of Dictyogens. There has been much difference of opinion amongst botanists with regard to the position of *Smilax* in the natural system, as well as the number of genera that ought to be admitted into the order *Smilaceæ*. Lindley has placed two genera, *Smilax* and *Ripogonum*, in this order, which possesses the following characters:—Flowers hermaphrodite or diœcious; calyx and corolla confounded, inferior 6-parted; stamens 6, inserted into the perianth near the base, seldom hypogynous; ovary 3-celled, the cells 1- or many-seeded; style usually trifid; stigmas 3; fruit a roundish berry; albumen between fleshy and cartilaginous; embryo usually distant from the hilum. They are mostly herbaceous plants, with a woody stem, and a tendency to climb. Their leaves are reticulated. This last character separates the order from *Liliaceæ* and its allied orders, with which it otherwise closely agrees.

Smilax is found in most parts of the world, especially in Asia and America. [SMILAX].

SMILAX, a genus of Plants which gives its name to the natural order *Smilaceæ*. The name occurs in Greek authors, as Theophrastus and Dioscorides, and is applied to several different kinds of plants, as the yew-tree; a species of Phaseolus or Convolvulus (Σμίλαξ τραχεῖα) is *Smilax aspera*, which belongs to the present genus. *Smilax* is characterised by having a 6-leaved corol-like perianth, with six stamens inserted into their base; the anthers are linear and fixed by the base; ovary 3-celled; ovules solitary, in each cell affixed to the apex; style very short; stigmas 3, spreading; berry 1-3-celled, 1-3-seeded; seeds globular; testa membranaceous, whitish; hilum large and coloured; albumen cartilaginous; embryo very small, remote from the hilum. The species form evergreen climbing shrubs, of which a few are found in temperate, but the majority in warm and tropical regions of both hemispheres, extending south to Australia, and north to Japan, North America, and the south of Europe. The species have fibrous or tuberous roots; stems often prickly; leaves alternate petiolate; cordate or hastate, nerved, reticulate, venose, conchiferous stipules between the petioles; flowers sessile on a globular receptacle; subcapital pedicellate and umbellate.

Though the original species (*S. aspera*) of this genus is an inhabitant of the south of Europe, those now most celebrated for yielding the different kinds of Sarza or Sarsaparilla are natives of South America. But *S. aspera* still continues to be employed for medicinal purposes in the south of Europe, where it is called *Sarsaparilla Italica*, but there is no truth in the statement of its being the plant yielding Indian Sarsaparilla, which is *Hemidesmus Indicus*. Another celebrated species is the *Smilax China*, which has a tuberous root abounding in fecula, and therefore probably useful as a demulcent, though the Chinese esteem it invigorating, and ascribe to it other virtues. It is remarkable that two Indian species, which, like the Chinese species, have tuberous roots, should be called in Silhet Hurina-Shook-China and Gootea-Shook-China. These are *Smilax glabra* and *S. lanceæfolia*, and their roots cannot be distinguished from the China root, or *Chob. chænea*, as it is called in India. A similar species is common in the southern parts of North America, and has been called *Smilax Pseudo-China*, though there is reason to believe that more than one species may be confounded under this name. *S. glycyphylla* is an Australian species, which has received its specific name from the sweetish taste of its leaves, and has been called Sweet Tea from its employment in the form of infusion, and is probably alterative and diaphoretic, as well as slightly tonic. It is probable that some of the species found in the Old World will be discovered to be possessed of virtues equal to the American species. Some of the Indian species were sent some years ago by Dr. Gibson, superintendent of the East India Company's botanic garden near Poonah, to the Medical Board of Bombay, for trial in the hospitals of that presidency. [SARSAPARILLA, in ARTS AND SC. DIV.]

SMI'LIUM, a genus of Barnacles. [CIRRIPEDIA.]

SMI'THIA, a genus of Plants belonging to the natural order *Leguminosæ*, named in memory of Sir James E. Smith. It consists of small plants with inconspicuous flowers, but the leaves are remarkable for their apparent sensibility on being touched, in which they resemble the Sensitive Plant. The genus is nearly allied to *Æschynomene* and to *Lourea*. The calyx is bipartite, the corolla papilionaceous, the stamens in two equal bundles, the legume transversely articulated, plicate, and inclosed within the calyx. The species are found in warm parts of the world, as in Australia and the plains of India, in the rainy season.

SMITHSONITE. [ZINC.]

SMOOTH-HOUND. [SQUALIDÆ.]

SMUT. [FUNGI; UREDO.]

SMY'RNIUM (Σμύρνιον), a genus of Plants belonging to the natural order *Umbelliferæ*. It is known by its obsolete calyx; lanceolate or elliptical, entire, acuminate petals, inflexed at the point; didymous fruit, contracted at the side. The half-fruits are almost globose and reniform, with three fine prominent ridges on the back, and two on the side, but almost obliterated; the channels with many vittæ; the seed is involute; the species are upright smooth biennials with fleshy roots, various leaves, terminal umbels, and variable involucres. The flowers are yellow or yellowish-green, and they are frequently polygamous.

S. Olusatrum, Common Alexanders, has a taper stem; the leaves of the stem are ternate, with ovate serrated-segments, and very short involucels. It is a native of the middle and south of Europe in humid places. It is found in Great Britain, and is observed most frequently near the coast, although not confined to such a locality. This plant was formerly much eaten in Europe both as a salad and potherb, on which account, and the black colour of its stalks and leaves, it derives its specific name *Olusatrum*, from 'olus' and 'ater.' Ray says that this is the *Herba Alexandrina* of Italy and Germany, whence our name Alexanders. It is supposed to have been originally brought from Alexandria. It flowers in May, and the whole plant dries up by the middle of July, but remains laden with large black seeds.

S. perfoliatum, Perfoliate Alexanders, has the stem angularly winged above, with ovato-cordate toothed leaves, which embrace the stem. This plant was obtained in Greece by Dr. Sibthorp, and is also an inhabitant of Spain, Italy, and Dalmatia. It is the *Smyrnium Dioscoridis* of Sprengel; and Sir J. E. Smith was of opinion that this species is the true Σμύρνα of Dioscorides, with whose description it remarkably agrees. (*Flora Græca*, p. 289.)

SNAILS. [GASTEROPODA; HELICIDÆ.]

SNAKE. [NATRIX.]

SNAKE-FISH. [CEPOLA.]

SNAKE-ROOT. [POLYGALA.]

SNAKE'S-TONGUE. [OPHIOGLOSSUM.]

SNAKE-WEED. [POLYGONUM.]

SNAKE-WOOD. [OPHIOXYLON.]

SNAKE-WOOD. [STRYCHNOS.]

SNAKES. [OPHIDIA.]

SNAPDRAGON. [ANTIRRHINUM.]

SNEEZE-WORT. [ACHILLÆA.]

SNIG. [MURÆNIDÆ.]

SNIPE. [SCOLOPACIDÆ.]

SNIPE-FISH. [CENTRISCUS.]

SNOW, water precipitated from the atmosphere in a frozen condition. It assumes very beautiful crystalline forms. When large solid pieces of water are thus precipitated, they are called hail. [WATER, in ARTS AND SC. DIV.] Snow often exhibits under the microscope organic beings. This is more especially the case with Red Snow. [SNOW, RED.]

SNOW-BALL-TREE. [GELDER-ROSE; VIBURNUM.]

SNOW-BERRY. [CHIOCOCCA.]

SNOW-BUNTING. [EMBERIZIDÆ.]

SNOW-FLAKE. [LEUCOJUM.]

SNOW, RED. The occasional occurrence of snow coloured red has for a long time created great interest, and it is only since the increased use of the microscope that it has been discovered that this curious phenomenon is entirely due to organic bodies for its existence.

It appears that this phenomenon did not escape the observant eye of Aristotle, and he mentions that living beings found in old snow had frequently a reddish colour, which he supposed they derived from the snow. ('Hist. Anim.,' v. cap. 19.) This observation of Aristotle's however does not appear to have excited any attention, and no other writer mentioned the occurrence of red snow till 1760, when Saussure discovered it on the Brevent and other mountains, but more especially on the Saint-Bernard, where it existed in great abundance. He made some chemical analyses of this snow, and came to the conclusion that it was of vegetable origin, and probably consisted of grains of pollen mixed with the snow, such a cause having been known to discolour rain, producing what was called a 'sulphur shower.' (De Saus., 'Voyage,' ii. p. 646.)

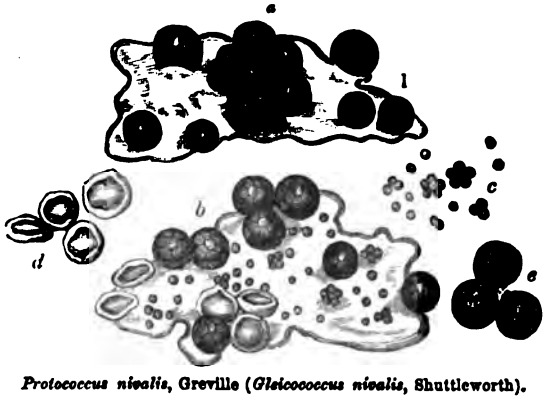
It was not however till the year 1819, when our countryman Captain

Ross returned from his arctic expedition, that this substance was accurately examined with a view to the discovery of the origin of its peculiar colour. Whilst in Baffin's Bay, 75° 54′ N. lat., 67° 15′ W. long., Captain Ross discovered a range of cliffs covered with snow of a crimson colour. The cliffs were about 600 feet high, and were coloured for the extent of eight miles. According to Captain Ross, the party he sent on shore "found that the snow was penetrated even down to the rock, in many places to a depth of 12 feet, by the colouring matter, and that it had the appearance of having been a long time in that state."

In the Appendix to the account of Captain Ross's polar expedition, Mr. Robert Brown described the colouring-matter of this snow as dependent on a species of unicellular plants belonging to the family of *Algæ*, and pointed out its resemblance to the *Tremella cruenta* of 'English Botany.' At the same time some of the red snow water brought from Baffin's Bay was sent to Francis Bauer, who published the results of a very careful examination of it under the microscope, in the seventh volume of Brande's 'Journal of Science and Arts,' accompanied with several drawings. He found that the water contained a number of opaque or red spherical globules, which were heavier than the water, forming a sediment at the bottom of the bottle, and also of some transparent vesicular bodies which floated about in the fluid. On examining the red globules, he found them possessed of a pedicel resembling that of some species of *Uredo*, and regarded them as a species appertaining to this genus. He subsequently observed that many of the globules were attached to a gelatinous matrix presenting a cellular and articulated character. On exposing the water with the globules for some days to the air, he found that they lost their colour, and that on the sides of the vessel were developed new portions of the gelatinous matrix, which were covered with small globules, which he looked upon as young Uredos. He also found that on comparing the chemical analysis of the *Uredo fœtida* with that of the red snow, they in a great measure agreed, and hence he came to the conclusion that the colouring-matter of the red snow was a fungus belonging to the genus *Uredo*, and to which he gave the name *U. nivalis*. [Protococcus; Hæmatococcus.]

But the question was not thus set at rest. In 1823 Baron Wrangel gave an account of a plant of a red colour, which he called *Lepraria Kermesina*, and supposed to be identical with the long-disputed *Byssus Iolithus* of Linnæus. This plant was obtained from the surface of white limestone rocks, forming over them a thin red crust, and was also found contained in the rain-water remaining on the limestone. During the same year Professor Agardh of Lund, who had previously suggested the identity of this plant and that of red snow, received specimens of the *Lepraria* from Baron Wrangel, and also of the *Uredo nivalis* of Bauer from England, and he came to the conclusion, after a very minute examination, "that the two plants were actually one and the same species." "We must conclude," says Agardh (Greville's 'Scottish Cryptog. Flora—Protococcus,' p. 15), "that the *Uredo nivalis* and the *Lepraria Kermesina* are alike called into existence by the gradual melting of the snow, and the intensity of light in their relative situations; and that they are neither washed down from the rocks, as some persons believe, nor are precipitated from the atmosphere, as might be inferred from the accounts transmitted by the Italians."

The plants which Agardh had thus identified, he could not consider, with Bauer, a fungus, or, with Wrangel, a lichen, but, from its analogy to some of the *Algæ*, he placed it in his 'Systema Algarum,' in that family under the name of *Protococcus nivalis*.



Protococcus nivalis, Greville (*Gleicococcus nivalis*, Shuttleworth).

a, mature globules mixed with younger ones (1) lying on a mass of gelatine; *b*, mature globules, some burst, with granules lying on the gelatine; *c*, granules; *d*, globules after discharging their granules; *e*, full-sized globules.

In 1825 the subject was taken up by Dr. Greville of Edinburgh. He had received specimens of the plant of red snow from the polar regions, and also from the island of Lismore in Scotland. From this latter situation it was sent to Dr. Greville by Captain Carmichael, who says:—"It occurs in abundance on the borders of the lakes of Lismore, spreading over the decayed reeds, leaves, &c. at the water's edge, but in greater perfection on the calcareous rocks within the reach of occasional inundation; and what is rather remarkable, it seems to thrive equally well whether immersed in water or exposed to the dry atmosphere. It is to be found more or less at all seasons of the year." The specimens were immersed in water, and then examined by the microscope. In every instance Dr. Greville observed a gelatinous substratum varying in thickness, colourless, diffuse, without any border. Upon this gelatine rested a vast number of minute globules, the colour of fine garnets, exactly spherical, nearly opaque, yet very brilliant, and nearly equal in size. In the full-sized globules granules were detected in the interior, which gave to the surface a reticulated appearance. When mature, they burst, and the granules escaped, to the number of six, eight, or more, and the membrane only of the globule was left behind, buoyant and colourless. The globules or granules were never observed to move. Dr. Greville at first doubted the propriety of referring his plant to Agardh's genus *Protococcus*, as in his definition Agardh had not mentioned any gelatinous substratum, which was so evident in his own specimens. He however determined on keeping up the genus with an amended character. Agardh's definition of *Protococcus* is merely, "plants with aggregated, not mucous globules." To this Greville added, "globules containing granules seated on a transparent gelatinous mass."

In the same year Sir William Hooker, in the 'Appendix to Parry's Second Voyage to the Arctic Regions,' described, under the name of *Palmella nivalis*, the plant of the red snow collected in that expedition. Sir William Hooker referred the plant to this genus, as it only differed in its globules being seated on a gelatinous mass, instead of being immersed in it.

From this time to 1838 a variety of memoirs and observations upon the red snow were published, chiefly on the Continent, by Kunze, Unger, Martius, and other observers, but no new matter of any importance was elicited.

We now come to another and very important point in the history of red snow. Hitherto all the examinations had been made on old specimens of the red snow, most of them removed at a great distance from the spots on which they were originally found. In August, 1839, Mr. Shuttleworth, an English gentleman resident in Switzerland, being at Grimsel, understood that there was red snow in the neighbourhood, and having a microscope with him, made observations on the recently procured snow. Having melted the snow and placed some of the red matter on the field of the microscope, he was surprised at finding, instead of the immoveable globules of an *Alga*, an immense number of exceedingly active animalcules, not of one form only, but of various sizes and forms. The results of this examination he has given in an interesting paper accompanied with drawings, in the 'Bibliothèque Universelle de Génève,' for February, 1840. The following are the forms of *Infusoria*, which he was enabled to detect:—1. An animalcule belonging to Ehrenberg's genus *Astasia*, which he called *A. nivalis*. 2. An animalcule, red inside, with a transparent carapace, belonging to the genus *Gyges* (*G. sanguineus*, Sh.). 3. One much smaller than the other two, moving, but resembling the globules of *Protococcus*. 4. One belonging to the genus *Volvox*. Several other uncoloured species were found, but they were considered accidental. In addition to the animalcules, Mr. Shuttleworth found bodies which he took to be true plants, and referred to the *Protococcus nivalis* of Agardh and the *P. nebulosus* of Kützing.

In 1840 Professor Agassiz of Neufchâtel made a visit to the glacier of Aar, having taken with him a microscope. He confirmed the researches of Shuttleworth, having found all the animalcules mentioned by him, and added four others to the list. Three of these are comparatively unimportant, but to the fourth great interest attaches, as he supposes that the ova of this animal are the globules which have been taken for a plant, and called *Protococcus*, &c. This animalcule is the *Philodina roseola* of Ehrenberg. It was found abundantly in the lower glacier of the Aar. It has a much higher organisation than the other animalcules, and contains in its inside a number of red globules, which may be distinctly seen through its transparent body. These globules are its ova, which, on being deposited, precisely resemble the globules of *Protococcus* as figured by Shuttleworth and others.

In the various papers referred to above, no mention is made of snow of any other colour than red. Martius however, a naturalist who accompanied the French expedition to Spitzbergen, mentions having found in one instance a field of green snow. It was accompanied however with the *Protococcus* giving a red colour. From many observations Martius arrived at the conclusion that the red globules of the green snow are identical with those of the red snow, and that the green snow (*P. viridis*) and the red snow (*P. nivalis*) are one and the same plant, only in different stages of development, but that it is difficult to state which is the original. The late Professor Meyen (Taylor's 'Ann. Nat. Hist.', August, 1841) remarks on this statement, that these *Protococci* are not plants, but animals, the *Euglena sanguinea* and *E. viridis* of Ehrenberg. The reason of their being so often taken for plants is, that they naturally pass a great portion of their existence in a passive state, only occasionally under favourable circumstances starting into activity. When they do this, their spherical

form is changed, and they become the elongated beings described and figured by Ehrenberg.

From these researches it is very evident that red snow is not dependent on one form of organic existence, but that several species of plants and animals contribute to its production. It may however be remarked that it is probable that a species of plant is first developed, and it is not impossible that all the forms of animalcules described, except *Philodina*, may turn out to be forms of the same species of plant.

SNOWDROP. [GALANTHUS.]
SOAP-BERRY. [SAPINDUS.]
SOAPSTONE. [STEATITE.]
SOAPWORT. [SAPONARIA.]
SOAPWORTS. [SAPINDACEÆ.]
SOCOTRINE ALOES. [ALOE.]
SODA. [SODIUM.]

SODA ALUM is a Mineral occurring in white fibrous masses. The outer fibres opaque by decomposition, internally transparent, and exhibiting a glossy or silky aspect. It is not scratched by the nail. Specific gravity 1·88. It is found at San Juan in South America. Its analysis by Thomson gives—

Sulphuric Acid	38·5
Alumina	12·0
Soda	7·5
Water	42·0
	——100;

with a little silica, lime, iron, and manganese.

SODA'DA, a genus of Plants named from 'Sodad,' the Arabic name of a shrub found in Egypt, as well as everywhere in the province of Yemen in Arabia. It was considered by Forskal, the discoverer, to be a distinct genus belonging to the natural family of *Capparidaceæ*. It is now arranged only as a sub-genus under *Capparis* [CAPPARIDACEÆ], distinguished by having concave leaflets of the calyx, stamens indefinitely numerous, berry ovate. It requires mention only as the unripe fruit is cooked, and forms an article of diet among the Arabs. The same plant is known in Egypt by the name Hombac. It forms a shrub with thorny nearly leafless branches.

SODALITE, a Mineral occurring crystallised and massive. Its primary form is the cube, but it is usually met with in rhombic dodecahedrons, parallel to the planes of which it is cleavable. Fracture conchoidal, uneven, with a vitreous lustre. Hardness sufficient to scratch glass easily. Colour white, gray, grayish-green, and green. Streak white. Lustre vitreous. Transparent, translucent. Opaque. Specific gravity 2·295 to 2·37.

Massive varieties amorphous. Structure granular, compact.

When heated by the blow-pipe, the edges are rounded with difficulty, and without any other alteration. With borax dissolves into a colourless transparent glass with great difficulty. It is found in Greenland, in Mount Vesuvius, and in Siberia. An analysis of the Vesuvian mineral by Arfwedson gave—

Silica	35·99
Soda	26·55
Alumina	32·59
Muriatic Acid	5·30
	——100·43

SODIUM, a Metal, the base of the alkali Soda. It was discovered at the same time with potassium by Sir Humphrey Davy. It oxidises so readily when exposed to the air, or any substance containing oxygen, that it is never found free in nature. Soda, the oxide of sodium, occurs naturally in combination with sulphuric acid, nitric acid, carbonic acid, and boracic acid. [GLAUBER SALT; GLAUBERITE; BORON; SODALITE.]

Sodium, in combination with chlorine, forms Chloride of Sodium, or Common Salt, the principal ingredient in sea-water.

Sea-water contains 32 to 37 parts of solid substances in solution in 1000 parts of water. The largest amount in the Atlantic, 36·6 parts, is found under the equator, away from the land or the vicinity of fresh-water streams; and the smallest in narrow straits, as Dover Straits where there are only 32·5 parts. In the Baltic and the Black Sea the proportion is only one-third that in the open ocean. Of the whole, one-half to two-thirds is common salt (chloride of sodium). The other ingredients are magnesian salts, chloride and sulphate, amounting to four-fifths of the remainder, with sulphate and carbonate of lime, and traces of bromides, iodides, phosphates, and fluorides. The water of the British Channel affords—water 964·7 parts in 1000, chloride of sodium 27·1, chloride of potassium 0·8, chloride of magnesium 3·7, sulphate of magnesia 2·30, sulphate of lime 1·4, carbonate of lime 0·03, with some bromide of magnesium, and probably traces of iodides, fluorides, and phosphates. The bitter taste of sea-water is owing to the salts of magnesia present.

The waters of the Dead Sea contain 200 to 250 parts of solid matter in 1000 parts (or 20 to 25 per cent.), including 7 to 10 per cent. of common salt, the same proportion of magnesian salts, principally the chloride, 2½ to 3½ per cent. of carbonate and sulphate of lime, besides some bromides and alumina. The density of these waters is owing to this large proportion of saline ingredients. The brine-springs of England and America are well known sources of salt. Many of the springs afford bromine and iodine, and large quantities of it are manufactured for making Daguerreotype plates and other purposes.

Chloride of Sodium crystallises in cubes, and its presence in water or the secretions of animal bodies may easily be detected by evaporation, and submitting the crystals to the microscope. Salt is originally associated with gypsum and clay, and sandstone (New Red-Sandstone). It is necessarily a constituent to a greater or less extent of all deposits formed from the bed of the ocean. It occurs in extensive beds in Spain, forming hills 300 or 400 feet high; also in Poland, the Tyrol, Bavaria, Saltzburg, Upper Austria, Styria, Hungary, Transylvania, Wallachia, Gallicia, Upper Silesia; at Vic and Dieuze in France; at Bex in Switzerland; in Cheshire, England; in Africa, Persia, India, China and Asiatic Russia, in South America, in Peru and the Cordilleras of New Granada.

The most remarkable deposits are those of Poland and Hungary. The former, near Cracow, has been worked since the year 1251, and it is calculated that there is still enough salt remaining to supply the whole world for many centuries. The deep subterranean regions are excavated into houses, chapels, and other ornamental forms, the roof being supported by pillars of salt; and when illuminated by lamps and torches they form objects of great splendour.

The salt is often impure with clay, and is purified by dissolving it in large chambers, drawing it off after it has settled, and evaporating it again. The salt of Northwich (in Cheshire) is in masses 5 to 8 feet in diameter, which are nearly pure, and it is prepared for use by crushing it between rollers.

Beds of salt have lately been opened in Virginia in Washington county, where as usual it is associated with gypsum. The Salmon Mountains of Oregon also afford rock-salt.

Salt-beds occur in rocks of various ages: the brines of the United States come from a Red-Sandstone below the coal; the beds of Northwich, England, occur in Magnesian Limestone; those of the Vosges in marly Sandstone beds of the Lower Secondary; that of Bex in the Lias or Middle Secondary; that of the Carpathian Alps in the Upper Oolite; that of Wieliczka, Poland, and the Pyrenees, in the Cretaceous Formation or Upper Secondary; that of Catalonia in Tertiary: and moreover there are vast deposits that are still more recent, besides lakes that are now evaporating and producing salt depositions.

Vast lakes of salt-water exist in many parts of the world. Lake Timpanogos, or Youta, called also the Great Salt Lake, has an area of 2000 square miles, and is remarkable for its extent, considering that it is situated towards the summit of the Rocky Mountains at an elevation of above 4000 feet above the sea. The state of California abounds in salt hills and lakes. In the north of Africa large lakes and hills of salt abound, and the deserts of Africa are frequently found covered with an efflorescence of salt.

Carbonate of Soda, or Natron, occurs in white efflorescent crusts, sometimes yellowish or grayish. It is abundant in the soda lakes of Egypt, situated in a barren valley called Bahr-bela-ma, about 30 miles west of the Delta. Also in lakes at Debreczin in Hungary; in Mexico, north of Zacatecas, and elsewhere. It is sparingly dissolved in the Seltzer and Carlsbad waters.

Trona is a Sesquicarbonate of Soda. In the province of Suckena in Africa, between Tripoli and Fezzan, it forms a fibrous layer an inch thick beneath the soil, and several hundred tons are collected annually. At a lake in Maracaibo, 48 miles from Merida, in South America, it is very abundant.

It is mostly obtained for commercial purposes from chloride of sodium by the addition of charcoal.

Nitrate of Soda is found native, in the district of Tarapaca, in South America; the dry pampa, for an extent of 40 leagues, is covered with beds of this salt, mixed with gypsum, common salt, sulphate of soda, and remains of recent shells. It is found in other parts of the world, and is used for many of the purposes to which nitrate of potash is put, especially in making nitric acid.

(Dana, *Manual of Mineralogy.*)

SOJA, a genus of Plants belonging to the natural order *Leguminosæ*. *Soja hispida* (Mœnch), *S. Japonica* (Savi), the *Dolichos Soja* (Linn.), is a native of Japan and the Moluccas, and abundant in the peninsula of India, though probably introduced there. The seeds resemble those of the haricot, French or kidney bean, and are used by the Chinese to "form a favourite dish, called 'ten-hu,' or 'tau-hu,' which looks like curd, and which, though insipid in itself, yet with proper seasoning is agreeable and wholesome." The Japanese call the seeds 'Miso,' and put them into soup, of which they sometimes partake three times a day. They likewise prepare with them the sauce termed 'Sooja,' which has been corrupted into 'Soy.' Soy is only sparingly used as a sauce in this country. It has the character of being a useful stomachic, but not more so than any of the other condiments when used with moderation.

SOLA, frequently *Shola*, is the name of a Plant common in moist places, and in the rainy season in many parts of the plains of India. It belongs to the genus *Æschynomene*, and has been called *Æ. aspera* by Linnæus, from the lower part of the stem being rough and scabrous, as well as the legumes. It has been called *Æ. lagenaria*, both by Loureiro and Roxburgh. The plants are remarkable for their light and spongy texture, and seem indeed to be composed almost entirely

of pith. On this account the thicker stemmed plants are collected in the dry months and the light substance applied to a variety of uses, as for making some kinds of toys, and the floats of fishermen's nets; cut into thin slices and pasted together, they are much employed for making hats, which, being light and having broad brims, are well suited for protecting the head from the influence of the powerful Indian sun, especially if a handkerchief be put loosely into the crown of the hat. This substance has also been employed for lining drawers of natural history, and in its texture very much resembles the substance called rice-paper, which is the pith or stem of a Malvaceous plant cut into thin slices.

SOLAN GOOSE. [DUCKS.]

SOLANA'CEÆ, a natural order of Plants belonging to the dicarpous group of Monopetalous Exogens. This order is composed of herbs or shrubs, rarely of arborescent plants, with colourless juices, round or irregularly angled stems or branches, sometimes armed with thorns or prickles; their leaves alternate, simple, entire, or lobed. The inflorescence is variable, mostly axillary, sometimes terminal; pedicels without bracts, and the flowers regular and united. The calyx is 5-parted, persistent, inferior; corolla monopetalous, hypogynous, 5-cleft or 4-cleft, regular, deciduous, plaited or imbricated in æstivation; stamens inserted upon the corolla, as many as the segments of the limb, and alternate with them; anthers bursting, mostly longitudinally, sometimes by pores at the apex; ovarium 2- or 4-celled, style continuous, stigma simple; fruit either a capsule, with a double dissepiment parallel with the valves, or a berry with a placenta adhering to the dissepiment; seeds numerous, sessile; embryo straight or curved, lying in fleshy albumen; radicle next the hilum.

This order is most closely allied to *Scrophulariaceæ*, but is distinguished by Brown from that order by the possession of a curved or spiral embryo, a plaited æstivation of the corolla, and the flowers being regular, with the same number of stamens as lobes. From the occurrence of many species in this order with a straight embryo, but with the other characters of *Solanaceæ*, Lindley, with Bartling and others, is inclined to look upon this as a secondary point, and a plaited corolla and symmetrical flowers to constitute the real character of this order. *Solanaceæ* and *Scrophulariaceæ* are however so nearly allied that scarcely any limits exist between them. They may be considered as the connecting groups of two larger masses of plants, of which one has a tendency towards regular flowers and symmetrical stamens, and the other a tendency towards irregular flowers and didynamous stamens.

The plants of this order are natives of most parts of the world, without the arctic and the antarctic circles, and especially within the tropics.

Nicotiana crispa.

a, cutting, showing alternate leaves and monopetalous flowers; *b*, transverse section of capsule with many-seeded placenta; *c*, pistil; *d*, fruit; *e*, seed, with straight embryo surrounded with albumen.

This order is one of the most important and interesting in its class, from its bringing together plants of the greatest utility, yet possessing apparently opposite properties. It is a great advantage of a natural system that it brings together not only plants that are allied in structure, but in properties also; but this order seems to form an exception. The Deadly Nightshade, the esculent Potato, the pungent Capsicum, the mild Tomato, the wholesome Egg-Plant, and the poisonous Tobacco, are all found here. They will all however, on close examination, be found to possess the same properties in a greater or less degree. The potato, the tomato, and egg-plant possess, when uncooked, in a mild degree, the properties of the Nightshade, the Stramonium, and the Henbane, confirming the remark of De Candolle, "that all our aliments contain a small proportion of an exciting principle, which, should it occur in a much greater quantity, might become injurious, but which is necessary as a natural condiment." In fact, when food does not contain some stimulating principle, we add it in the form of spices. Many of the plants of this order are used in medicine, amongst the most valuable of which are Henbane [HYOSCYAMUS], Deadly Nightshade [ATROPA], Bitter-Sweet [SOLANUM], Stramonium [DATURA], and Tobacco [NICOTIANA]. The species of *Physalis* were formerly used in medicine, but are not now in repute in this country. *P. Alkekengi*, the Common Winter Cherry, is grown as an ornamental plant; and in Arabia, and even Germany and Spain, the berries are eaten as a dessert. *Lycium barbarum* is known in this country as Tea-Plant, and has been recommended as a substitute for the Chinese plant. The Calabash-Trees of the West Indies and the American continent are different species of *Crescentia*, which is often referred to this order. The fleshy pulp of the fruit of some is eaten, but in most species is deleterious. The most valuable part of the calabashes is their rind, which is tough, and it is applied by the negroes to a variety of purposes. Cups, mugs, bowls, basins, and saucepans, are made from them, and many other articles of household use. Cayenne-pepper [CAPSICUM] is the produce of this order, as well as the potato, tomata, and egg-plant [SOLANUM], which are used extensively as articles of diet.

SOLANDRA, a genus of Plants belonging to the natural order *Solanaceæ*, which has been thus named in compliment to Daniel C. Solander, LL.D. The name has been applied to other genera, but is now restricted to a small Solanaceous genus, which is remarkable for the beauty and great size of the flowers of its species, which are natives of Mexico, Jamaica, and Brazil, with a doubtful species in Ceylon, forming large scandent shrubs, with broad alternate leaves crowded at the extremities of the branches with the solitary extra-axillary or terminal flowers. The genus is characterised by having a sheath-like calyx splitting on one side, and 3-5 cleft at the apex. Corolla funnel-shaped and ventricose, with a plicate quinquefid limb and undulated lobes. Stamens 5; anthers versatile, opening longitudinally. Berry pulpy, covered by the split calyx, 4-celled, many-seeded. These, being highly ornamental plants, are cultivated in our hothouses, but, requiring moisture and much room, are difficult to flower. Sweet says the best way is to plant them in a loamy soil, and allow them to grow fast at first, till they have made a great many shoots; then keep them very dry till their leaves drop off, and they will produce plenty of flowers. The best way to have plants flower young is to take the cuttings from the flowering shoots.

SOLANOCRINITES. [ENCRINITES.]

SOLA'NUM, the name of one of the most extensive genera of Plants, the type of the natural order *Solanaceæ*. This genus is distinguished by the following characters:—Calyx permanent, 5-10-parted; corolla rotate; anthers oblong, connivent, opening by two pores at the extremity. Fruit a berry, subglobose, 2-celled, sometimes 3-4-celled. The species are herbs or shrubs, unarmed or prickly, rarely spiny The leaves are entire, sinuated or lobed, mostly alternate.

Upwards of 400 species of plants belonging to this genus have been enumerated, including many with apparently very opposite properties. The esculent Tomato, the Egg-Plant, and the invaluable Potato, with the various species of poisonous Night-Shades, are found united so closely by botanical characters that it is impossible generically to separate them. The properties of these plants however do not differ in kind but in degree; and the berries and leaves, and even the tubers when uncooked, of the Potato, possess in a mild degree the narcotic properties of the poisonous Nightshades. Many of them have also very handsome flowers, and are much cultivated in our gardens and greenhouses. From the immense list of species belonging to this genus, we shall select for description a few of those that are used as medicines or food, or are much cultivated.

S. tuberosum, Common Potato, is known in the genus by its tuberous subterranean stem, herbaceous stems without thorns, unequally pinnate leaves with entire leaflets, and articulated pedicles. It is one of the plants for which we are entirely indebted to America. It is found native in the greatest abundance on the western coast of South America. Like most plants which are much cultivated, an abundance of varieties have been produced from the original plant, and in the leaves, colour of the flowers, shape, size, and colour of the tubers, it has a great tendency to depart from its normal character. [POTATO, in ARTS AND SC. DIV.] Two other species of *Solanum*, namely, *S. Valenzuela* and *S. montanum*, produce edible tubers, but they are little used.

S. nigrum, Common or Garden Nightshade. Stem herbaceous, without thorns; leaves ovate, bluntly toothed, and waved; umbels lateral, drooping. Throughout Europe it is a weed in cultivated ground, and is also found in Africa and Asia. It is common in gardens, fields, and waste places in Great Britain. It has white flowers, producing small berries of a black colour.

S. dulcamara, Woody Nightshade, or Bitter-Sweet. Stem shrubby, thornless, climbing, flexuous; leaves cordate, upper ones jagged; corymbs almost opposite the leaves. It is a native of Europe, Asia, and North America, in hedges and among bushes. It is plentiful in Great Britain. It has purple flowers and crimson berries, which

latter may be mistaken by children for red currants, a mistake that has sometimes been attended with fatal consequences.

S. Melongena, Egg-Plant, Mad Apple, or Jew's-Apple. Stem herbaceous, woody at the base, clothed with star-shaped hairs; ovate serrated leaves; flowering peduncles reflexed; fertile peduncle solitary, sterile one racemose; calyx campanulate; corolla angular. It is a native of the East Indies, and also said to be of Arabia. This plant has purple flowers, and bears large smooth shining berries, which are the shape and size of a small hen's egg. Two varieties of this plant are recorded—the *S. M. ovigerum*, in which the stem, calyx, and leaves are without thorns; and the *S. M. esculentum*, in which these parts are more or less covered with thorns. Several sub-varieties of both these are recorded, varying in the shape and colour of the fruit. The berries are mostly of a white colour, but in some of the sub-varieties they are yellow, red, purple, and black. The fruit of this plant is used by the French and Italians in stews and soups. For this purpose the varieties used are the oval-shaped white, the globular-shaped white, and the purple or violet-coloured of both forms. In cultivating them they may be reared in hot-beds in a rich light soil, or in fine summers they will even produce their fruit in this country against a wall, if planted out in June after having been struck in a hotbed.

S. Sodomeum, Sodom Egg-Plant, or Apple of Sodom. Stem shrubby, diffuse; prickles straight, dilated at the base; leaves oblong-sinuate, shining above, and rather scabrous and prickly on both surfaces; lobes obtuso-angular; peduncles bifid. It is a native of the North of Africa and the south of Europe. The fruit of this plant is white, and about the size of a walnut. It is very subject to the attacks of an insect which deposits its eggs within the germen, and as the fruit enlarges, the larvæ of the insect, as in the case of many other fruits, destroy and pulverise the whole of the interior, whilst the rind is left unchanged and entire. When the fruit is gathered under these circumstances, it is crushed to pieces by the hand; or if conveyed to the lips, the mouth becomes filled with an ash-like powder, exceedingly bitter to the taste. To these berries remarkable properties have been assigned by Josephus, Tacitus, and others. Mandeville, an old English writer, says, speaking of the Dead Sea, "And there besyden growen trees that baren fulle faire apples and faire of colour to beholden, butte whoso breakethe them or cuttethe them in two, he shall find within them coles and cyndres." Milton finely alludes to this fruit n the lines:—

> "Greedily they pluck'd
> The fruitage fair to sight, like that which grew
> Near that bituminous lake where Sodom flamed.
> This more delusive, not the touch but taste
> Deceived; they fondly thinking to allay
> Their appetite with gust, instead of fruit
> Chewed bitter ashes."

S. sanctum, Palestine Egg-Plant. Stem shrubby, tomentose; leaves ovate-repand, oblique at the base, clothed with hoary tomentum on both surfaces. Berries nearly globose. This plant is a native of Palestine; it is often found in collections of plants. There are several other species of *Solanum*, which, on account of the size, form, and colour of their fruits, are called Egg-Plants, as *S. Indicum*, the Indian Egg-Plant, &c.

S. Æthiopicum, Æthiopian Nightshade. Stem herbaceous; leaves ovate-repand, angular; peduncles usually 1-flowered, drooping. Berries torulose. It is a native of Ethiopia, China, and Japan. There are two varieties recorded: one, the *S. Æ. violaceum*, is a native of China, and the fruit is frequently eaten in that country as a dessert. It has a large spheroid oval berry of a red colour. The other variety is the *S. Æ. aculeatum*, having a prickly stem, and small yellow berries of the size of peas.

S. pseudo-quina, False Quina Nightshade. Stem shrubby, unarmed. Leaves oblongo-lanceolate, narrow, acute-entire, glabrous above, but with fascicles of villi in the axils of the nerves beneath. Racemes extra-axillary, short; calyx glabrous. This plant is a native of Brazil in the district of Curitiba, in St. Paul without the tropics. The Brazilians use this for the same purposes as the Quina, or Jesuits Bark. It is intensely bitter, and may with advantage be used as a substitute for that bark.

S. verbascifolium, Mullein-Leaved Nightshade. Stem shrubby; leaves ovato-oblong, acuminated, entire, tomentose, white beneath, without any leaves in the axils; corymbs nearly terminal, dichotomous; calyx semi-quinquefid. It is a native of Asia, America, and the tropical parts of Australia. This plant is frequently cultivated. Every part is covered with a powdery white tomentum. The flowers are white, and the berries are of the size of small cherries.

S. Lycopersicum of Linnæus, Common Love-Apple or Tomato. This, with some other of the older species of *Solanum*, now form the genus *Lycopersicum*, which is distinguished by possessing a calyx 5-6 parted; corolla rotate, 5-6-cleft; stamens 5; anthers conical, connate at their extremities by an elongated membrane, and dehiscing lengthwise inside; berry 2-3-celled; seeds villous. The present species is called *L. esculentum;* it has herbaceous pilose stems; unequally pinnate leaves; leaflets cut, attenuated at the apex, glaucous beneath; flowers many, united; berries torulose. This plant is a native of South America, but it is much cultivated and well known in the United States of North America, and in France, Germany, and Italy. When ripe the fruit has an acid flavour, and is added to soups, sauces, &c. It is also used in confectionary as a preserve, and sometimes as a pickle. It is not often used in this country, but in Italy, near Rome and Naples, whole fields are covered with it, and scarcely a dish is served up into which it does not enter as an ingredient. In the cultivation of these plants the seed should be sown in March in a hot-bed, and when 2 inches high they may be pricked out into another hot-bed. In May they should be transplanted into a warm south border, where they may have the full sun, and the fruit may ripen quickly. The stem runs up 6 or 8 feet high, and should be trained to stakes or nailed up a wall or pales. The fruit begins to ripen in August, and may be gathered in October, and, when kept dry, will keep good till November. There are several varieties cultivated; the best are called the Large and Small Cherry and Pear-Shaped Red, and the Large and Small or Cherry-Shaped Yellow. The size of the fruit is seldom larger than a golden-pippin apple. (Don's Miller, vol. iv., p. 444.)

Several other species of *Solanum* are recorded as having medical properties. *S. Jacquini* is considered by the native practitioners of India as an expectorant; *S. Bahamense* is used as a gargle for sore throat in the West Indies; *S. mammosum*, *S. paniculatum*, and *S. cernuum*, have the reputation of being diuretic and astringent.

(Lindley, *Flora Medica*, p. 512.)

SOLA'RIUM. [TROCHIDÆ.]

SOLASTERIÆ, or SOLASTERINÆ, a sub-family of *Asteriadæ*, including those forms of Star-Fishes which have two ranges of suckers in each avenue. There are two British genera, *Cribella* and *Solaster*.

Cribella has only a few rays covered with spine-bearing warts; the intermediate spaces porous; the avenues bordered by two sets of spines.

There are two species which are not uncommon on the shores of the British Islands, *C. oculata* and *C. rosea*.

Solaster (Forbes) has many rays studded over with bundles of spines; the avenues bordered by three sets of spines.

S. papposa, the Rosy Sun-Star, is common on the eastern coasts of Great Britain, where, on account of the number of its rays, it is called Ten-Fingers. It is of a deep red or orange colour. Another British species is *S. endeca*. [ECHINODERMATA.]

SOLDANELLA, a genus of Plants belonging to the natural order *Primulaceæ*. Some of the species are slightly purgative.

SOLE. [PLEURONECTIDÆ.]

SOLEA. [PLEURONECTIDÆ.]

SOLECURTUS. [PYLORIDIA.]

SOLEMYA. [PYLORIDIA.]

SOLEN. [PYLORIDIA.]

SOLENA'CEA. [PYLORIDIA.]

SOLENE'LLA (Sowerby), a genus of *Mollusca*.

SOLENIDÆ. [PYLORIDIA.]

SOLENI'TES, a Fossil Plant from the Yorkshire coast. (Lindley.)

SOLE'NODON, a genus of Insectivorous *Mammalia* established by Brandt on a specimen sent from the island of Hispaniola by Jäger. The habit is generally between that of *Sorex* and *Didelphys*. Muzzle elongated, the snout smooth, produced, and with nostrils at the sides of its apex. Eyes minute. Ears large, rounded, nearly naked. Body hairy. Stern and upper part of the rump beset with a few very short silky hairs. Feet ambulatory, plantigrade, pentadactylous; claws falcular, those of the fore feet the longest. Teats inguinal (?) Tail long, smooth, and for the most part scaly. Dental Formula:—

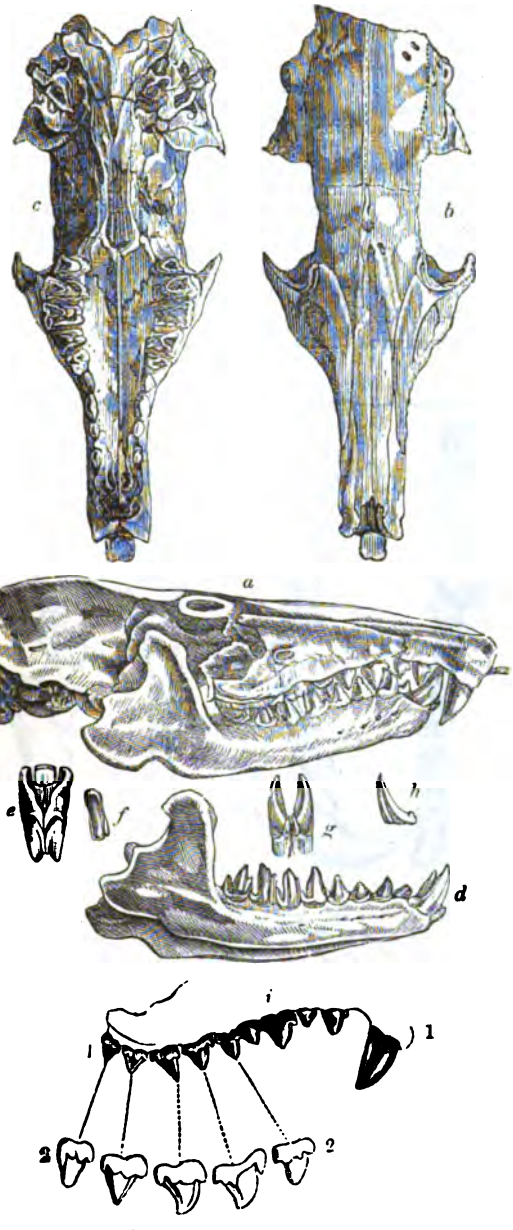
$$\text{Incisors, } \frac{6}{6};\ \text{Molars (spurious) } \frac{6}{6};\ \text{true Molars } \frac{8}{8} = 40.$$

The skull of *Solenodon* is considerably elongated: the occipital, parietal, and temporal bones are moderately convex; and the condyles of the occipital are prominent. There is an obtuse crest on the sagittal suture, but none on the coalesced frontal bones. The internal pterygoid processes alone are conspicuous, thin, and joined by a suture with the perpendicular parts of the palatal bone. There is no bony bulla, and consequently the interior wall of the tympanic cavity is only closed by skin. There is no zygomatic arch. The coronoid process of the mandible is dilated and directed outwards. The angle of the mandible is dilated, subtetragonally rounded, and prominent above the condyloid part.

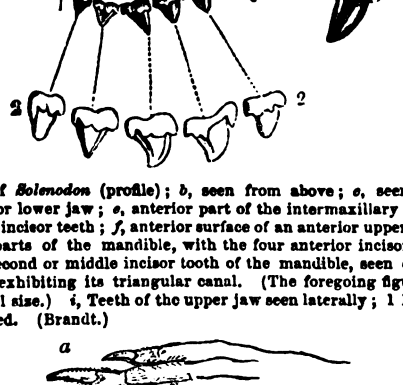
The two anterior upper incisor teeth are the largest, disjoined from the others, perpendicular, and unicuspid; the two anterior lower incisors are very short and very narrow; the two middle are the longest, and conical, and excavated on the internal surface with a rather deep triangular canal. Brandt remarks that the structure of the teeth manifests a greater similitude to that of *Mygale* than any other genus.

S. paradoxus has the sides of the head and neck dilute yellow-brown, mixed with ferruginous, and occasionally with gray. Abdomen and feet dilute yellow-brown, with hardly a mixture of gray. Space upon the breast between the anterior limbs dilute ferruginous, extended to the internal side of the feet, and anteriorly to the cubit. A similarly coloured space occupies the inguinal region, and also extends upon the anterior part of the legs. Upper part (dorsum) of the

muzzle, forehead, vertex, middle of the nape, and anterior part of the back, tinged with black-brown: the rest of the back black-brown, the colour (more diluted) extending towards the posterior part of the sides and towards the external surface of the thighs. The basal and middle part of the scaly tail gray; the apical part white.



a, Skull of *Solenodon* (profile); *b*, seen from above; *c*, seen from below; *d*, mandible or lower jaw; *e*, anterior part of the intermaxilliary bone, with the two anterior incisor teeth; *f*, anterior surface of an anterior upper incisor tooth; *g*, anterior parts of the mandible, with the four anterior incisor teeth; *h*, the crown of a second or middle incisor tooth of the mandible, seen on its internal surface, and exhibiting its triangular canal. (The foregoing figures are nearly of the natural size.) *i*, Teeth of the upper jaw seen laterally; 1 1, natural size; 2 2, magnified. (Brandt.)

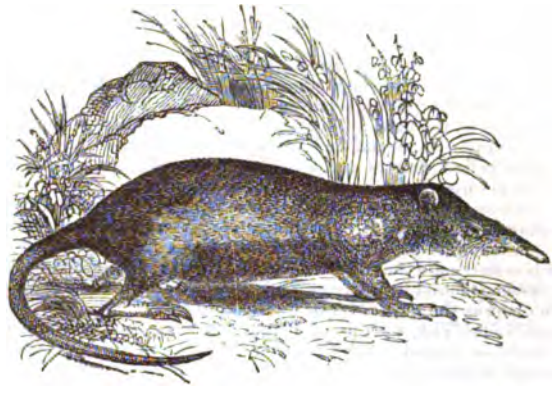


Feet of *Solenodon*. (Brandt.)

a, anterior part of the anterior foot, seen on the dorsal or upper side; *b*, a similar view of the anterior part of the posterior foot.

Habits, &c.—Brandt remarks that nothing is known of the mode of life of this animal; but from the structure of the proboscis and claws, he concludes that it must burrow. The form of the nose and of the cribriform plate seems, he observes, to indicate a well-developed organ of smell.

The true place of this animal is, most probably, among the *Soricidæ*



Solenodon paradoxus. (Brandt, 'Memoirs of the Imperial Academy of Sciences of St. Petersburg, 1832-33.')

SOLETELLI'NA. [PYLORIDIA.]

SOLIDA'GO, a genus of Plants belonging to the natural order *Compositæ*, the sub-order *Corymbiferæ*, and the tribe *Asteroideæ*. It has radiant heads of flowers, the florets of the ray pistilliferous, ligulate in one row; those of the disc tubular, with stamens and pistils, the receptacle rather alveolate, the involucre imbricated, with a few scales on the peduncle; the pappus pilose in one row; the fruit terete. This genus closely resembles *Aster*, from which it is distinguished by its pappus in a single row, and its terete fruit.

S. Virgaurea, Golden Rod, has an erect slightly angular stem, the leaves lanceolate, narrowed at both ends; the lower leaves elliptical, stalked, serrated; the raceme erect, simple, or compound; involucral scales lanceolate, acute; the fruit downy. This plant is a native of the woods and thickets of Great Britain, and was formerly much used in medicine. Its leaves and flowers are said to be aperient, and it has been employed for internal hæmorrhages. It is astringent and tonic.

SOLIPE'DES, Cuvier's name for his third family of *Pachydermata*. [PACHYDERMATA.]

SOLITAIRE. [DODO.]

SOLITARY SNIPE. [SCOLOPACIDÆ.]

SO'LLYA, a genus of Plants belonging to the natural order *Pittosporaceæ*. The genus is closely allied to *Pronaya* and *Billardiera*, and the species are highly ornamental plants, which are indigenous in Australia and Van Diemen's Land, with voluble stems, oblong alternate, shining, dark-green leaves, with the flower-stalks terminal, or opposite to the leaves, and bearing bunches of bright blue nodding flowers. *S. heterophylla* and *S. angustifolia* are two common species cultivated in our greenhouses, and were very common everywhere until the severe winter of 1837-38.

SOLOMON'S SEAL, the common name of the species of *Polygonatum*, a genus of Plants belonging to the natural order *Liliaceæ*, and the sub-order *Asparageæ*.

Polygonatum has the perianth tubular, 6-toothed, tardily deciduous; the ovary 3-celled; cells 2-ovuled; the stigma blunt, trigonous; berry with 1-seeded cells; the flowers not jointed to pedicel. There are three British species.

P. verticillatum has linear-lanceolate whorled leaves, with an erect angular stem. It is a rare plant in Great Britain.

P. officinale, Solomon's Seal, has leaves ovate-oblong, half-clasping, glabrous, stem angular; peduncles 1-2-flowered; filaments glabrous. It is the *Convallaria Polygonatum* of Linnæus, and has been confounded with the following. It is only found in Scotland.

P. multiflorum has leaves ovate-oblong, half-clasping, glabrous, alternate; stem round; peduncles one- or many-flowered; filament downy. This plant is the common species known by the name of Solomon's Seal.

SOMATE'RIA. [DUCKS.]

SOMERVILLITE, *Humboldtilite*, is a Mineral occurring crystallised. Primary form a square prism. Cleavage perpendicular to the axis, very distinct. Colour pale dull brownish-yellow. Fracture uneven. Transparent, translucent. It is found in the cavities ejected from Vesuvius. Its analysis by Monticelli and Covelli gives—

Silica	43·96
Lime	31·67
Magnesia	8·83
Alumina	0·50
Protoxide of Iron	2·00
	86·96

Kobell found 4·25 per cent of Soda.

SOMMITE. [NEPHELINE.]

SONCHUS (Σόγχος), a genus of Plants belonging to the natural order *Compositæ*; sub-order *Cichoraceæ*. It is characterised by a many-flowered head, involucre imbricated with scales, swelling at the base; receptacle naked; fruit transversely striated; pappus simple, sessile. The species are inhabitants of Europe, Asia, Africa, and America. De Candolle enumerates forty-five species, of which four are natives of Great Britain. They are not used in medicine, but some of them are cultivated in gardens.

The most common species is the *S. oleraceus*, the Common Sow-Thistle. It has a downy subumbellate flower-stalk; a glabrous involucre; lyrato-runcinate leaves, upper ones lanceolate sagittato-amplexicaul at the base, all dentato-ciliate. This plant is found commonly in waste places and cultivated ground all over the world. It has small yellow flowers and a conical involucre when in seed, and is greedily fed upon by many animals.

S. arvensis, Corn Sow-Thistle. Flower-stalks corymbose; involucre glandulose-hispid; leaves denticulate, cordate at the base, oblongo-lanceolate, lower ones sinuato-runcinate. It is frequent in corn-fields in this country and the southern parts of Europe, and in Pennsylvania. Dr. Sibthorp found it in Greece, and was of opinion that it was the same plant as the Σόγχος ἕτερος of Dioscorides.

SONNERA'TIA, a genus of Plants belonging to the natural order *Myrtaceæ*, so named by the younger Linnæus in compliment to M. Sonnerat, well known by his 'Voyage à la Nouvelle Guinée,' and his 'Voyages aux Indes Orientales et à la Chine,' and who made known many new plants. The genus is characterised by having a 4-6-cleft campanulate calyx, adhering to the ovary at the very base; petals 4 to 6, alternating with the valvate lobes of the calyx; stamens numerous; styles filiform, with a peltate stigma; fruit baccate, appearing half-superior, many-celled; seeds numerous, nestling in a fleshy pulp, curved; the species form moderate-sized trees, with opposite leaves, which are entire, thick, and almost veinless; flowers usually solitary, large.

S. acida is the best known species, being the Pagapate of Sonnerat, and the Blatti of Rheede, which has an acid eatable fruit. The branchlets tetragonal; leaves oval, oblong; calyx 6-cleft; petals 6; berry globose. The tree is forty feet high, and is a native of New Guinea and the Moluccas, as well as of the Malabar coast and of the delta of the Ganges.

S. alba is another species of the Moluccas, and *S. apetala*, a native of Ava, near Rangoon, as well as in moist situations along the Burmese coast.

SOPHORA, a genus of Plants belonging to the natural order *Leguminosæ*, said to be so named from an Arabic name (Sophera) of one of the species. These are ornamental shrubs and trees, found in central and tropical Asia, also in the warm parts of North America and the equinoctial and sub-tropical parts of South America. The genus is characterised by having a 5-toothed campanulate calyx; corolla papilionaceous; petals of the keel usually united together at their apex; stamens 10, distinct; legumes moniliform, without joints or wings, and containing several seeds; the leaves are impari-pinnate, usually exstipulate and terminal; the inflorescence is in racemes or panicles of yellow, white, or blue flowers. The species best known in England are *S. Japonica* and *S. Chinensis*, which, being from the northern latitudes of the countries from which they are named, are hardy enough to withstand the climate of England; and it has been proposed to engraft the Nepaul *S. velutina* on the *S. Japonica*. Being handsome trees, with both leaves and trees differing much from European trees, they are well adapted for standing singly in lawns. They are raised from layers, but also from seeds, and require a little protection when young.

SORBUS, a genus of Plants, comprising the Mountain-Ash, Rowan-Tree, and Service-Tree. [PYRUS.]

SORDAWALITE, a Mineral occuring massive. Its fracture is conchoidal. Colour grayish- greenish- or bluish-black. Structure compact. Hardness 2·5 to 3·0. Brittle. Lustre vitreous. Opaque. Specific gravity 2·50 to 3·0. It is found near Sordawala in Finland, and at Bodenmais in Bavaria.

Its analysis by Nordenskiold gives—

Silica	49·40
Alumina	13·80
Peroxide of Iron	18·17
Magnesia	10·67
Phosphoric Acid	2·68
Water	4·38
	99·10

SORE'CIDÆ, the family of Shrews, or Shrew-Mice, comprising the genus *Sorex* of Linnæus.

"The *Soricidæ*," says Mr. Swainson, "like the bats, have the grinders furnished with conical points; but they are destitute of wings or lateral membranes, and they possess clavicles; they have no cæcum, and they all press the entire sole of the foot on the ground in walking. In their economy they are nocturnal, leading for the most part a subterraneous life, and deriving their principal support from insects: those that are natives of cold countries pass the winter in a lethargic state.: their feet are short, and their motions, when on the surface of the earth, slow and feeble."

This family, according to Mr. Swainson, embraces the Shrews, Moles, and Hedgehogs, with the following characters:—

Muzzle lengthened, pointed. Legs short, feeble; feet pentadactylous. Lower incisors generally very long, pointing forwards. No lateral membranes. Mammæ ventral. The family thus characterised includes the genera *Erinaceus*, Linnæus; *Sorex*, Linnæus; *Mygale*, Geoff.; *Scalops*, Cuv.; *Chrysochloris*, Cuv.; *Talpa*, Linnæus; *Centenes*, Cuv.; and *Condylura*, Desm.

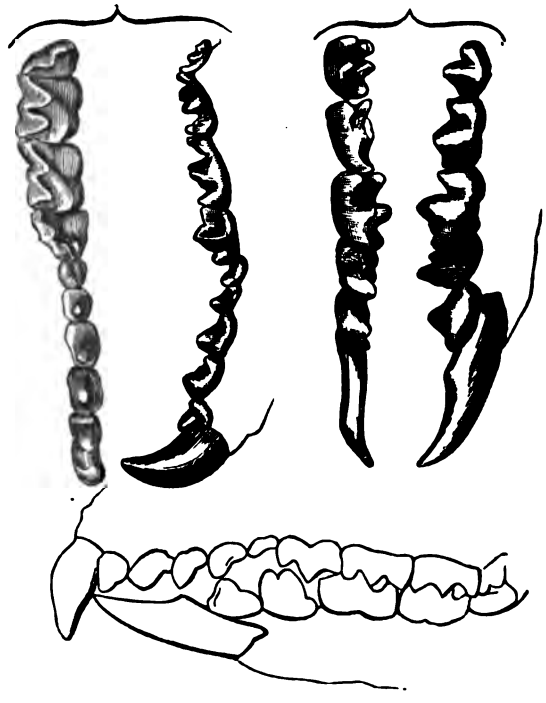
The *Insectivora* of Cuvier consist of the Hedgehogs (*Erinaceus*); the Tenrecs (*Centenes*); the Shrews (*Sorex* and *Scalops*); the Desmans (*Mygale*); *Chrysochloris*; *Talpa*; and *Condylura*.

The genus *Sorex* of Linnæus is placed between *Talpa* and *Erinaceus*; and this article will be confined to the true Shrews (*Sorex*) and the forms which most closely approximate to that genus.

The geographical distribution of the forms of these *Soricidæ* is wide: examples of them occur in Europe, Asia, Africa, and America.

Sorex.—Upper incisors curved and toothed or notched at the base; lower incisors nearly horizontal, all much produced. Body covered with soft and velvety fur. Muzzle very much attenuated; ears short and rounded. Five toes with moderately strong claws on each foot. Tail generally long.

Dental Formula:—Incisors, $\frac{2}{2}$; Canines, $\frac{0}{0}$; Molars, $\frac{8-8}{5-5} = 30$.



Teeth of *Sorex*, from a large species taken in the island of Mauritius. (Six times larger than nature.)

S. araneus, is the Musaraigne of the French; Toporango of the Italians; Murganho of the Spanish; Spitzmaus and Zismaus of the Germans; Nabbmus of the Swedes; Nsebmuus and Museskier of the Danes; and Llygoden Goch, Chwistlen, and Llyg of the Welsh. It is reddish mouse-colour above, paler beneath; tail somewhat quadrangular, rather shorter than the body, not ciliated beneath.

Mr. Bell, whose description we have above given, states that he has ventured, after some consideration, to retain the name of *Araneus* for the Common Shrew of England, notwithstanding the doubts which have existed in the minds of many zoologists, and in which he had till lately participated. These doubts, he observes, have arisen from what he believes to be an erroneous statement of Geoffroy, who, in his paper on the Shrews, in the 'Annales du Muséum,' has given as a character of *S. araneus*, that the teeth are all white; and as Daubenton, in his memoir on the same subject, in the 'Mémoires de l'Académie des Sciences,' does not mention the colour of the teeth at all, the authority, he adds, of Geoffroy has been sufficient to produce considerable hesitation as to whether the *S. araneus* of the continental authors be identical with our Common Shrew, which has invariably brown teeth. "It seems however," says Mr. Bell in continuation, "to have been overlooked, that Daubenton, in his description of the Shrews in Buffon's 'Histoire Naturelle,' has set the question at rest, as far as regards the colour of the teeth; for, in describing the Musaraigne (*S. araneus*), he refers, for the account of the teeth, to his description of the Musaraigne d'Eau (*S. fodiens*); and we there find that the teeth of the Musaraigne are brown at the tips. Now, as he invariably speaks of this species without any adjunct to the name

in contradistinction to the Water-Shrew, there can be no doubt, as far as this character is concerned, that the continental and British animals may be identical; and there appears to be no reason, from any other characters, to doubt that such is the case. That more than one species have been confounded amongst the Common Shrews of this country, I have long entertained a decided prepossession; but I have not at present sufficient ground to warrant me in describing them as distinct. ('History of British Quadrupeds.')

Insects and worms are the food of the Common Shrew. Pennant states that it inhabits old walls, heaps of stones, and holes in the earth, and is frequently found near hay-ricks, dunghills, and similar places. The annual autumnal mortality among these animals, at which season (about August) they are so often found dead, has been observed by most, and satisfactorily accounted for by none, as far as we know. Pennant says, and Agricola, as we shall presently see, noticed the fact before him, that cats will kill but not eat them, being probably disgusted by their peculiar and somewhat musky smell; and the bodies of the dead Shrews have been observed to be marked by a nip near the loins, as if by the bill of some rapacious bird. Kestrels and Owls however are known to prey upon them, and the bones of the head have been found in the stomach of the Barn-Owl. Mr. Turner, of Bury St. Edmunds, detected among twenty casts from that owl, taken from a considerable mass, the skeletons of seven Shrews.

Shrews are very pugnacious; and Mr. Bell remarks that, if two be confined in a box together, a very short time elapses before the weaker of the two is killed and partly devoured; he also gives his reasons for supposing that Shrews fall victims to the rapacity of moles. The nest, which is framed of soft grasses and other plants, is generally found in a hole more or less shallow in the ground, or a dry bank, and is entered at the side, being, so to speak, roofed over. Here the female produces in the spring from five to seven little Shrews.

Among the ancients, the Shrew-Mouse had a very bad reputation. Thus Aristotle declares that its bite is dangerous to horses and other beasts of burden; and that it is more dangerous if the Shrew-Mouse be with young. The bite, he says, causes boils (φλύκταινα), and these burst, if the Shrew-Mouse be pregnant when she inflicts the wound; but if she be not, they do not burst. ('Hist. Anim.,' viii., 24.) Pliny states that the bite of the Italian Shrew-Mice is venomous:—"In Italia muribus araneis venenatus est morsus." ('Nat. Hist.' viii., 58.) With reference to this supposition, it is worthy of remark that the French apply the term Musaraigne, or Musette, to a disease of the horse, which manifests itself in a small tumour (anthrax) on the upper and internal part of the thigh, and is often accompanied by very severe symptoms.

Agricola, in his book 'De Animantibus Subterraneis,' does not forget the ancient traditions of the Shrew's venom, and thus hands them on:—"The *Mus araneus*," says he, "took its name among the Latins, because it injects venom from its bite, like a spider." The Greek name, Μυγάλη, he derives from the facts that it is of the size of a mouse, whilst it is of the colour of a weasel. In his description of the animal, he notices the termination of the teeth in both jaws in bifid points, whence, he remarks, animals bitten by it receive quadrifid wounds. He tells us that its bite in warm regions is generally pestiferous, but that in cold climates it is not; consoling those who may suffer by the not unusual assertion in such cases, that the animal itself, torn asunder or dissected and placed upon the wound, is a remedy for its own venom. Agricola states also that cats kill it, but abhorring this same venom, do not eat it.

This harmless little animal was also an object of fear and superstition to our ancestors. This is referred to by Mr. Bell in his 'History of British Quadrupeds,' and also by White in his 'Natural History of Selbourne.'

Common Shrew (*Sorex araneus*).

The other British Shrews are the Water-Shrew (*S. fodiens*, Pallas); and the Oared-Shrew (*S. remifer*, Geoffroy).

The Water-Shrew, whose habits are graphically described by Mr. Dovaston in 'Loudon's Magazine' (ii.), appears to be the Musaraigne d'Eau of the French. The Oared-Shrew seems to have been first published as British in Sowerby's 'British Miscellany,' from a specimen taken by Dr. Hooker in Norfolk, under the name of *S. ciliatus*.

Under surface of hinder feet of Shrews. (Bell.)
a, Common Shrew. *b*, Water-Shrew. *c*, Oared-Shrew.

S. Indicus, *S. myosurus*, Pallas, the Musk-Rat of India, has much the same appearance in point of colour and the size of its naked ears as our Common Shrew, but is nearly as large as our common Brown Rat, and the tail is round and thinly furnished with hairs. This species diffuses a most powerful odour of musk, which impregnates everything that is touched by it. It has been alleged that even the wine in a well-corked bottle, over which the animal has run, has been rendered unfit for use in consequence of the flavour imparted to it. Cuvier states that this species is found throughout the East Indies and in a part of Africa, and that it is among the animals embalmed by the ancient Egyptians; but, according to others, it is *S. Olivieri*, Desm., which Olivier found in a mummy state in the catacombs of Sakkara.

Mygale.—Great lower incisors having between them two very small teeth. Muzzle in a very small and very moveable proboscis. Ears short. Five unguiculated toes on each foot united by a membrane. Tail long, scaly, compressed laterally.

Dental Formula:—Incisors, $\frac{2}{8}$; Canines, $\frac{0}{0}$; Molars, $\frac{10-10}{7-7} = 44$.

Teeth of the upper jaw of *Mygale moschata*. (F. Cuvier.)

M. moschata, *Castor moschatus*. Linn., appears to be the Dæsman of the 'Fauna Suecica;' Le Desman of the French; the Biesamratze of the Germans; the Wychozhol of the Russians; and the Muscovy or Musk-Rat of the English.

Musk-Rat (*Mygale moschata*).

The tail is shorter than the body, scaly, nearly naked, contracted at its base, cylindrical, and convex in its middle, very much compressed vertically at its extremity; fur brown or dusky above, whitish-ash below. Total length, including the tail, about 15 inches, of which the tail measures 8 inches. It is found in the river Volga, and the adjacent lakes from Novgorod to Saratov.

This species does not appear to have been seen on dry land; and indeed it is broadly asserted that it never goes there, but wanders from lake to lake in fortuitous floods only. It is often seen swimming or walking under the water, and coming for air to the surface, where, in clear weather, it is apt to sport. Stagnant waters shut in by high banks are its favourite localities, and in such places it makes burrows

some twenty feet in length. Its principal food is alleged to consist of fish, leeches, and the larvæ of water-insects; but fragments of roots have been found in its stomach. Its pace is slow; but it does not seem to be torpid in winter, at which season it is often taken in nets. The holes which it makes in cliffs and banks have the entrance far beneath the lowest level of the water, and the animal works upwards, never however reaching the surface, but only sufficiently high to secure itself from the highest rise of the river. Fish, as we have seen, forms part of its food; but the quadruped in its turn falls a victim to the Pikes and *Siluri*, whose flesh becomes so impregnated with the flavour of musk in consequence, as to be not eatable.

From the region about the tail a sort of musk, resembling the genuine sort, is expressed; and the skins are put into chests and wardrobes among clothes, for the purpose of preserving them from moths. These skins were also supposed to guard the wearers of them from fevers and pestilence. The price at Orenberg for the skins and tails was formerly twenty copecs per hundred. They were so common near Nischnei-Novgorod, that the peasants were wont to bring five hundred each to market, where they sold a hundred of them for a rouble.

There is a species more than eight inches in length (*M. Pyrenaica*) inhabiting Tarbes, at the foot of the Pyrenees.

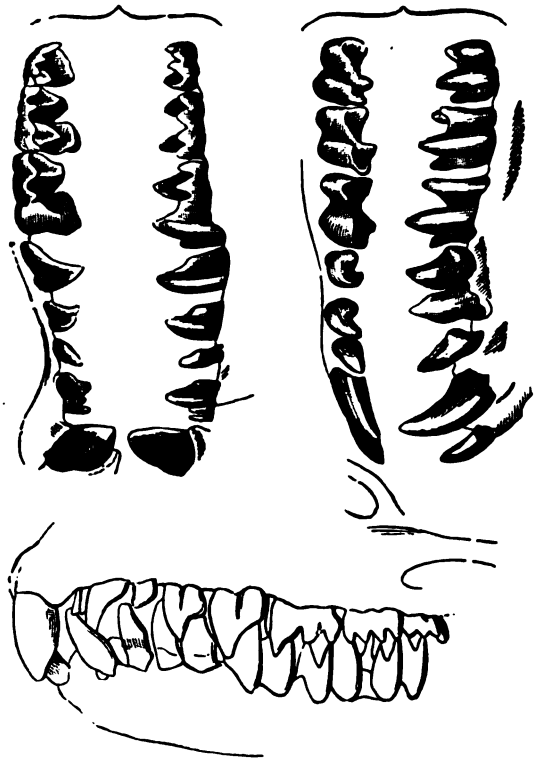
Scalops.—Muzzle pointed and cartilaginous; no external ears. Three toes on the anterior feet, which are short, wide, and armed with strong claws fit for burrowing; posterior feet feeble, with five toes. Tail short.

Dental Formula :—Incisors, $\frac{2}{2}$; Grinders, $\frac{10-10}{10-10} = 44$.

The above is the formula given by Sir John Richardson; but F. Cuvier (and he is followed by Lesson) makes the number 36, namely:

Incisors, $\frac{2}{4}$; Canines, $\frac{0}{0}$; Molars, $\frac{9-9}{6-6} = 36$.

We subjoin the teeth as given by F. Cuvier, but Richardson's description appears to be very carefully given, and his accuracy is well known.



Teeth of *Scalops*.

S. Canadensis, Cuv. (*Sorex aquaticus*, Linn.) is the Brown Mole of Pennant; the Shrew-Mole of Godman; the Mole of Lewis and Clarke; and the Musaraigne-Taupe of Cuvier.

The body is thick and cylindrical, like that of the Common Mole, without any distinct neck; limbs very short, being concealed by the skin of the body nearly down to the wrist and ankle-joints; fore extremities situated nearly under the auditory opening; the moveable snout almost linear, and projecting about 4½ lines beyond the incisors, naked at its extremity, particularly above, thinly clothed with hairs below for about two-thirds of its length next the incisors; a conspicuous furrow extends nearly its whole length on the upper surface, and beneath there is also a furrow, reaching half its length from the incisors, beyond which last the snout is transversely wrinkled beneath, and its small, flat, or truncated extremity is smooth and callous; the small oblong nostrils open in an inclined space immediately above this circular callous end. The eyes are concealed by the fur, and scarcely to be found in dried specimens. In most lights it is browniah-black; when blown aside it shows a grayish-black colour from the roots to near the tips. Such is the general colour over the whole body, but there is a slight chestnut-brown tinge on the forehead and about the base of the snout. On the throat the fur is shorter and paler. Length of head and body 7 inches 8 lines, and of tail 1 inch 6 lines. Such is, in substance, the accurate description by Sir John Richardson of this species.

It inhabits the banks of the Columbia River and the adjoining coasts of the Pacific, where it occurs in considerable numbers.

Sir John Richardson states that the Shrew-Mole resembles the common European Mole in its habits, in leading a subterranean life, forming galleries, throwing up little mounds, and in feeding principally on earth-worms and grubs. The individual domesticated by Mr. Titian Peale is described by Dr. Godman, who paid much attention to the manners of these animals, and who relates that they are most active in the early part of the morning, at mid-day, and in the evening, coming daily to the surface, when in their natural state, at noon. Then they may be taken by driving a spade beneath them and throwing them on the ground, but they are hard to be caught at any other time of the day. They burrow in a variety of soils, but in wet seasons they retire to the high grounds. Mr. Peale's shrew-mole fed largely on fresh meat, cooked or raw, drank freely, was lively and playful, followed the hand of its feeder by scent, burrowed for a short distance in loose earth, and after making a small circle returned for more food. It employed its flexible snout in a singular manner whilst it was eating, in order to thrust the food into its mouth, doubling it so as to force it directly backwards.

Shrew-Mole (*Scalops aquaticus*).

M. Lesson makes the *Scalops Pennsylvanica* the type of his genus *Talpasorex*, acknowledging however that it only differs from *Scalops* in its dental formula, which he gives thus:—

Incisors, $\frac{2}{4}$; Canines, $\frac{0}{0}$; Molars, $\frac{11-11}{6-6} = 40$.

It will be well for the student to bear in mind, with reference to the genus proposed by Lesson, Sir John Richardson's observations on the dentition of *Scalops* above noticed.

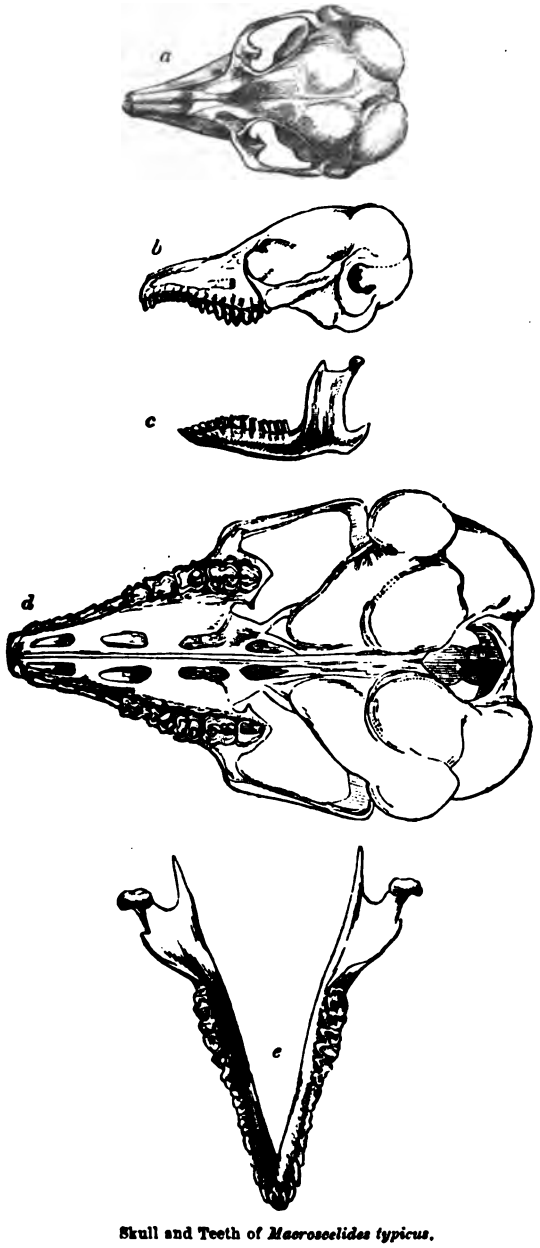
With regard to the question of the existence of True Moles in North America, the following remarks of the last-mentioned accurate and diligent author are also worthy of attention:—"From the great resemblance of the Shrew-Mole to the common one, they might be readily mistaken for each other by a common observer; and Bartram and others, who have asserted the existence of a species of the genus *Talpa* in America are on this account supposed, by later writers, to have been mistaken. There are however several true moles in the Museum of the Zoological Society which were brought from America, and which differ from the ordinary European species in being of a smaller size, and in having a shorter and thicker snout. Their fur is brownish-black. I could not learn what district of America they came from." ('Fauna Boreali-Americana.')

Macroscelides.—Muzzle narrow, ending anteriorly in a long and subcylindrical proboscis, having nostrils at its apex; eyes moderate; ears large and round. Body furry. Tail elongated, scaly, annulated, and furnished scantily with hairs. Feet distinct, plantigrade, and 5-toed; the claws falcular; hind legs much shorter than the fore feet.

Incisors, $\frac{2}{2}$; Canines, $\frac{4-4}{4-4}$; Molars, $\frac{5-5}{5-5} = 40$. (Smith.)

M. typicus.—Above brown, brightened by an intermixture of tawny; beneath whitish; extremities covered with a very short

whitish hair; ears within, scantily furnished with some of a similar colour, without, nearly bare; tail thinly clothed with a stiff short black hair; whiskers near the base of the proboscis, each hair variegated black and white; claws short, black, compressed, and pointed. Length from nostrils to root of tail 4¾ inches; length of tail 3¼ inches. The colour of both sexes is nearly alike.



Skull and Teeth of *Macroscelides typicus*.

a, upper surface of the skull, natural size; *b*, lateral parts of the same, natural size; *c*, lower jaw of the same, natural size; *d*, under surface of the skull of the same, double the natural size; *e*, lower jaw of the same, double the natural size. (Smith.)

It inhabits the open country in the interior of South Africa, and is occasionally seen during the day about the roots of bushes or amongst brushwood, whence, upon being discovered, it instantly retreats to its natural and subterraneous habitation. ('Zoological Journal.')

This, or one of the species (but most probably this) seems to be the Elephant-Shrew of Pennant, and is thus described:—"Shrew with a very long, slender, and little nose; the whole animal of a deep brown-colour. Inhabits the neighbourhood of the Cape of Good Hope: called the Elephant, from its proboscis-like snout: engraven from a drawing by Mr. Paterson." Pennant further remarks that this animal has been very ill represented by Petiver, in Table 23 of his 'Gazophylacii Naturæ et Artis Decas tertia,' and truly so it is: but Pennant's figure is not much better. Petiver's description is: "9. *Mus araneus Capensis maximus*. Taken from a painting of Dr. Sherard's, now consul of Smyrna."

Macroscelides typicus. (Reduced from Dr. Smith's figure.)

SOREX. [SORECIDÆ.]

SORGHUM, a genus of Grasses, said to be named from the Oriental name of one of the species, of which 'sorgo' is the Italian name. The species have sometimes been referred to *Holcus*, sometimes to *Andropogon*, but from their habit and uses they seem well entitled to be considered as a distinct genus, which may be characterised as having the flowers monœcious, paniculed; glume coriaceous, cartilaginous, 2-flowered; the upper flower hermaphrodite, the lower palea more or less deeply bifid and awned between the lobes, the upper often wanting. The species form tall grasses with succulent stems, and are found in the tropical parts of Asia, whence they have spread to the warm parts of Europe.

S. vulgare is the largest of the small cereal grains, and may be considered the representative of the Indian Corn (*Zea Mays*) in America, where it is usually called Guinea Corn, and in some works the Great or Indian Millet. The different kinds are usually called Joar in India, where they form principal objects of culture, and one of much more importance than would appear in Europe, as many of the inhabitants live as much upon these small or dry grains as upon rice. The Joar is the Durra of some Arab tribes, and the Zurrut of others; its Indian origin is indicated by the Persian name, Jawurs Hindee. It is extensively cultivated throughout Asia, and appears to be the Tall Corn of the Chinese. It has been introduced into the south of Europe, where it is chiefly employed for feeding cattle and poultry, but it is also made into cakes. The flour is white, and a good deal resembles that of the Indian corn in nature. The species commonly sown in India are *S. vulgare* and *S. bicolor* (Kala-Joar). *S. cernuum* is a distinct species, which forms the principal food of the mountaineers of the Munnipoor district. *S. saccharatum* is also cultivated in many parts during the rainy and cold seasons, on land which is too high for rice. The stalks and straw of all are much valued as fodder for cattle, being cut into small pieces, commonly called Kurbee.

SORREL. [RUMEX.]

SORREL, WOOD. [OXALIS.]

SORUS, in Botany (from σωρός, 'a heap'), a term applied to the collections of the sporangia or capsules which are found on the edges or the under surface of the fronds of ferns. In most instances, as in the *Aspidiaceæ*, *Asplenіaceæ*, *Davilliaceæ*, &c., the sori are covered with a peculiar projecting portion of the epidermis, which is called the Indusium, and forms an important part in the systematic arrangement of these plants. In some instances, as in *Adiantum* and *Ceratopteris*, the substance of the leaf has a share in the formation of the indusium. It has been generally admitted that the indusium is the analogue of the bract in the higher plants, but Treviranus maintains that it is an entirely peculiar organ, nor, according to this view, can it be looked upon as a mere extension of the epidermis. In looking for analogies between flowering and flowerless plants, Kölreuter supposed that the indusium represented the stamens.

The term Sorus is sometimes applied to mere collections of spores or granules, as seen in many *Algæ*, of which *Delesseria alata* and *D. sinuosa* are examples.

SOUI-MANGA. [CINNYRIDÆ.]

SOULAMIA (Soulamion is the name of the tree in the Moluccas), a genus of Plants belonging to the natural order *Polygalaceæ*. It has 5 sepals, the 3 outer ones very small, the 2 inner large and concave; the petal is concave; the capsule samaroid, indehiscent, compressed, corky, emarginate, and 2-celled.

S. amara, Bitter Soulamia, is a shrub with crowded ovate leaves tapering to the base, quite entire, and veiny. It is a native of the Moluccas, and has white racemose flowers, the size of those of the vine. The fruit is compressed, thin at the edges, dry, with 2 seeds in

each cell resembling cucumber seeds, but smaller, each lying in a small cavity of the cell.

(Lindley, *Flora Medica.*)

SOUR-SOP. [ANONACEÆ.]

SOUSLIK, the name of certain Marmots with cheek-pouches (*Spermophilus*, F. Cuv.). [MURIDÆ.]

SOUTHERN-WOOD. [ARTEMISIA.]

SOW-THISTLE. [SONCHUS.]

SOY. [SOJA.]

SOYA, or SOWA, an Umbelliferous Plant cultivated in India. It is the *Anethum Sowa* of Roxburgh, of which the aromatic seed is much used by the natives in cookery, as well as for medicinal purposes; the green parts also are cut down, and sold in the bazaars, as the plant is used as a vegetable both by Mussulmans and Hindoos. The seeds are the 'shubit' of Avicenna, which is usually translated Anethum; by the Arabs it seems to have been considered the "Ανηθον of Dioscorides.

SOYMI'DA, a genus of Plants belonging to the natural order *Meliaceæ*, named by A. Jussieu from the Telinga name of the tree, which was referred to *Swietenia*, and called *S. febrifuga* by Dr. Roxburgh. This is a large forest-tree, a native of the mountainous parts of the Rajahmundry Circars, and likewise of the jungly parts in general of the central parts of Hindustan. The genus is characterised by calyx 5-leaved, imbricate; petals 5, shortly clawed; stamen-tube cup-shaped, 10-lobed, each lobe bidentate at the apex; anthers 10, included within the tube and lodged between the teeth of the lobes; ovary 5-celled, seated on a broad disc; ovules numerous, pendulous from the centre of the cells; style short, stigma peltate, 5 cornered; capsule woody, 5-celled, 5-valved; seeds winged. The only species known attains a height of 80 feet, with abruptly pinnate leaves. The inflorescence is a large diffuse and terminal panicle.

This tree, which is called Rohuna in Hindustan, is particularly noted on account of its bark. This is of a dull red colour, of a fibrous nature, and astringent, and has been much employed in India for the cure of intermittent fevers.

SPADIX. [INFLORESCENCE.]

SPALAX. [MURIDÆ.]

SPANIEL, a variety of Dog. It is not at all improbable that dogs of this race were known to the Romans. Lieut.-Col. Hamilton Smith remarks that the Spaniel, *Canis extrarius* (?), is clearly figured on some of the later monuments, and seems to be identical with the *C. Tuscus* praised by Nemesianus; and indeed the lines in the 'Cynegeticon,' beginning—

> "Quin et Thuscorum non est extrema voluptas
> Sæpe canum, forma est illis licet obsita villo,"

with the allusion to their hunting qualities—

> "Moresque simul naresque sagaces"—

strongly favour that opinion. It may also be noted that Nemesianus, in another part of the poem, speaks of dogs—

> "Quorum proles de sanguine manat Ibero."

The Spaniel appears to have been the companion of the Falconer at a very early period. In 'The Booke of Falconrie or Hawking' (1611), 'heretofore published by George Turbervile, Gentleman,' we find among 'The Contents of this Booke,' 'A little treatise translated out of the Italian tongue, touching the diseases happening to Spanyels, with their Cures;' and on turning to the page we come to 'A Treatise and discourse of the cure of Spaniels when they be any way over-heat; devised and written by M. Francesco Sforzino Vicentino, the Italian Gentleman-Falconer,' and beneath the title a cut, where stands the falconer, hawk on fist, hat on head, staff in hand, and pouch on side, in trunk-hose, and with bare-headed attendants, accompanied by two couple of Spaniels.

In the sporting prints engraved by Hollar after Barlow, a whole team of spaniels are introduced giving tongue in 'Partridge Hawking,' with the following lines at the bottom of the plate:—

> "The fearful Partridge being sprung by quest
> Of Spaniells from their pleasing foode and rest,
> The keene and bloody Hawke pursues; the Knight
> Hath then his sport, and feasts on them at night."

And again in 'Feasant Hawking,' with the following quatrain:—

> "The Feasant Cocke the woods doth most frequent,
> Where Spaniells spring and pearche him by the sent;
> And when in flight, the Hawke with quickened speed
> With 's beake and savage talens makes him bleed."

Spaniels, apparently of a stouter breed, are also introduced in 'Hern Hawking' by the same hands, a circumstance worthy of remark, inasmuch as in the cut in 'The Booke of Falconrie,' with the superscription 'How to flee a Hearon,' the mounted gentleman-falconer, who is covered, is attended by bare-headed domestics, and accompanied by a couple of grayhounds.

The author of the 'Sportsman's Cabinet' states that the race of dogs passing under the denomination of spaniels are of two kinds, one of which is considerably larger than the other, and known by the appellation of the Springing Spaniel, as applicable to every kind of game in any country, whilst the smaller is called the Cocker, or Cocking-Spaniel, as being more adapted to covert and woodcock shooting.

Dr. Caius, in his systematic table of British Dogs, makes the Fowlers consist of the Spaniel (*Hispaniolus*), Setter (*Index*), and Water-Spaniel or Fynder (*Aquaticus*); whilst under the title Lap-Dogs, the Spaniel Gentle or Comforter (*Melitæus* or *Fotor*—the Maltese Lap-Dog), stands alone.

Pennant, in following out the tract of Caius, says, "The third division of the more generous dogs comprehends those which were used in fowling; first, the *Hispaniolus*, or Spaniel: from the name it may be supposed that we were indebted to Spain for this breed. There were two varieties of this kind, the first used in hawking, to spring the game, which are the same with our Starters. The other variety was used only for the net, and was called Index, or the Setter, a kind well known at present." [SETTER.]

The probability appears to be that all the varieties of the Spaniel, the small Water-Spaniel, the Cocking Spaniel, King Charles's Spaniel, and the Blenheim Spaniel, if that breed be not the true spaniel of King Charles I., are all the result of careful breeding from the large Water-Spaniel (not the Rough Water-Dog which some call a Water-Spaniel), which seems to have been the old Springing Spaniel.

It is no small proof of the merit of the Spaniel that it has kept its ground amid all the revolutions of sporting. 'A good spaniel is still a great jewel.' The companion of the hawk and net now attends the grayhounds, and it is indispensable in woodcock-shooting: apart from its excellent services in cover, there is no more lively field-shooting than that with a team of thoroughly well-bred spaniels broken never to give tongue, to range well, but not at a greater distance than fifteen or twenty yards from the gun, and never to chace either feather or fur. The sportsman's attention is always kept on the alert, and he who has accustomed himself to this style of shooting will generally be found to be a quick and sure shot.

Spaniels have a great share of intelligence and affection; these qualities, being combined with much beauty, make them highly prized as companions; and we have, in our day, the

> "Spaniel, bred with all the care
> That waits upon a fav'rite heir,"

Seventy pounds have been refused for one of these dogs.

The docility of the Spaniel is equal to its intelligence and feeling of attachment. A spaniel has been taught to wait at table, take away plates and fetch others, carry wine in a glass without spilling, and to hold the stirrup in his mouth for his master while he was mounting his horse. The spaniel given by Mr. Daniel, author of 'Rural Sports,' to the Hon. Mr. Greville, would, we are told, in addition to the common tricks which dogs trained to fetch and carry exhibit, bring bottles of wine from the corner of the room to the table by the neck, with such care as never to break one, and was the 'boots' of the mess-room.

SPANISH FLY. [CANTHARIDÆ.]

SPAR, a word from the German 'Spath,' employed, combined with specific terms, in Mineralogy, to include a great number of crystallised earthy and some metallic substances, but chiefly the former. Thus calcareous spar is crystallised carbonate of lime; fluor-spar, fluoride of calcium; heavy spar, sulphate of barytes, &c. By miners the term is frequently used alone to express any bright crystalline substance; but in mineralogy, strictly speaking, it is never so employed.

SPAR, HEAVY. [BARYTES.]

SPARGA'NIUM (from σπάργανον, a bandage), a genus of Plants which with the genus *Typha* constitute the natural order *Typhaceæ*. The species are monœcious. The flowers are arranged in dense spherical heads. Both the barren and fertile flowers are composed of a single perianth with three leaves; the stamens are longer than the calyx, and the fruit consists of a dry drupe with one seed. The species are found commonly in ditches and marshes of the northern hemisphere. Three of these are common in Great Britain.

S. ramosum, Branched Bur-Reed, is known by its branched flower-stalk, triangular leaves, and linear stigma. This species was the only one of the genus found by Dr. Sibthorp in Greece, and appears to be the Σπαργάνιον of Dioscorides. It is an inhabitant of ditches, lakes, and stagnant waters, forming a handsome addition to their vegetation.

S. simplex, Unbranched Bur-Reed, is known by its simple stem; and the *S. natans*, Floating Bur-Reed, by its long linear floating leaves. They are both found in the same situations as the first.

SPA'RIDÆ, or SPAROI'DES, a family of Fishes belonging to the section *Acanthopterygii*, which are distinguished by the following characters combined, namely: the possession of a single dorsal fin, the anterior half of which is supported by spinous rays, and which is not divided, nor is it protected by scales; the operculum is spinous, the palate destitute of teeth, the branchiostegous membrane has five or six rays, and the pyloric appendages are few in number. The body is usually of an ovate form, and covered with large scales; the mouth is not protractile.

The species of this family feed chiefly upon the animals of small shells, *Crustacea*, &c., for crushing which their strong teeth are admirably adapted.

Guided by the structure of the teeth, Cuvier divides the family into four tribes. In the first the jaws are provided with teeth, which are rounded like paving-stones; in the second the teeth are conical

and pointed; in the third the teeth are minute and thickly crowded; and the fourth tribe have a series of trenchant teeth.

To the first of these tribes belongs the genus *Sargus*, where the incisors, or foremost teeth, are compressed, and have sharp-cutting edges; the molars are rounded, and form several rows.

Of this genus numerous species are described in the 'Histoire des Poissons' of Messrs. Cuvier and Valenciennes. Several are from the Mediterranean, and the others are chiefly from the coast of America, north and south.

The next genus, *Charanx*, is founded upon a single species, an inhabitant of the Mediterranean, which has sharp-cutting incisors, like the species of *Sargus*, but the molars are extremely minute, and form only a single row.

The third genus of the first tribe is *Chrysophrys*, which is distinguished from the *Sargus* by the incisors being conical, and usually four or six in number in front of each jaw; the molars for the most part are rounded, and form at least three rows on each side of each jaw, a character which serves to distinguish the present genus from *Pagrus*.

This genus is numerous in species, and these are almost entirely confined to the seas of the warmer and tropical parts of the Old World. The *Chrysophrys aurata*, a species which is very common in the Mediterranean, is also occasionally met with on our coast, as well as that of France.

The same remark applies to the *Pagrus vulgaris*, which is an example of the next genus, *Pagrus*, which differs from *Chrysophrys* in having only two rows of molar teeth on each side of the jaw. Several species of this genus are found in the Mediterranean, others inhabit the Indian seas, some again are found on the coasts of Australia and New Zealand; and the *Pagrus argyrops* is found on the North American coast.

The last genus of the first division is *Pagellus*, the species of which are easily distinguished by the foremost teeth in each jaw being all of them small, curved, pointed, and dense.

Numerous examples of this genus occur in the Mediterranean; and two species, the *P. erythrinus* and *P. centrodontus*, have been found on our own coast. The former appears to be of very rare occurrence on the British coast; the latter, known by the name of the Sea-Bream and Gilt-Head, is by no means an uncommon fish on the southern shore of England, and is not unfrequently found on the coast of Ireland.

To the second section belong the genera *Lethrinus*, *Dentex*, and *Pentapus*. The first of these genera is at once distinguished from all other genera of the first section by there being no scales on the cheeks; the mouth is but little cleft; and the teeth are, some of them strong, pointed, and curved; others very small and dense, and the molars form only a single row.

In the genus *Dentex* the teeth are conical, and generally confined to a single row; some of the foremost of them are elongated, curved, and sharply pointed.

The species of this genus, which are very numerous, appear to be almost entirely confined to the temperate and tropical portions of the Old World. But one species is found on the British coast, the Four-Toothed Sparus of Mr. Yarrell's work, *D. vulgaris*, Cuv. and Val.

The genus *Pentapus* is founded upon certain Sparoid Fishes found in the Indian Seas, and off the coast of Australia, which approach the genus *Dentex*, but have two strong canine teeth in front of each jaw, between which sometimes are two or four much smaller teeth; the other teeth are minute, prickly, close together, and arranged in a single row in each jaw.

Close to the ventral fins on each side is a spine, and a third spine is situated between these fins. Similar spines are found in other species, but they are usually less developed than in the present genus. The name of *Pentapus* is applied to these fishes from these spines giving to them the appearance of having five ventrals.

The third section, in which all the teeth are minute and dense as the pile on velvet, contains but one genus, *Cantharus*. Of this genus an example is found on the British coast, and is known by the name of the Black Bream (*C. griseus*, Cuv. and Val.). This fish, though more rare than the Sea-Bream, is not uncommon on various parts of our coast.

In the fourth section Cuvier arranges the genera *Box*, *Oblata*, *Scatharus*, and *Crenidens*. All these genera have the foremost range of teeth compressed, placed close together, and with a cutting edge which is more or less notched. In the genus *Box* there is but one series of teeth in each jaw. The *B. vulgaris* (*Sparus boops*, Linn.) is a common species in the Mediterranean, and lives upon vegetable substances.

The genus *Oblata* is founded upon a fish from the Mediterranean, the *Sparus melanurus*, Linn., in which, in addition to the compressed front teeth, which are emarginated at the apex, there is an inner series of minute teeth.

The genus *Scatharus* is also founded upon a Mediterranean fish; here there is but one series of compressed teeth, and these are pointed, or lancet-shaped.

Lastly, the genus *Crenidens* is distinguishable by the foremost row of compressed teeth being dilated at the apex and notched; behind these are numerous small globular teeth. There is but one species, the *C. Forskalii*, Cuv. and Val., an inhabitant of the Red Sea.

SPARRMANNIA, a genus of Plants belonging to the natural order *Tiliaceæ*. The genus is known by its calyx of 4 sepals, 4 roundish petals, numerous stamens, intermixed with tomentose threads; echinated, 5-angled, 6-celled, 6-valved capsules, with 2-seeded cells. There is only one species, the *S. Africana*, which is a native of the Cape of Good Hope. It is a beautiful shrub, much cultivated, flowering in the beginning of the spring.

SPARROW. [PASSER.]

SPARROW-HAWK. [FALCONIDÆ.]

SPARTALITE. [ZINC.]

SPARTI'NA, a genus of Grasses belonging to the tribe *Chlorideæ*. It has upright 1-flowered spikes in racemes, the glumes unequal, the upper long and acuminate; the palea unequal, the outer boat-shaped, compressed, retuse; the styles elongated, united half-way up; the stigmas filiform, protruding at the summit of the floret. There are two British species, the *S. stricta* and *S. alterniflora*. The former grows in muddy salt-marshes, the latter has been found only on the mud-flats of the river Itchin at Southampton. (Babington, *Manual of British Botany.*)

SPARTIUM, a name applied by the Romans to the plant much used by them for cordage. It is fully described by Pliny ('Nat. Hist.,' xix. 2). Authors have differed much respecting the plant intended; some conceiving that some of the brooms are intended, as *Spartium junceum*, or Spanish Broom, which produces a fibrous thread of which cloth is made; and *S. monospermum*, which is found on the coasts of Spain as far as the moving sands reach; its twigs are used for tying bundles, and herbs are brought to market tied together with them. The leaves of both afford food for sheep and goats. Others are of opinion that some of the grasses are intended, which grow in the same places and are used for the same purposes, as, for instance, *Lygeum Spartum* and *Stipa tenacissima*, both of which are called Esparto by the Spaniards, and both are used for making ropes, baskets, nets, and for filling palliasses.

SPARUS. [DENTEX.]

SPATANGUS. [ECHINIDÆ.]

SPATHE (the Greek σπάθη). This term is applied to the sheathing involucrum of many plants. It is seen in the greatest perfection in the flowers of *Palmaceæ* and *Araceæ*, where, during the flowering of the plants, it embraces the entire inflorescence. This organ is considered by most botanists to be a modification of the bract.

SPATHO'DEA, a genus of Plants belonging to the natural order *Bignoniaceæ*. The calyx is spathaceous, cleft and toothed or entire on the other side; the corolla is funnel-shaped, with a 5-lobed rather unequal limb; the four stamens are divided into two long and two short, with the addition of a fifth sterile filament; the capsule silique-formed, falcate, falsely 4-celled, and corky; the seeds are furnished with membranous wings; the species are erect shrubs or trees, rarely climbing shrubs; the flowers somewhat panicled, orange-coloured, yellow, or purple.

S. Rheedii has downy impari-pinnate leaves, roundish downy leaflets, terminal erect racemes, and a much-curved slender corolla; the shoots are covered with a whitish down; the racemes the length of the leaves; the flowers white and pretty large; the limb spreading; the fruit about a foot long, pendulous, twisted in various forms.

S. Roxburghii has its leaves three in a whorl or scattered impari-pinnate; the leaflets from 4 to 5, in pairs, serrated and smooth; the panicles erect, terminal, dense, downy, and many-flowered; the fruit narrow and 4-celled; the calyx generally 2-parted, with the upper lip 2-cleft and downy. It is a native of the Circars. The branches are very spreading; the back gray, with a few scabrous spots; the flowers large, rose-coloured, and delightfully fragrant; the limb of the corolla nearly equal, and elegantly waved at the edges. This species is remarkable on account of its serrated leaves. The wood is employed for many purposes by the natives.

S. longiflora is an arboreous plant, and has large spreading terminal panicles, a bilabiate corolla, long pendulous slender sub-cylindrical follicles, with sharp edges and variously curved; the flowers are large, yellow, and very fragrant; the follicles very long; the wood of this tree is high-coloured, hard, durable, and of much use amongst the inhabitants of the hills about the coasts of Coromandel and Malabar, where it is plentiful.

SPATULA. [DUCKS.]

SPATULARIA, a genus of Fishes of the Sturgeon tribe, remarkable for the form of their snouts, which are enormously prolonged and leaf-like in form. The Paddle-Fish of the Mississippi is the type.

SPAWN, the white fibrous matter which, shooting through earth, dung, decaying vegetable matter, &c., is the matrix from which mushrooms and other *Fungi* are produced. It is generally composed of small white thready fibres, which produce, at various distances, little white knobs, from which the stem and cap of the mushroom proceed. This matrix or spawn, called Mycelium, is in fact the real stem of the mushroom, and the stipes and pileus, with their appendages, are the inflorescence. This spawn is made use of for the purpose of procuring from it the growth of the Edible Mushroom (*Agaricus campestris*). [FUNGI.]

SPEARMINT. [MENTHA.]

SPECIES OF PLANTS. All the individual forms of plants, as well as animals, that occur on the globe, may be collected into groups resembling each other, and these groups are called species. A species has been defined to be "a combination of individuals alike in all their parts;" "a systematic combination of homogeneous individuals;" "a collection of individuals which will breed together and produce fertile offspring." De Candolle says, a species is "a collection of all the individuals which resemble each other more than they resemble anything else, which can by mutual fecundation produce fertile individuals; and which reproduce themselves, by generation, in such a manner that we may from analogy suppose them all sprung from one single individual." However clear such a definition may be, it would assist a botanist only in a very limited degree in determining whether a new plant should be looked upon as a new species. If there were perfect structural identity between two individuals of the same species, or if we could ascertain, on the physiological ground, that the individuals after fecundation reproduced similar individuals, it would then be a more easy task. But perfect structural identity does not exist, and the physiological test cannot be always applied, and hence the difficulty of determining what is really a species. From this some have gone so far as to deny the existence of species altogether, and assert that the supposed distinctions between plants are altogether arbitrary and imaginary. This notion is however altogether upset by the well-known fact of plants maintaining for centuries the same structural characters.

However much it may be regretted, on account of the vexatious multiplication of species, that some fixed rules cannot be laid down for their formation, it does not appear at present that anything more than general rules can be given, and that much must depend on the judgment and experience of the observer.

As a general rule species are not distinguished by differences in the internal organisation, such differences being left for the higher divisions into genera, orders, and classes; but upon those superficial and external differences which are independent of internal structure. Of these may be named duration, dimension, surface, form, division, numerical proportion, and colour. The value of each of these points varies according to circumstances, and in proportion to the knowledge of the observer will be the skill with which he selects them for distinguishing species. The duration of a plant is a point of great importance, as in no instance do we find, unless from change of climate, plants of the same species differing in being annual, biennial, &c. Dimension is rarely of any importance, and should only be taken into consideration in extreme cases. Differences of surfaces, depending on structural peculiarities, are of importance; smoothness, roughness from tubercles, and the existence of stinging hairs and prickles, are points of value. The presence or absence of lymphatic hairs on the surface of leaves is a point that may mostly be disregarded; they are of more importance on other parts. The form of parts is only of importance when it is the consequence of anatomical differences, that is to say, the arrangement of the veins, &c. The division of organs is not of much importance where it depends on the degree of the laceration of the parenchyma. The union or non-union of contiguous organs, as the parts of the calyx, corolla, &c., is of the greatest value, being mostly uniform in all the individuals of the same species. The numerical proportion of the parts of a plant is of value in proportion to the small number of parts or organs; the greater the number, the more subject it is to variation. Differences in colour are little to be relied on; the same may be said of odour and taste; as all these properties are liable to undergo change by a slight alteration of the circumstances of the plant.

Those departures from identity of structure, which are considered insufficient to constitute a species, are called Varieties, and the points of structure that should constitute a species or variety is frequently a matter of difference, and it is no unfrequent thing for one author to reduce the species of another to mere varieties. Thus, Borrer has made 71 species of *Salix*, but Koch has reduced them to 29, and numerous examples could be cited. A careful attention to the influence of climate, soil, elevation, &c., on species, would save much trouble and vexation on this point. De Candolle has elegantly summed up the influence of these agents on plants:—"Let us suppose," he says, "what really happens, that the seeds of plants are scattered at hazard over the surface of the earth; or, to speak more correctly, by causes that have no necessary connection with the existence of those plants; such seeds will find themselves in an infinite variety of situations: some which have fallen in soil that is too tenacious or too loose, too dry or too wet, too hot or too cold, do not grow, and are soon destroyed. But between these extremes some will succeed, although it may be under very different circumstances. Thus, for instance, if the place has not light enough, the plant will be half blanched, which will be indicated by its paleness and feebleness, or by being spotted, or by the diminution or even loss of its hairs; if the light is too bright, the plant will be stronger, smaller, more deeply coloured, harder, and more velvety than usual. Temperature also exercises some influence, though in a less degree; in a cold climate the same plants are smaller and weaker than ordinary, the colour of the flowers and fruit is paler, the wood worse ripened, their leaves more deciduous, their fruit often abortive, and the sap destined to nouriah it throwing itself into the neighbouring parts, sometimes changes their appearance. In a hot climate plants become larger, produce more wood, and their leaves have brighter colours and a higher flavour. In the same climate humidity causes the appearance of differences without end; plants that grow in water lose all their hairs, their leaves become divided into capillary segments so as to look like hairy roots, their stems and flower-stalks lengthen to reach the surface of the water, and these different effects are further variable as the water is still or agitated, clear or turbid, pure or mixed with heterogeneous substances; the varieties of *Ranunculus aquatilis* offer a remarkable example of this. If, on the other hand, a plant accustomed to water is found to live in a drier soil, it becomes covered with hairs, remains smaller than usual, and acquires greater hardness. In air rarified like that of mountains, plants are generally found smaller and more stunted than usual, while their flowers are larger than upon the plains. The influence of soil is not less manifest: if it is tenacious, the roots, which penetrate it with difficulty are small, hard, and clustered; if it is very sandy, the roots become large, fleshy, and fully formed; if it contains a great quantity of carbon, the colours of the flower are often altered, as those of the *Hydrangea* into blue, and of the Pink into violet; if it is charged with salt, or if the plant is within the reach of salt, even brought through the atmosphere, we usually find the leaves more fleshy and more glaucous, as in *Lotus corniculatus*. All these different circumstances, combined with each other in nature, are fertile causes of varieties, which are still further multiplied by cultivation."

SPECTACLE-SNAKE. [NAIA.]

SPECULA'RIA (so called from *Speculum Veneris*, Venus's Looking-Glass, the old name of one of the species), a genus of Plants belonging to the natural order *Campanulaceæ*. It has a rotate corolla, a linear-oblong prismatical capsule opening by lateral pores between the calycine segments. In other respects this genus resembles that of *Campanula*, from which it has been separated by recent systematists. The species are small annual plants inhabiting the regions of the Mediterranean and the temperate parts of Europe. One species, the *S. perfoliata*, is a native of North and South America.

S. hybrida has a simple or branched stem; the leaves slightly crenate, wavy, oblong, sessile, the lower leaves spathulate; the calyx scabrous; the segments lanceolate, longer than the corolla, shorter than the ovary. This plant is a native of the corn-fields of Great Britain, and is found commonly throughout the region of the Mediterranean. There are several other species of this genus, all of which are worth cultivating on account of their showy flowers. The seeds should be sown in the open ground, where it is intended the plants should remain. By sowing the seeds in the autumn an early blossoming may be ensured in the following summer, and by successive sowings in the spring and summer they may be made to blossom for several months during the summer.

(Don, *Dichlamydeous Plants*; Babington, *Manual of British Botany*.)

SPEEDWELL. [VERONICA.]

SPELTER. [ZINC.]

SPERGULA, a genus of Plants belonging to the natural order *Caryophylleæ*. It is possessed of a 5-parted calyx, 5 undivided petals, 5 or 10 stamens, 5 styles, 8-celled 5-valved many-seeded capsule. This genus is found in fields and cultivated ground, especially on sandy soils, all over the world. It is divided into two sections, one of which possesses stipules; the other is without these organs. On this ground many writers have constituted new genera.

S. arvensis, Corn-Spurrey, or Yarr, has its leaves in whorls, with minute membranaceous stipules at their base; the stalk of the fruit reflexed; and the seeds hispid, with a narrow border. It is a native of Europe, in gardens and fields, and in North America on the banks of the Columbia, and is common in Great Britain. Though not cultivated in England, this plant is of some importance on the continent, and in the Netherlands and Germany is sown for fodder.

Three other species—the *S. nodosa*, Knotted Spurrey; *S. saginoides*, Pearl-Wort Spurrey; and *S. subulata*, Awl-Shaped Spurrey—are also natives of Great Britain, but are neither ornamental nor useful.

SPERMACETI, or *Cetaceum*, a fatty material obtained from the *Physeter macrocephalus*. This animal, called the Cachalot, or White Whale, is of immense size, frequently 60 or more feet in length, of which the head constitutes one-third. This part is the chief reservoir of the spermaceti, which however is found in several other parts of the body, mixed with the sperm oil. It is mostly lodged in two large cavities of the upper jaw, one above and the other below, divided from each other by the nostrils. These cavities are subdivided into numerous cells of unequal size, by ligamentous or tendinous partitions; these partitions are of the same nature as those which separate the fat in other animals, but, owing to the great size of the creature, of a larger and stronger kind. The purest spermaceti is contained in the largest and least ligamentous cells. The part in which it is lodged is quite distinct from the cranium containing the brain, which spermaceti was at one time supposed to be. During the life of the animal the spermaceti is in a fluid state, and on the head being opened has the appearance of an oily clear white liquid. On exposure to the air the spermaceti concretes and deposits from the oil. They are then separated, and put into different barrels.

SPERMACETI-WHALE. [CETACEA.]

SPERMACOCE, a genus of plants belonging to the natural order *Rubiaceæ*, so named from the seeds being terminated by two remarkable points. The genus is characterised by having the calyx 2-4-dentate; corolla 4-lobed; stigma bifid or entire; capsule 2-celled, crowned with the limb of the calyx, which is sometimes obliterated. Seeds oval, oblong, marked in the inner side with a longitudinal furrow. The species are very common and abundant in tropical parts of the world; and have usually quadrangular stems and branches, with small white or blue flowers. Some of the species, as *S. Poaya* and *S. ferruginea*, are useful, like other plants of the same family, in having roots which form substitutes for ipecacuanha.

SPERMADICTYON, a genus of Plants belonging to the natural order *Rubiaceæ*, named from *σπέρμα*, seed, and *δίκτυον*, a net, from the manner in which the seeds cover the placenta. The genus is characterised by having the calyx-tube ovate, 5-partite, persistent; corolla densely pubescent; tube long, straight, 5-lobed; stamens 5, included within the corolla-tube; stigma 5-cleft; capsule crowned by the calyx, contains 5 nuts. The species form shrubs, with white and light blue very fragrant flowers, with leaves lance-shaped, shortly petioled; stipules short. They are natives of Hindustan. *S. suaveolens*, the *S. Hamiltonia* of Roxburgh, ascends the Himalayas to elevations of 3000 feet, and has been cultivated in this country as a stove-plant.

SPERMESTES, Swainson, a sub-genus of *Fringillidæ*.

SPERMOE'DIA, the name given by Fries to a certain altered form of the seeds of rye and other grasses, and to which the name Ergot and Spurred Grain has been commonly applied. The bodies to which this name is given are solid elongated masses, growing from the inside of the ovary of Grasses, rootless, of a firm mealy substance, with a concrete scaly or powdery crust. Fries says they have no proper fructification; but other authors state that the interior is composed of flocci and sporules firmly compacted into a solid homogeneous mass. The precise nature of these grains, both on account of their peculiar medicinal effects and their poisonous quality when taken as food, have excited much attention amongst botanical observers. Wildenow supposed the Ergot to be merely a diseased state of the grain, and stated that he could produce it at pleasure by excessive watering. General Field made some observations which led him to suppose that it originated from the puncture of insects. De Candolle and others more recently determined that the Ergot was a distinct parasitic plant, developing itself from the ovary of Grasses, and referred it to the genus *Sclerotium*. Fries, in his 'Systema Mucologicum,' considered the Ergot to be a diseased state of the grain, and placed it in the doubtful genus *Spermoedia*. More recently this production has been carefully investigated by Mr. Edward Quekett, who communicated the results of his observations to the Linnæan Society in November 1838. From his examinations, it appears that the great mass of the Ergot consists of the albuminous matter of the grain in a diseased state. The interior of these grains had been described as being filled by flocci and sporules compacted together; but on examination with the microscope, after the outside was scraped off, the interior was found to be composed of irregular cells filled with globules of a fatty oil. The cause of this changed state of the internal parts of the grain was found on the outside of the ergotised grain, where a number of very small oval or elliptical bodies were found, about 1-6000th of an inch in diameter, and containing within them a number of smaller granules. These were found to be the sporidia and sporules of a fungoid plant, which, attached to filaments, developed themselves early in the growth of the grain, and produced its diseased state. Mr. Quekett has since succeeded in obtaining ergotised rye by applying to healthy plants of rye water containing the sporules of this fungus diffused through it; thus affording additional proof that plants become diseased by imbibing the seeds or sporules of other plants from the soil in which they grow. For the plant as above described, Mr. Quekett proposes the name *Ergotæia abortans*. It belongs to the tribe *Mucedines* and sub-order *Coniomycetes* of the order *Fungaceæ* of Fries, thus occupying a different position to the *Sclerotium Clavus* of De Candolle, or the *Spermoedia Clavus* of Fries. [ERGOT.]

SPERMO'PHAGA (Swainson), a sub-genus of *Fringillidæ*.

SPERMO'PHILA (Swainson), a sub-genus of *Fringillidæ*.

SPERMOPHILUS. [MURIDÆ.]

SPERMOPHORE. [FRUIT.]

SPERMOSPI'ZA (G. R. Gray), a sub-genus of *Fringillidæ*.

SPHÆRALCE'A, a genus of Plants belonging to the natural order *Malvaceæ*. It is characterised by a 3-leaved deciduous involucre; 5-cleft calyx; 5 obliquely emarginate petals; numerous stamens united together, the stamen-tube being longer than the petals; many-celled ovary, with three seeds in each cell; styles consolidated and stigmas capitate; a globose umbilicated downy capsule, with cells dehiscent at the back. The species are trees or shrubs with toothed or 3-5-lobed leaves. Flowers on peduncles, 1- or many-flowered, of a reddish or flesh colour. This genus was separated from *Malva*, which it greatly resembles, by Auguste St.-Hilaire. With the exception of one, a native of the Cape of Good Hope, the species are all found in South America.

S. Cisplatina, the Cisplatine Globe-Mallow, has a slender shrubby stem, ovate 3-lobed toothed or crenate leaves, tomentose beneath; axillary racemose flowers. It is a native of Brazil, in the western part of the Cisplatine province. It is used medicinally in Brazil, in the same manner as marsh-mallows are in Europe.

SPHÆRANTHUS, a genus of Plants belonging to the natural order *Compositæ*, so named from *σφαῖρα*, a globe, and *ἄνθος*, a flower, on account of the globular form of the heads of the flowers. The species are small herbs common in tropical parts of the Old World, with alternate decurrent leaves. Flowers tubular, external ones female, many-rowed, the central ones male with imperfect style; receptacle naked. Pappus wanting. *S. mollis* is common in most parts of the plains of India, and has a strong aromatic odour, and is used by the natives in medicine. *S. microcephalus* (*S. Indicus*, Linn.) has also an aromatic odour, and is employed as a diuretic in Java, according to Dr. Horsfield, and as an anthelmintic in India, according to Rheede, and in fevers, according to others.

SPHÆ'REDA, a fossil Plant from the Yorkshire coast.

SPHÆ'RIA, a genus of Plants belonging to the natural order *Fungaceæ*. This genus is known by possessing a rounded external receptacle, which opens at the top with a minute orifice. Within the receptacle, the sporidia, or seed-vessels, are found inclosed in tubes which are arranged in one or more rows. These tubes are called Asci. The size of the rounded receptacles of these *Fungi* varies from that of a millet-seed to that of a small marble. They are generally found upon decaying vegetable matter, and seem as if they were immersed in the substance on which they grow. Their most frequent position is on the bark of the stem and branches of decayed trees. They are however by no means confined to this situation, being frequently found on decaying leaves, on the stems of grasses, and on the surface of decaying wood. Some of them are found occupying the bark, leaves, &c. of plants that are still living, but in most instances this must be looked upon as indicative of a loss of vitality in the part of the plant thus attacked. One of the species, *S. militaris*, is remarkable for growing from the dead bodies of caterpillars and other decaying animal matters. Another species, the *S. entomorhiza*, is also found in the same positions.

Although the plants of this genus are so simple in their structure, yet their receptacle, with its contents, presents so great variety in form, size, colour, &c., that upwards of 600 different species have been described. Of these, 201 species have been recorded as British, by the Rev. M. J. Berkeley, in the 2nd vol. of Hooker's 'British Flora.' These plants are very generally diffused throughout the world in the temperate zones. So abundant are they, that scarcely a decaying stick can be taken up in autumn without presenting some form of them.

Like the great mass of the vast order of *Fungi*, the species of *Sphæria* have not been used as food or medicine, or cultivated as ornament. Their great use in the economy of nature appears to be the appropriating those elements as materials of their growth, which, if left unconsumed, would become a source of deterioration to the atmosphere. As examples of this genus we shall select a few of the more common of the British species.

S. hypoxylon, Flat-Horned Sphæria. Receptacles of a black colour, of a corky consistence, single or branched, compressed, at first covered over with a mealy powder, then becoming naked, the stem villous. This is a very common species, and is found on sticks and stumps of trees. Unlike most of the species, it has a great tendency to sport, being sometimes exceedingly branched, sometimes palmate, and sometimes quite simple.

S. stigma, Black-Dotted Sphæria. Effused, often nearly surrounding the branch, flat, even, at length becoming black, the orifices nearly plain. In the course of its growth, it pushes off the cuticle of the bark of the stick on which it grows; it is at first brown, and then becomes black. It is perhaps the most common of all the species.

S. verrucæformis, Wart-Like Sphæria. Receptacles ovate with a short neck; plant of a black colour. Found on branches of the hazel and beech.

S. quaternata, Quaternate Sphæria. Receptacles generally grouped four together, naked; orifices collected together. It is found on beech-trees alone. Many other forms are found on only one kind of plant.

S. sanguinea, Blood-Coloured Sphæria. The receptacles scattered, very small, ovate; papillary of a blood-red colour. It is very common on all kinds of decaying wood and sticks, and is easily recognised by its red colour; there are however many other forms with a red colour, but not so common as this.

(Fries, *Systema Mycologicum*; Hooker, *British Flora*; Greville, *Scottish Cryptogamic Flora*.)

SPHÆROCA'RYA, a genus of Plants belonging to the natural order *Rhamnaceæ*, so named from *σφαῖρα*, a sphere, and *κάρυον*, a nut. The species forms moderate-sized trees in Nepaul. The calyx is 5-parted. Petals 5, and alternate with the 5 stamens, which, like the petals, are inserted into the calyx, and with 5 fringed scales placed between the stamens, and opposite the calycine segments. Drupe pear-shaped, containing a smooth round nut. *S. edulis* is so called from its fruit being eaten and relished by the Nepaulese, though not very palatable to a European taste. This tree is a native of the forests of Nepaul, and has alternate, ovate-entire, exstipulate leaves, with axillary and terminal villous racemes of small greenish-coloured flowers, which are without odour.

SPHÆROCOCCITES, a genus of Fucoidal Fossil Plants, from the Oolitic series of the Yorkshire coast. (Presl.)

SPHÆROCOCCUS, a genus of plants belonging to th

order *Algæ*. It was formed by Stackhouse, and applied to the plants belonging to it on account of their globose fructification. A great number of species of this genus have been described, including amongst them some of the most useful of the sea-weed tribe. These species have been distributed by later botanists into the genera *Rhodomenia*, *Gigartina*, *Chondrus*, *Gelidium*, and *Phyllophora*, and the genus *Sphærococcus* has only one species, the *S. coronopifolius*. The genus *Chondrus* affords the Carrageen-Moss, which is so much used as an article of diet. It is a species of *Gelidium*, with which the swallows build their nests in the Eastern Archipelago, and which are so highly valued as articles of food by the Chinese.

SPHÆ'RODUS, a Fossil genus of Fishes. [FISH.]

SPHÆROMA. [ISOPODA.]

SPHÆRONITES. [ECHINODERMATA.]

SPHÆROPS. [IGUANIDÆ.]

SPHÆROSIDERITE. [IRON.]

SPHÆRULITE, a Mineral occurring in small botryoidal and spheroidal masses. Surface sometimes rough, at other times smooth. No regular cleavage. Structure compact, fibrous. Fracture conchoidal. Hardness 7 to 7·5. Brittle. Colour gray, brown, red, yellow, of various shades. Opaque; translucent on the edges. Specific gravity 2·4 to 2·54. Before the blow-pipe almost infusible, the edges becoming covered with a sort of enamel. It is found embedded in pitchstone at Speithausen in Saxony; in pearlstone at Glashutte, near Schemnitz, Hungary, and also in Iceland and Scotland. It yields by analysis:—

Silica	79·12
Alumina	12·00
Potash and Soda	3·58
Magnesia	1·10
Oxide of Iron	2·45
Water	1·75
	——100

SPHAGNUM, a genus of Plants belonging to the natural order of Mosses. It is known by the following characters:—Receptacle pedunculated, its peduncle resembling a fruit-stalk; capsule sessile, entire, its lid deciduous, its mouth naked; calyptra irregularly torn. The plants of this genus are very widely diffused over the surface of the earth, perhaps more so than any other, hardly any limits being ascertained for their geographical distribution. They are aquatic plants, and constitute the great mass of our bogs in swampy and moory districts. All the species of this genus used to be included under the name of *S. palustre;* but later writers have multipled the species to fourteen. Of these, Sir William Hooker, in his 'Muscologia Britannica,' admits only four, and one or two even of these he thinks may be varieties.

S. obtusifolium, Obtuse-Leaved Bog-Moss, has tumid branches, with obtuse ovate leaves. It is found on the surface of watery turfy bogs throughout Europe.

S. acutifolium, Narrow-Leaved Bog-Moss, has attenuated branches and ovato-lanceolate leaves; and is very abundant, especially in bogs in mountainous situations.

S. cuspidatum, the Long-Leaved Floating Bog-Moss, seems to be a variety of the last, having peculiar characters from growing constantly under water. Its leaves are looser and narrower than those of the narrow-leaved bog-moss. It seldom bears fruit; its stems are sometimes 4 feet long, and its leaves three-quarters of an inch broad.

SPHARGIS. [CHELONIA.]

SPHE'CIDÆ, Leach (*Sphegides*, Latreille), a family of Hymenopterous Insects of the section *Fossores*, distinguished by the following characters:—Hinder tarsi at least equal in length to the head and thorax; antennæ generally slender, and formed of elongated joints, which are often arched and contorted, at least in the females; prothorax forming a kind of neck, very distinctly separated from the mesothorax, and contracted in front. The base of the abdomen constricted into a long petiole; mandibles internally toothed. The following are the principal genera contained in this family:—

Pepsis (Fab.), has the labrum distinct; the antennæ, at least those of the males, are nearly straight, composed of joints closely applied to each other; maxillary palpi scarcely longer than the labial, prominent, and with the joints unequal; all the cubital cells perfect; the first recurrent nervure inserted near the anterior extremity of the second of these cells. The males have the tibiæ and the first joint of the posterior tarsi compressed.

All the known species of *Pepsis* are exotic, and they abound most in South America and in the West Indian islands; they are usually of large size, and have dark-coloured wings.

Ceropales.—The labrum and antennæ resemble those of *Pepsis*, but the maxillary palpi are much longer than the labial, pendent and unequal-jointed.

Pompilus (Fab.).—This genus is placed by Latreille in the *Sphegidæ*, but, according to Leach, it forms the type of a distinct family (*Pompilidæ*), characterised by having a transverse prothorax, at least as broad again as long, with its posterior margin acute; the abdomen obovoid, without any contraction, in the shape of a long petiole, at its base. The antennæ are setaceous and long; the superior wings have one marginal cell, nearly semicircular, and three sub-marginal cells, the first as long or longer than the two following; the second receiving about its centre the first recurrent nervure; the third, which is either triangular or subquadrate, receives the second; a fourth submarginal cell is sometimes traceable.

Several species of this genus are found in England; they usually make burrows in the sand for nidification, but some are said to make their nests in wood. The perfect insect provides its cell with spiders, these constituting the food of the larvæ.

Ammophila (Kirby).—Abdomen with the petiole long; superior wings with one oval marginal cell, and three submarginal cells; the first as long or longer than the two following, the second receiving both the recurrent nervures, the third very small and narrow towards the marginal cell; legs long, the anterior tarsi slightly ciliated.

These insects, observes Mr. Shuckard, on the authority of St.-Fargeau, construct their burrows in sand alone, and supply their larvæ with *Arachnidæ* and the larvæ of *Lepidoptera*, and select by preference those of the *Noctuæ*, sometimes as large as themselves. They sting them towards the middle of the body, which renders them torpid, but does not kill them, and prevents their motion. The *Ammophila* then extending itself in its whole length upon the larva, seizes it with its mandibles near the head, and supports the remainder of the body with its legs. But thus encumbered it can no longer fly; it therefore proceeds slowly, dragging it along. Should it perceive any obstacle in the path, such as a stone or tuft of plants, it quits its load an instant, and springs lightly forward to reconnoitre and explore its way, but returns immediately to resume its burden.

A female has been observed by St.-Fargeau, thus loaded, to clear a wall eight or ten feet high, but not without much ingenious contrivance. The caterpillar fell several times to the ground, when the *Ammophila* placed it upon a projecting stone to rest itself and recruit its strength; but it renewed its task with extraordinary perseverance, and succeeded in accomplishing it.

In the genera *Sphex*, *Pronæus*, and *Chlorion*, the mandibles and labrum are comparatively short, and more or less curved at the point.

Pronæus.—The second cubital or submarginal cell receives the two recurrent nervures.

Sphex.—The superior wings have one long and narrow marginal cell, which is rounded at the apex, and three submarginal cells, the first as long as the two following; the second quadrate, receiving the first recurrent nervure towards its extremity; the third forming a truncated triangle with its posterior margins slightly rounded, and receiving the second recurrent nervure in its middle: a rudimentary fourth cell is sometimes observable. One species has been found in England, but appears to be extremely rare.

Chlorion has the first recurrent nervure inserted under the first cubital cell, and the second beneath the third cubital.

Dolichurus, Latr., has the maxillary palpi much longer than the labial, and nearly setaceous; the mandibles are dentated.

The remaining genera of this family have no teeth to the mandibles: they are, *Ampulex*, *Podium*, and *Pelopæus*. The first of these genera resembles *Chlorion* as regards the insertion of the recurrent nervures in the superior wings, and in the genera *Podium* and *Pelopæus* the second cubital cell receives two recurrent nervures.

SPHECOTHERES. [MERULIDÆ.]

SPHE'GIDÆ. [SPHECIDÆ.]

SPHENACANTHUS, a genus of Fossil Fishes. [FISH.]

SPHE'NE. [TITANIUM.]

SPHENISCUS. [PENGUINS.]

SPHENOCLE'A, a genus of Plants belonging to the natural order *Campanulaceæ*, consisting of only a single species. The genus is characterised by having a superior 5-parted calyx with inflexed segments. Corolla 5-parted, with the segments inflexed and somewhat auricled at the base, and which conceal the 5 sessile stamens; ovary inferior; style very short and 2-lobed; capsule membranous, many-seeded, with a central fungous placenta, circumsciasile; seeds minute, embryo without albumen, straight, with the radicle next the hilum. The only known species, called *S. Zeylanica*, is an annual, with alternate entire leaves, without stipules; found in marshy situations in all parts of India. It is sometimes made the type of an order.

SPHENOCLEA'CEÆ, a natural order of Plants, consisting of only one species, belonging to the monopetalous sub-class of Exogens. It was formed by Martius, and consists of a single genus, which at that time was called *Sphenoclea*, but now known as *Pongatium*. This plant is very like a *Campanula* in its structure, but it is distinguished from all *Campanulaceæ* by the absence of albumen in its seeds, and also the want of collecting hairs on its styles. It has also round subsessile anthers, and a habit different from that of plants allied to it in structure. [SPHENOCLEA.]

SPHENOID BONE. [SKELETON.]

SPHENONCHUS, a genus of Fossil Fishes. [FISH.]

SPHENOPH'YLLUM, a genus of Fossil Plants. [COAL-PLANTS.]

SPHENOPS. [SCINCIDÆ.]

SPHENO'PTERIS, a genus of Fossil Ferns. [COAL-PLANTS.]

SPHENU'RUS, Swainson, a sub-genus of *Columbidæ*.

SPHERCHEUS. [HYDROPHILIDÆ.]

SPHEROSTILBITE, a Mineral, occurring in globular masses. Structure radiated. Fracture brilliant. Lustre pearly. Fibres flexible. Hardness above 3·0. Specific gravity 2·31. It is found in Iceland and

the Faroe Islands. An analysis, by Gehlen, of a specimen from Iceland gave—

Silica	55·61
Alumina	16·68
Lime	8·17
Soda	1·53
Water	19·30
	——101·29

SPHIGU'RUS. [HYSTRICIDÆ.]

SPHINCTER (from *σφίγγω*, 'I restrain') is a name applied generally to the muscles which close the external apertures of organs, as the sphincter of the mouth, of the eyes, &c., and more particularly to those among them, which, like the sphincter ani, have the peculiarity of being, during health, in a state of permanent contraction, independently of the will, and of relaxing only when it is required that the contents of the organs which they close should be evacuated. [NERVOUS SYSTEM.]

SPHI'NGIDÆ, a family of Lepidopterous Insects belonging to the section *Crepuscularia;* in fact, regarding the family in its most extended sense, it composes the section named.

The section *Crepuscularia* by most authors is placed between the Diurnal and Nocturnal *Lepidoptera* (sections *Diurna* and *Nocturna*), and corresponds with the genus *Sphinx* of Linnæus.

The insects belonging to this division generally fly in the evening, or early in the morning, but there are many which fly in the daytime. The body is usually stout, and in the typical species remarkable for its pointed apical portion; in some the body is cylindrical. The antennæ are moderately long, angular, and generally increase in thickness from the base, and terminate in an elongated club, having the apex pointed and recurved. The wings when at rest are usually a little inclined, but sometimes horizontal, and in some species the inferior wings project beyond the upper margin of the superior. These inferior wings are provided at the base of their upper margin with a bristle-like spine, which, passing through a hook of the upper wing, serves to unite the two wings. The spines in question are visible upon viewing the under side of the insect; they are also found in the Nocturnal *Lepidoptera*, but here the antennæ are stoutest at the base, gradually decreasing in thickness. The larvæ are always provided with sixteen legs, six thoracic, eight abdominal, and two anal. In the more typical *Sphingidæ* the larvæ are moreover provided with a spurlike process on the upper surface of the last segment of the abdomen, the point of this somewhat curved and horny process being directed backwards.

According to the views of some authors, the *Crepuscularia* constitute a family, but most modern writers regard this division as one of higher value, and divide it into several families.

The following are the characters of four families adopted in Stephens's 'Illustrations of British Entomology:'—

Sphingidæ.—Antennæ prismatic, sometimes serrated towards the middle, ciliated slightly in the males, terminated by a scaly seta, or naked filiform appendage: palpi short, 3-jointed, densely clothed with hair or scales, the terminal joint minute; abdomen conical, not tufted at the apex; larva exposed, cylindrical, or attenuated anteriorly, with a horn on the last segment, naked, sometimes granulated, the sides frequently with oblique or longitudinal stripes; pupa subterranean, or subfolliculated.

The family embraces some of the largest European *Lepidoptera:* among others may be mentioned the Death's-Head Hawk-Moth (*Acherontia Atropos* of modern authors; *Sphinx Atropos* of Linnæus), an insect not uncommon in some parts of England, and which measures from tip to tip of the expanded wings usually a trifle less than five inches. Its general colour is dark, the superior wings being mottled with brown, black, and yellow; the body is yellow, has a longitudinal black dorsal mark, and narrow black bands; the under wings are also yellow, and have two black bands; on the thorax are pale markings, which bear some resemblance to a skull. The larva is of a greenish-yellow colour, with the back speckled with black, and transverse lateral lines partly blue and partly white. It feeds upon the potato plant, jasmine, &c. When full-grown the larva measures about five inches in length; and when about to assume the pupa state, it buries itself in the ground. "Towards the end of September, or the beginning of October," says Mr. Stephens, "the imago is produced, and, like the rest of the group, flies morning and evening only. The conspicuous patch on the back of its thorax, which has considerable resemblance to a cranium, or death's-head, combined with the feeble cry of the insect, which closely resembles the noise caused by the creaking of a cork, more than the plaintive squeaking of a mouse, has caused the insect to be looked upon by superstitious persons as the 'harbinger of death, disease, and famine,' and their sudden appearance in Bretagne, as we are informed by Latreille, during a season while the inhabitants were suffering from an epidemic disease, tended to confirm the notions of the superstitious in that district, and the disease was attributed by them entirely to the visitations of these hapless insects."

The Death's-Head Moth is at times very troublesome to the keepers of bee-hives, which it robs of the honey. [BEE.]

Zygænidæ.—Antennæ fusiform, sometimes bipectinated, without a fascicle of scales at the apex; head smooth; palpi short or elongated, clothed with long scales or hair, the terminal joint elongated; abdomen cylindric, with a slight tuft at the apex; larva exposed, fusiform, slightly villose, not tailed; legs minute; pupa folliculated.

The insects of this family, observes Mr. Stephens, are of a gregarious nature, and, unlike the *Sphingidæ*, they fly chiefly by day. Their flight is very heavy and slow. Their caterpillars subsist upon the leaves of divers plants, and they form a silken web in which they change to pupa.

The species of this group are generally very brilliant in their colouring, and many exotic species have the wings transparent in parts. Examples of two genera are found in this country, *Ino* and *Anthrocera* (or *Zygæna*). Of the former of these genera but one English species is known, *Ino Statices*, an insect measuring from the points of the expanded wings rather more than an inch. Its superior wings are of a brilliant green-colour, and the inferior are brownish.

The genus *Anthrocera* contains several indigenous species: the superior wings are usually of a deep metallic green-colour, spotted with red, and the under wings are red margined with black. The species are known by the name Burnet-Moth. The Six-Spotted Burnet-Moth (*Anthrocera Filipendulæ*) measures nearly an inch and a half in width, the wings being expanded, and has six red spots on the superior wings. It is very common in various parts of England, making its appearance in meadows, &c. about the end of June. The caterpillar is yellow, spotted with black. It feeds upon the plaintain, trefoil, dandelion, &c.

Sesiidæ.—Antennæ prismatic, ciliated in the males, slightly hooked, the apex terminating in an oblique scaly process; palpi short, clothed with scales, the terminal joint extremely minute; abdomen conical, with the apex tufted; larva naked, with a horny appendage on the hinder segment; pupa smooth, without spines, inclosed in a cocoon upon the ground.

To this family belongs the Humming-Bird Hawk-Moth (*Macroglossa stellatarum*), an insect not uncommon in various parts of England. Of this species Mr. Stephens says there are usually three broods in the year, appearing respectively at the end of April, June, and August; some of the last brood have been known to hybernate. The moth measures in width about an inch and three-quarters, or rather more, and is of an ashy-brown colour; the upper wings have two transverse waved black marks; the under wings are of an orange-colour, edged with black, and on the sides of the body are some white patches. This insect flies about in sunny weather, and is remarkable for the swiftness of its motions; in which respect it greatly resembles the humming-bird, as well as in its habits of feeding upon honey, which it extracts from the flowers by means of its enormously long proboscis, but without settling upon the plant.

Other species of the present family are found in England. They constitute the genus *Sesia*, and are distinguished from *Macroglossa* by the disc of their wings being transparent.

Ægeriidæ.—Antennæ fusiform, a little curved, ciliated in the males, the apex terminating in a plume of scales; ocelli two, minute, placed behind the antennæ; palpi elongate, thickly clothed with scales and long hairs, the last joint elongate; abdomen cylindric, tufted at the apex; wings horizontal and generally transparent, with the exception of the apical portion, which is more or less covered with scales; larva tailless, assumes the pupa state in the stems of plants or dead wood of trees; pupa furnished with spines on the segments of the body.

The species of this family are usually of small size, and remarkable for their transparent wings and the possession of ocelli, or simple eyes, in addition to the ordinary compound eyes. They fly by day, and many of them bear superficial resemblances to insects of other orders, and hence have received such names as *Crabroniformis*, *Ichneumoniformis*, &c. Numerous species are found in England, and these constitute the two genera *Trochalium* and *Ægeria*. In the former of these genera the maxillæ are very short, and the antennæ are short, whilst in *Ægeria* the maxillæ are elongated, and the antennæ also long.

SPHINX. [CREPUSCULARIA; SPHINGIDÆ.]

SPIDER-ORCHIS. [OPHRYS.]

SPIDER-WORT. [COMMELYNACEÆ.]

SPIDERS. [ARACHNIDA; ARANEIDÆ.]

SPIGE'LIA, a genus of Plants belonging to the natural order *Spigeliaceæ*. It is commemorative of Adrian Spigelius. The characters of this genus are:—Calyx 5-parted; corolla funnel-shaped, with a 5-cleft equal limb; anthers converging; capsule didynamous, 2-celled, 4-valved, many-seeded. This genus consists of annual and perennial herbs, and under-shrubs with opposite leaves and rose-coloured or purple flowers. They are natives of North and South America, and are found in various soils.

S. Marylandica, Maryland Worm-Grass, is an herbaceous perennial, with simple tetragonal scabrous stems; opposite, sessile, glabrous, ovato-lanceolate leaves; solitary spikes; funnel-shaped corolla, and inclosed stamens. It is a native of Virginia, Maryland, the Carolinas, and Georgia, in rich moist soils, by the edges of woods; also in the forests on the banks of the Arkansas. Although all the species possess active properties, the Maryland Worm-Seed is that which is principally used in medicine.

S. Anthelmia, Annual Worm-Grass, is an herbaceous annual, with branched nearly square stems; ovate or oblong-acute leaves, with short petioles; floral leaves four in a whorl; funnel-shaped corolla, and inclosed stamens. It is a native of Guyana, Trinidad, and Brasil. It possesses powerful narcotic properties, and is used in the same manner as the last. This species is often cultivated: it has small pale-red flowers.

SPIGELIA'CEÆ, a small natural order of Plants belonging to the monopetalous sub-class of Exogens. The order consists of herbaceous plants or under-shrubs, with opposite, entire, stipulate leaves, and flowers arranged in 1-sided spikes. The calyx is inferior, regularly 5-parted; corolla regular, with five lobes, having a valvate æstivation; stamens 5, inserted in the corolla, all in the same line; pollen-grains 3-cornered, with globular angles; ovary superior, 2-celled; fruit a capsule, 2-valved, many-seeded, valves turned inwards at the margin, and separating from the central placenta; embryo very small, lying in the midst of fleshy albumen, with the radicle next the hilum.

The order consists of two genera, *Canala* and *Spigelia*, the species of which are natives of America. [SPIGELIA.]

SPIKE. [INFLORESCENCE.]

SPIKENARD is a substance which has enjoyed celebrity from the earliest period of the world's history, and has engaged the attention of numerous commentators on the works of the ancients, as well as of some modern authors. It is interesting therefore not only as making us acquainted with one of the substances known to and esteemed by the Greeks and Romans, but it is important likewise as being mentioned in the Bible, since the Nard of Scripture is supposed to be the same substance as the Nardos of the ancients, called also *Nardostachys* (*ναρδόσταχυς*), and hence Spikenard, the word Stachys being rendered by the word Spike.

Dioscorides, in the first chapter of his first book, treats of the various aromatic and stimulant substances which were known to the ancients, and among these of the various kinds of Nard. Of the first kind, called simply Nardus (*νάρδος*), there are two varieties, the one Syrian, the other Indian; the former so called not because it comes from Syria, but because the mountains in which it is produced have one part turned towards Syria and the other towards India. This may refer either to the Hindu-Kush, or to so many Indian products finding their way to Syria, by the way of the Red Sea and the Euphrates, from the earliest times. The other variety is called Gangitis, from the river Ganges, near which, while flowing round a mountain, it is produced, bearing many hairy spikes from one root. These are strong-smelling, but those growing in moist situations less so than those found on the mountains. One variety, he further says, is called Saupharitioon, from the name of a place. This first kind being called Nardus, and distinguished into the Syrian and Indian varieties, the second kind he calls Celtic Nard (*νάρδος Κελτική*), and the third kind a Mountain Nard (*νάρδος ὀρεινή*). On consulting Avicenna, we are referred from Narden to Sunbul, pronounced Sumbul, and in the Latin translation from Nardum to Spica, under which the Roman, the mountain, the Indian, and Syrian kinds are mentioned. This proves, as has been already stated by Sir William Jones, that Sumbul, &c., was always considered by Arabian authors as synonymous with the Nardos of the Greeks. In Persian works on Materia Medica, all translated from the Arabic, as, for instance, the 'Mukhzun-al-Adwieh,' or 'Magazine of Medicines,' we have four different kinds of Sunbul:—1, Sunbul Hindee; 2, Sunbul Roomee, called also Sunbul Ukletee, and Narden Ukletee, evidently the above Celtic Nard, said also to be called Sunbul Italion, that is, the nard which grows in Italy; 3, Sunbul Jibullee, or Mountain Nard: hence it is evident that the kinds described by Dioscorides are alluded to, and in fact the accounts given are merely translations of his descriptions. The fourth kind of Sunbul appears to be a hyacinth or polyanthus. But the first is that with which alone we are at present concerned. The synonyms given to it are—Arabic, Sunbul-al-Teeb, or Fragrant Nard; Greek, Narden; Latin, Nardoom; and Hindee, Balchur, and Jatamasee.

Having the Hindee and Sanscrit names of an Indian plant, the next step was to obtain it. This was first attempted by Sir William Jones, at a time when we had no access to the Himalayan Mountains, and a wrong plant was sent him. Dr. Royle informs us that on making inquiries on the subject, when at Saharunpore, in 30° N. lat., about 30 miles from the foot of the Himalayas, he learnt that Jatamansi, better known in India by the name Bal-Chur, was yearly brought down in considerable quantities from the mountains, such as Shalma Kedarkanta, near the Ganges and Jumna rivers, to the plains. Having obtained some of the fresh brought down roots, he planted them both in the East India Company's Botanic Garden, and in the mountains, in a nursery attached to it. The plant produced was found to belong to the natural order *Valerianaceæ*, and has been named *Nardostachys Jatamansi* by De Candolle, and formerly *Patrinia Jatamansi* by Mr. Don, from plants sent home by Dr. Wallich from Gossainthan, a mountain of Nepaul. Mr. Don obtained the additional corroboration that spikenard bought in a chemist's shop by this name exactly corresponded with the roots of the Jatamansi. (Royle, 'Illust. Himalayan Bot.,' p. 242.)

Hence there can be no doubt that the Nardos described by Dioscorides is the Jatamansi of the Hindoos, and probably the same substance which has been mentioned by such writers as Hippocrates; and there is nothing improbable in its being the Nard of Scripture, and it has been shown to be a plant belonging to the natural order *Valerianaceæ*. It is curious that the Celtic and mountain nards are also Valerians, the former being yielded by *Valeriana Celtica* and *V. Saliunca*, still exported from the mountains of Austria to Egypt, whence it has spread into both Africa and Asia, being valued for its fragrance, and hence employed in perfuming baths; and the other by *V. tuberosa*. Dr. Royle mentions it as a curious coincidence, if not allowed to be a sign of accurate knowledge, that the Persians should translate the *φυ* of Dioscorides, which he also calls Wild Nard, Foo of the Arabians, by the term Bekh-i-Sunbul, Root of Soonbul. The plant correctly ascertained by Sibthorp has been named by him *Valeriana Dioscoridis*.

SPILANTHES, a genus of Plants belonging to the natural order *Compositæ* and the sub-order *Corymbiferæ*. It has a many-flowered head, either heterogamous with the florets of the ray ligulate, or homogamous with all the florets tubular and 5-toothed; the involucre is in two rows, adpressed, shorter than the disc, the outer scales somewhat leafy, the inner rather membranous and folded up.

S. oleracea, has a branched diffused stem; opposite stalked broadly ovate leaves, obtuse at the base, truncate or somewhat cordate; the pedicles are 1-headed, longer than the leaf; the heads thick, ovate, and discoidal; the achænia ciliated at the angles, bi-aristate or awnless. The whole plant, but especially the involucre and receptacle, acts as a powerful stimulant of the salivary organs.

(Lindley, *Flora Medica.*)

SPINACH. [SPINACIA.]

SPINA'CIA, a genus of Plants belonging to the natural order *Chenopodiaceæ*. This genus is dicecious, the male and female flowers being on different plants; the male flowers are composed of a calyx, with 5 deeply cloven concave oblong obtuse segments; 5 stamens, with filaments longer than the calyx, with oblong double anthers. The female flowers have a monosepalous calyx, with four divisions, two of which are smaller and opposite; a superior ovary with 4 styles and simple stigmas. As the fruit ripens the calyx hardens and adheres to it. The ovary contains a single seed. There are only two species, which are herbaceous plants with alternate leaves, and axillary flowers of a green colour.

S. oleracea, the Common Spinach, is well known on account of its use in the kitchen. It has an herbaceous stem one or two feet high, branched, and hollow; arrow-shaped leaves; male flowers in long spikes, abounding with pollen; female flowers on another plant, axillary, herbaceous, and small. The fruit is a small round nut, which is sometimes very prickly.

SPINDLE-TREE. [CELASTRACEÆ; EUONYMUS.]

SPINE. [SKELETON.]

SPINE, in Botany, is applied to the sharp hard conical extremities of the branches of plants. The spine is seen in great perfection in the Gleditschia, Sloe, White-Thorn, and other plants. Spines differ from prickles in being in connection with the wood of the stem, and in being composed of bark and wood, as the stem itself. The prickle consists of merely hardened cellular tissue, and can be removed from the wood with the bark.

SPINE-BACKS, a name given to the *Notocanthidæ*, a family of Acanthopterygious Fishes.

SPINELL, *Spinell Ruby, Balas Ruby, Ceylanite, Candite*, &c., a Mineral occurring in loose and imbedded octahedral crystals. Primary form the cube. Cleavage easy, parallel to the faces of the octahedron of the black opaque variety; difficult in the other varieties. Fracture conchoidal. Hardness greater than that of quarts, but less than that of corundum. Colour red, blue, violet, green, yellow, brown, and black. The first is the most common. Streak white. Lustre vitreous. Transparent, translucent, opaque. Specific gravity 3·5 to 3·7. Infusible by the blow-pipe; the red varieties are rendered black and become opaque by exposure to it, but on cooling, at first of a fine green by transmitted light, then nearly colourless, and at last become again red.

Spinell is found in Ceylon and Siam in isolated and rolled crystals in the beds of rivers. It is found embedded in carbonate of lime in North America and Sweden.

Several varieties have been analysed: red transparent spinell by Vauquelin; blue, by Berzelius; green and black, by Dr. Thomson:—

	Red.	Blue.	Green.	Black.
Silica . .	—	5·48	5·62	5·59
Alumina . .	82·47	72·25	73·30	61·78
Magnesia . .	8·78	14·63	13·63	17·86
Protoxide of Iron	—	4·26	7·42	10·56
Lime . .	—	—	trace	2·81
Chromic Acid .	6·18	—	—	—
	97·43	96·62	99·97	98·60

SPINELLANE, a Mineral occurring crystallised. Its primary form is the cube; its usual form the rhombic dodecahedron. Cleavage parallel to the faces of the dodecahedron. Fracture conchoidal, uneven. Hardness 5·5 to 6. Colour brown, gray, grayish black. Lustre vitreous. Translucent; opaque. Specific gravity 2·28. It gelatinises in acids.

It is found on the borders of Lake Laach, near Andernach on the Rhine. Its analysis by Klaproth gives—

Silica	43·0
Alumina	29·5
Soda	19·0
Lime	1·5
Peroxide of Iron	1·0
Sulphuric Acid	2·0
Water	2·5
	——98·5

SPINIGRADA. [ECHINODERMATA.]

SPINOPORA. [MILLEPORIDÆ.]

SPIRÆA, a genus of Plants belonging to the natural order *Rosaceæ*, tribe *Spiraceæ*. The name occurs in ancient authors, and is supposed to be derived from σπεῖρα, a cord, in allusion to the fitness of the plants for twisting into garlands. The genus is diffused through the temperate parts of the northern hemisphere, and is characterised by having a 5-cleft permanent calyx; stamens 10 to 50, inserted in a torus with the 5 petals, which are inserted into the calyx; carpels sessile, solitary or several, rarely connected into a capsule; seeds 2-15, pendulous, very rarely ascending. The species, upwards of 50 in number, form small unarmed shrubs or perennial herbs; leaves usually simple, sometimes pinnately cut; flowers white or reddish. They are found in Europe, North America, Siberia, China, and the Altai and Himalayan Mountains.

S. Ulmaria, Meadow-Sweet, is found in our meadows; and *S. filipendula* on our downs, &c. Pigs are said to be fond of the tubers of the roots. Several of the species are astringent, and might be used in tanning. *S. trifoliata* is sometimes called Ipecacuanha de Virginia, being employed as an emetic.

SPIRAL STRUCTURES. In the development of the tissues of plants and animals two tendencies are observed; the one simply that of extension in a vertical direction, the other is that of curvation, mostly resulting in the production of a spire. The tendency to develop parts in a spiral direction, though much more prominent in the vegetable than in the animal kingdom, is by no means confined to it. In the ninth volume of the 'Annales des Sciences Naturelles,' Mandl has shown that all the tegumentary appendages of animals, as the scales, feathers, hair, &c., have a spiral arrangement, and that many of the internal organs are subject to the same law. The tendency to develop structures in a spiral form appears to be dependent on some of the higher laws regulating organic life; and in this view the subject has been investigated by recent botanists. Göthe, the German poet, in his 'Essay on the Spiral Tendency of Vegetation,' published in 1831, gives the following view. He supposes that there is a dependence of those properties which plants possess of resisting external agents, and of enduring for a length of time, upon those parts that are developed vertically, while the nutritive and reproductive functions are connected with spirally-developed structures. In support of this generalisation he adduces a number of facts. If a branch of an ash-tree is injured, so that the lower parts become over-nourished, it possesses a tendency to become spiral. When the leaves of the Italian poplar are injured by insects, the petioles become twisted. Spiral vessels exist in greatest numbers in the growing parts of plants, as the alburnum. They also exist in greater numbers in the higher plants, the lowest possessing none. A spiral arrangement of parts is also much less observable in the lower than in the higher groups of plants. The organs of nutrition and reproduction, the leaves and parts of the flower, have normally a spiral arrangement. Von Martius, Mohl, and others, have also written on the general theory of spiral structure.

Cellular tissue was at one time supposed to consist of plain simple cells, but the researches of later botanists have proved that the cells of this tissue are often furnished with fibres, which are twisted in a spiral manner. This spiral fibrous tissue is abundant in the roots of orchidaceous plants, in the seed-coats of many plants, and in the linings of the valves of almost all anthers. Spiral fibres, independent of any cells, and apparently surrounded by vegetable mucus, have been found in the testa of the seeds of *Collomia linearis*. In the seed-coats of the seeds of species of *Blepharis* and *Acanthodium* spiral fibres inclosed in membranous tubes are found in very great abundance. The organs called elaters, which are contained with the sporules in the conceptacles of *Jungermannia*, consist of spiral fibres surrounded by a tube. In the reproductive cells of both animals and plants a spiral arrangement of the protoplasm is often observed, and as a rule the spermatozoa and spermatozoids of plants and animals are developed in this form.

In the vascular tissue of plants is found a tissue, which on account of its spiral structure has been called Spiral Vessels. These vessels appear to be little more than fibrous cellular tissue elongated, the parietes of the cell forming an elongated tube, which is tapering at each extremity, and contains within it one, two, three, or more spiral fibres. This tissue is exceedingly abundant in exogenous and endogenous plants, but is not found in the lower families of *Cryptogamia*. It exists however in Ferns, *Lycopodiaceæ*, and *Equisetaceæ*. It is only sparingly found in *Coniferæ*. These spiral fibres possess the power of moving when touched.

The spiral tendency is developed in the structure of the stem and leaves of plants. The part of the latter which exhibits this structure is the petiole, and in this organ all forms of the spire may be seen, from a single twist to the complicated spires observed in the organs called cirrhi. In most plants these cirrhi assist them in climbing, their structure adapting them to this purpose. The spires of the cirrhi twist in some from right to left, in others from left to right; and in the cirrhi of the genera *Passiflora* and *Bryonia* the direction changes several times in the course of the spire from right to left and from left to right.

In the structure of many of the *Confervæ* a spiral arrangement of the tissues is observed, especially of those which approach the animal kingdom in their movements, as the *Oscillatoriæ*. The setæ which support the conceptacle of *Jungermannia*, and which contain the spiral elaters before mentioned, possess in many instances a spiral structure. This is also occasionally developed in the same organ in mosses, a remarkable instance of which occurs in *Funaria hygrometrica*. In this moss the setæ are quite straight when young, but assume the spiral structure as they increase in age. In this setæ the spire turns in two directions: from the base about two-thirds up the stem it goes from right to left; it then becomes quite straight, and turns in the opposite direction from left to right. A curious property is possessed by these setæ when the capsules are ripe. If the upper part of the spire is moistened, the capsule commences turning from right to left; but if the lower part only is moistened, it turns from left to right.

The entire stems of plants are frequently spiral, as is seen in the plants which are called Climbers. These plants, by reason of the spiral arrangement of their tissues, twine around the nearest objects, whether organic or inorganic. In most of them the winding of the spire is to the left side, but in a few the turning is to the right. Amongst the former are the genera *Cuscuta*, *Phaseolus*, *Dolichos*, *Passiflora*, *Banisteria*, &c.; amongst the latter are the genera *Humulus*, *Dioscorea*, *Lonicera*, *Polygonum*, &c. This winding in a particular direction is not only confined to the species of a genus, but to the genera of an order; and Mohl, who has paid great attention to this subject, states that he knows of but one exception to this rule, which is the genus *Abrus*, in the order of *Leguminosæ*, which twines to the left, whilst all the others twine to the right. The direction of the spires of the cirrhi is not so constant. Between the twining of the cirrhi and the stems of plants Mohl has pointed out an essential difference. The cirrhi are first developed longitudinally, and the spiral tendency proceeds from the point to the base; but in stems the first three or four internodes grow straight, and the next internode is developed very rapidly; and from this lower internode the spiral tendency is developed upwards. Sometimes a spiral direction is seen in the direction of trees that ordinarily grow straight; and Göthe records several instances of twisted trunks in the chestnut, the white-thorn, beech, and others. A remarkable instance of spiral structure connected with function is seen in the peduncle of the female flowers of *Valisneria*, which is a water-plant. The female flowers spring to the surface of the water in the summer, at the time the male flowers have perfected their pollen, and scattered it upon the surface of the water. As soon as the pollen is conveyed to the female flower its spiral stem becomes contracted, and its fruit is perfected at the bottom of the water.

The most remarkable and important exhibition, in a practical point of view, of the spiral tendency in plants, is the arrangement of the leaves upon the axis of the plant. If we take a branch of the willow, oak, pear, apple, or many others, and examine the leaves, we shall find they are arranged in such a manner, that if we were to draw a line from leaf to leaf up the stem, we should produce upon it a spiral which would in the case of any of these trees be of a different character from any of the others. In theoretical botany the spiral arrangement of the leaves which makes them alternate upon the stem is looked upon as their normal form, and those leaves which are opposite or verticillate are supposed to be produced by the suppression of an internodium. The spiral arrangement of the leaves on the stem has been made a matter of mathematical investigation by Braun and Schimper, and it is found that this arrangement is possessed of certain fixed mathematical properties. Of course the same observations are applicable to all those parts of the plant, as the bracts, sepals, petals, scales of the fruit, &c., which are considered modifications of the leaf. The fruit of the common pine may be taken as an illustration of these properties. If the cone of a pine or a spruce-fir be broken through the middle, three scales will be observed, "which, at first sight, appear to be upon the same plane; but a more attentive examination shows that they really originate at different heights, and moreover that they are not placed at equal distances from each other; so that we cannot consider them as a whorl, but only a portion of a very close spiral. But considering the external surface of the cone viewed as a whole, we find that the scales are disposed in oblique lines, which may be studied—1, as to their composition, or the number of scales requisite to form one complete turn of the spire; 2, as to their inclination, or the angle, more or less open, which they form with their axis; 3, as to their total number, and their arrangement round the common axis, which constitutes their co-ordination. Finally, we may endeavour to ascertain whether the spires turn from right to left, or vice versâ." (Lindley.)

In the arrangement of the leaves several series of spires are discoverable, and between these there constantly exists a certain arith-

metical relation which may be expressed by figures, and which results from the combination of the elements of which they are composed. All the spires depend upon the position of a fundamental series, from which the others are deviations. The nature of this series is expressed by a fraction, of which the numerator expresses the number of turns which make up one spire, whilst the denominator expresses the number of leaves, scales, &c., upon the spire. So that suppose we mark the seat of one leaf at the bottom 0, and go on following the leaves, we shall come at one directly over the first, and this completes the spire; if this leaf occurs after ten turns of the spiral, and there should be eighteen leaves upon the spire, the expression for this series would be $\frac{10}{18}$. By applying this rule very different figures may be obtained for various plants. The following are results obtained by Braun:—

$\frac{1}{1}$ is the expression for the leaves of Woad, *Plantago lanceolata*, and the bracts of *Digitalis lanata*. $\frac{1}{2}$ in *Sempervivum arboreum*, and the bracts of *Plantago media*. $\frac{1}{3}$ is a common form; it exists in the bay-tree, the holly, and *Aconite*. $\frac{2}{5}$ is the most common, representing the *Quincunx*. It is seen in *Mezereum*, *Lapsana communis*, the potato, &c. $\frac{3}{8}$ is seen in the spikes of all grasses, in *Asarum*, the lime-tree. the vetch, and pea.

No application of this doctrine has at present been made, and these researches are only in their infancy. It seems in some genera to be a mode of distinguishing species. Thus the expressions for the following species of *Pinus* are—*P. pinaster*, $\frac{2}{5}$; *P. sylvestris*, $\frac{2}{5}$; *P. Cembra*, $\frac{3}{5}$; *P. larix*, $\frac{3}{5}$; *P. microcarpa*, $\frac{3}{5}$.

(Göthe, *Ueber die Spiral-Tendenz der Vegetation*; Meyen, *Pflanzen-Physiologie*, band iii.; Lindley, *Introduction to Botany*; Henslow, *Botany*, in *Cabinet Cyc.*; Virey, *Philosophie de l'Histoire Naturelle.*)

SPIRAL VESSELS. [TISSUES, VEGETABLE.]

SPIRALIS. [HYALÆIDÆ.]

SPIRATELLA. [HYALÆIDÆ.]

SPIRICELLA. [SEMIPHYLLIDIANS.]

SPI'RIFER (Sowerby), a group of Fossil *Brachiopoda*.

SPIRIT-DUCK. [DUCKS.]

SPIRO'RBIS. [ANNELIDÆ.]

SPI'RULA. [SPIRULIDÆ.]

SPIRU'LIDÆ, Professor Owen's name for a family of Polythalamous Decapodous Dibranchiate *Cephalopoda*.

The family is thus characterised:—Shell partly internal; cylindrical, multilocular, discoid; the whorls separated; septa transverse, concave next the outlet, and with regular intervals. Siphon marginal and internal, uninterrupted. Animal having an oblong body with minute terminal fins, the mantle supported by a cervical and two ventral ridges and grooves. Anus with six rows of very minute cups; tentacles elongated. Funnel valved.

The character of the family is that of the genus *Spirula*, of which it is at present composed.

Professor Owen makes three species of the *Nautilus Spirula* of Linnæus. These are *Spirula Peronii*, *S. Australis*, and *S. reticulata*. The shell of one or other of these species is not unfrequently found on the British coast, and instances are recorded of its having been found on the coasts of Ireland, Cornwall, and Devon. The animal has been very seldom taken whole, and the portions that have been found led to much discussion, till one was obtained perfect by Mr. Percy Earle on the coast of New Zealand. The shells are found in great abundance on the coasts of New Zealand. They abound also on the Atlantic coasts.

SPI'SULA (J. E. Gray), a genus of *Conchifera* founded on *Mactra fragilis* and similar species.

SPIZAËTUS (Vieillot), a genus of Birds. [FALCONIDÆ.]

SPIZELLA (Bonaparte), a genus of *Fringillina*.

SPLACHNUM, the name of a genus of Cryptogamic Plants belonging to the natural order of Mosses. The word is adopted from Dioscorides, who used both Σπλάχνον and Βρύον to designate the families of Lichens and Mosses. It is known by its terminal fruit-stalk; single peristome with eight double teeth; capsule with an evident apophysis, and mitriform glabrous furrowless calyptra. They are generally annual plants, and remarkable amongst their tribe for their size and beauty as well as singularity. Seven of the species are British. The most common in England is the *S. ampullaceum*, Purple Gland-Moss, which is found growing chiefly on rotton cow-dung. The receptacles are obtuse, inversely conical, of a greenish-purple colour, and three times as thick as the capsule.

S. sphæricum, Green Globular Gland-Moss, has a green globular receptacle, with ovato-lanceolate, pointed, entire leaves, and a capillary fruit-stalk. It is a native of alpine situations in the north of Europe and Scotland, and is generally found on cow-dung. It occurs in green tufts, and has elegant slender wavy tawny fruit-stalks from one and a half to three or four inches high.

S. rubrum, Red Umbrella Gland-Moss, has an orbicular convex red receptacle, with partially toothed leaves. The fruit-stalks are six inches in length; the receptacle is very conspicuous, being half an inch wide, and having the form of an inverted cup, which is of a rich crimson colour and finely reticulated, making this moss one of the most remarkable and beautiful in the family. It is a native of Norway, Finland, Russia, and Siberia.

SPLEEN (Σπλήν, *Lien*, *Splen*). There are few parts of the human body on which more has been written than on the Spleen, and none where the result has been more unsatisfactory. The purpose which it serves in the animal economy is still only imperfectly known, and the record of the theories which have been entertained of its uses is a most uninstructive page in human physiology.

The Spleen is an organ which is not found in any tribe of animals below the class of fishes. Some animals have two, and this number has not unfrequently been found in man; for, as Haller says ('Elem. Physiol.,' t. vi. p. 388), everything connected with this organ is uncertain and variable. Its form is generally somewhat oval, being smooth and convex on the exterior, where it is in apposition with the diaphragm, and irregularly concave on the opposite side, which is unequally divided into two parts by a transverse slit for the transmission of its vessels. (Quain, 'Elem. of Anat.') It is for the most part placed in the left hypochondriac region, between the diaphragm and the stomach, and beneath the cartilages of the ribs. (Quain.) It varies so much in size, that it is almost impossible to say what are its normal proportions. (Bichat, 'Anat. Descr.') It is much enlarged by disease, as will be hereafter noticed; but in health, taking a general average, its greatest diameter may be said to measure about four inches, its breadth three inches, and its thickness from two to two and a half inches; its usual average weight is from eight to ten ounces. It is of a slight spongy consistence (ἁραιὸς καὶ σπογγοειδὴς, Hippocr. 'De Morb. Mulier.' lib. i. tom. ii. p. 683, ed. Kühn), and is at all times easily torn; and in many cases it is found, soon after death, so soft as to be readily broken by a slight pressure, when it appears a grumous, dark, confused mass. Its colour is deeply red, with a tinge of blue, particularly round its margin. It has a peritoneal investment prolonged to it from the stomach, by which, as well as by vessels, it is connected with that organ; but it has also a smooth and fibrous tunic proper to itself, which is so firmly adherent to the serous investment above-mentioned, that they cannot be separated except at its concave surface. (Quain.) No organ receives a greater number of bloodvessels in proportion to its size than the spleen; a fact noticed by all anatomists, and the more so because it secretes no fluid of any sort, at least none that has hitherto been discovered. (Bichat.) Almost all the blood that it receives is derived from the Splenic Artery (Haller, p. 400, 401); this is the largest branch of the coeliac axis, and near the Spleen divides into several branches, some of which enter the fissure in that organ, and are distributed to its substance. These are called the Rami Splenici; they are five or six in number, and vary in length and size. (Quain.) They are the proper terminal branches of the artery, and by infinite ramifications form within the substance of the Spleen a capillary system, which probably anastomoses in a direct manner with the capillaries of the veins (Bichat), as is proved by the facility with which injections pass from one to the other. The Splenic Vein is a vessel of very considerable size compared with the bulk of the organ; and it returns the blood not only from the Spleen, but also from the pancreas, duodenum, the greater part of the stomach and omentum, the left colon, and part of the rectum. It commences by five or six branches, which issue separately from the fissure of the Spleen, but soon join to form a single vessel. Its direction is then traversed from left to right, embedded in the substance of the pancreas, in company with the Splenic Artery, beneath which it is placed. On reaching the front of the spine it joins the Superior Mesenteric Vein nearly at a right angle, from the conflux of which proceeds the vena portæ. (Quain.) The nerves of the Spleen accompany the Splenic Artery, and are derived from the solar plexus, forming an interlacement called the Splenic Plexus, previous to their entrance into it. (Ibid.) They are small compared with the size of the organ; and accordingly the Spleen has very little sensation, a fact which was noticed as early as the time of Aretæus. ('De Caus. et Sign. Diuturn. Morb.,' lib. i. cap. 14, p. 111, ed. Kühn; Haller.) Its lymphatic vessels are very numerous; but as no appreciable product is elaborated by this apparatus, it has no excretory duct. (Quain.) The fibrous or proper coat of the Spleen sends into its interior a multitude of cellular bands and fibres, which form by their intersections cells of various forms and sizes, and support the soft, pulpy, red tissue of the organ. In the red substance there are in many animals contained whitish round corpuscles, visible to the naked eye, which were first discovered by Malpighi, and of which the existence in the human Spleen has been at one time admitted and at another denied. The corpuscles of the human Spleen are described by Dupuytren and Assolant as grayish bodies, devoid of internal cavity, and measuring one-fifth of a line to one French line in diameter, and so soft as to take a liquid form when raised on the knife. Meckel describes them as roundish whitish bodies, one-sixth of a line to one line in diameter, most probaly hollow, and at all events very soft and very vascular. In the human Spleen the Malpighian corpuscules are distinguished with great difficulty. They vary from one-third to one-sixth of a line, and much smaller corpuscles are seen, which are probably commencing stages of the larger ones. Each of the corpuscles is formed of a fibrous envelope, which it appears to derive from the coat of the artery to which it is attached, and is often surrounded by minute capillaries. When crushed the corpuscles are found to consist of very minute indented cells and free nuclei. Dr. Sanders describes also a layer of nucleated spherical cells, which are placed beneath the corpuscle. Each corpuscle, according to Dr. Sanders, is traversed by

arterial twigs of considerable size, which may be seen by boiling the Spleen in acidulated water, and cutting it into thin sections.

The function and structure of the Spleen have been recently studied with great care by Mr. Gray, and his Essay on this subject obtained for him the Astley Cooper prize. He sums up his researches under the following heads:—

1. The Spleen exists without exception in all Vertebrate Animals.

2. It presents however by far its greatest development of structure, and consequently its function is most perfectly developed, in the *Mammalia*, this being partly dependent upon the greater general completeness and requirements of their organisation.

3. Part of the offices of this organ are plainly those of a diverticulum for blood. This is especially seen in the Diving Animals, where its large size is undoubtedly associated with considerable obstruction to the circulation which takes place under these circumstances. Its large size also in those animals in which assimilation of food rapidly occurs, and in which, consequently, new material is suddenly added to the circulation as compared with its extremely diminutive size under the opposite conditions, also affords evidence of its diverticular function.

4. The total absence in Reptiles and Fishes of one of the main elements of this gland in *Mammalia* and Birds, is in perfect accordance with their low grade of organisation, and the remarkable faculty they possess of sustaining hunger for almost an unlimited period; whilst in the former they form a ready, although a scanty, sinking fund for albuminous materials that can be rapidly given up to the blood during their temporary and occasional abstinence, and which cannot be borne by them with impunity for any long period.

5. Its function then is not for specific but for general purposes, serving to regulate under many varied and opposite conditions the quantity and also the quality of the blood.

SPLEENWORT. [Asplenium.]

SPODU'MENE, *Triphane*, a Mineral occurring in imbedded crystalline masses. Primary form a rhombic prism. Cleavage parallel to the primary faces and to the diagonal planes; that parallel to the smaller diagonal is most brilliant, and that parallel to the greater most difficult. Fracture uneven, granular. Hardness, scratches glass and gives fire with steel. Colour whitish- and greenish-gray. Streak white. Lustre pearly on the cleavage planes. Specific gravity 3·17 to 3·188. Before the blow-pipe it swells and fuses into a glass almost colourless and transparent; with borax it swells, but does not easily dissolve.

It is found at Uto in Sweden, in the Tyrol, Ireland, and North America. The analyses of this mineral by Arfwedson from Sweden, by Stromeyer, and Le Hunt from Ireland, gives the annexed results:—

	Arfwedson.	Stromeyer.	Le Hunt.
Silica	66·40	63·288	63·812
Alumina	25·30	28·776	28·508
Lithia	8·85	5·626	5·604
Lime	—	—	0·728
Protoxide of Iron	1·45	0·794	0·828
Protoxide of Manganese	—	0·204	—
Moisture	0·45	0·775	0·360
	102·45	99·463	99·840

SPONDIA'CEÆ, a natural order of Plants belonging to the Syncarpous group of Polypetalous Exogens. It has unisexual flowers; a 5-cleft regular calyx; 5 petals, inserted under the disc; 10 perigynous stamens arising from the same part as the petals; superior sessile ovary, 2-5-celled, with 5 very short styles and obtuse stigmas; one ovule in each cell. Fruit drupaceous. Seeds without albumen. The plants of this order are trees without spines, having alternate unequally pinnate leaves without pellucid dots. The flowers are arranged in panicles or racemes. This order was formerly included in *Terebinthaceæ*, but has been separated by Kunth and Lindley, on account of their syncarpous fruit and the absence of a resinous juice. The real affinity of *Spondiaceæ* appears to be with *Aurantiaceæ*, from which they differ in little beyond their perigynous stamens and the absence of dots on their leaves. They are natives of the West Indies, the Society Islands, and the Isle of Bourbon. The fruit of some of the species of *Spondiaceæ* is eatable, and is known in the West Indies by the name of Hog-Plums.

SPONDYLIDÆ. [Pectinidæ.]

SPONDY'LUS. [Pectinidæ.]

SPONGA'RIUM, a genus of Silurian Fossils.

SPO'NGIA, the generic name under which Linnæus and many subsequent systematists have ranked the very numerous forms of organisation analogous to the sponges of commerce. Generally, and we think justly, zoologists have claimed these organisations for the animal kingdom, and ranked them among the *Zoophyta;* but there are eminent writers who dissent from this view on different grounds, and prefer to rank the marine and freshwater sponges with plants. For in regard to their constituent structure, they are composed, as so many of the *Polypifera* are, of a firm horny or stony skeleton, immersed in a soft gelatinous living mass; in respect of the aspect of these two substances, the resemblance which they offer to *Alcyonia* appears very strong, while their external forms, uncommonly varied,

Spondias Mombin. [Spondiaceæ.]

a, branch with leaves and fruit; *b*, flower, showing the hypogynous disc, with the stamens and petals under it; *c*, portion of branch, showing inflorescence; *d*, section of fruit, showing its five cells.

sometimes resemble *Alcyonia*, often approach to *Palmipora*, frequently to *Pavonia*, *Agaricia*, and other forms of Lamelliferous *Zoophyta*. The currents of water which pass through the canals of their substance are analogous to many operations among *Polypifera* and *Mollusca*, and depend on similar ciliary organs, which have been detected in situ in *Grantia ciliata*. As however they contain no *Polypi*, it is difficult to rank them under the *Polypifera*. Dr. Johnson omits, in his excellent work on British *Zoophyta*, the sponges, and the following summary of his reasons deserves attention:—"If they are not the productions of Polypes, the zoologist who retains them in his province must contend that they are individually animals, an opinion to which I cannot assent, seeing that they have no animal structure or individual organs, and exhibit no one function usually supposed to be characteristic of the animal kingdom. Like vegetables, they are permanently fixed; like vegetables, they are non-irritable; their movements, like those of vegetables, are extrinsical and involuntary; their nutriment is elaborated in no appropriated digestive sac; and, like cryptogamous vegetables or algæ, they usually grow and ramify in forms determined by local circumstances, and if they present some peculiarities in the mode of the imbibition of their food, and in their secretions, yet even in these they evince a nearer affinity to plants than to any animal whatever." On this we may remark, that very many animals are as permanently fixed as sponges; that irritability is not to be looked for in every part of a sponge, any more than in a *Rhizostoma*, whose divided digestive cavities are very unlike ordinary stomachs; and that the forms of sponges include remarkable analogies with the supports of *Polypi*.

It is to our countrymen Ellis and Grant that the history of sponges is most indebted. The former established the existence and nature of the currents of water which pass through the substance; and the latter, besides confirming the results of Ellis, added a vast quantity of new and valuable observations. Mr. Bowerbank has contributed precise information regarding both the fossil and recent sponges. (Ellis, 'On Corallines;' Grant, 'On Sponges,' in 'Edinburgh Philosophical Journal;' Bowerbank, 'Geological Proceedings,' 1840; and 'Microscopical Journal,' 1841.)

Sponges may be thus characterised:—They consist of an albuminous skeleton and gelatinous matter, forming a mass not irritable, with numerous holes, connected internally with anastomosing canals. The skeleton is either simple, consisting of horny fibres, as the species so commonly used for domestic purposes; or compound, being strengthened by calcareous or siliceous spicula. Some of the skeletons of sponges are entirely horny; others are entirely siliceous; some are entirely calcareous; but the greater number are compound, and consist of horny matter with additions of spicula in various proportions. The gelatinous matter, abounding in horny matter and transparent globules, connects the different parts of the skeleton and membranes, lines the various canals, and forms the margins of the openings. The pores are minute openings (on the surface) with a gelatinous margin, strengthened or defended by the skeleton or spicula, into which the water enters in currents, generated probably by a ciliary apparatus, which however has not yet been detected by the microscope, except in *Grantia ciliata*. The water, after traversing the interior canals, is ejected by means of orifices which are larger than

the pores, and in many species are elevated above the surface in the form of tubular prolongations of the canals. The ova are numerous, at first appearing like groups of minute irregularly shaped opaque granules, derived from the gelatinous matter, which unite into ovate bodies, falling at maturity into the canals, and are expelled by the orifices. These ova float in the water, and exhibit spontaneous motion by the rapid action of the cilia, which cover the anterior portion of the body, and at length attach themselves, and then expand into the forms of maturity. The currents from the orifices are best examined by placing the recent animal in a shallow dish of water, and throwing a little powdered chalk on the surface, the motion of which will indicate the direction of the streams. For the purpose of examining the skeleton, it is requisite to macerate the sponge in hot water, which removes the gelatinous matter, and leaves the skeleton in a state fit to be examined under a microscope. When the spicula are siliceous, the animal matter may be removed by nitric acid, or by combustion, as was practised by Müller ('Zool. Dan.,' t. 85), when the vitreous needles will appear unaltered.

The gelatinous substance of sponges is scarcely capable of conservation. It is usually of a ropy consistence, sliding off from the skeleton, or else pressed off by the divers for sponge. It is of various colours, but commonly fawn-coloured or orange-coloured; in this respect resembling the gelatinous parts of *Polypiaria*.

Horny Sponges with anastomosing fibres, fit for domestic use, belong mostly to warm zones of the sea; sponges with calcareous spicula are rather numerous on the British coasts; and siliceous spicula are common in the sponges of most latitudes. [SPONGIADÆ.] Remains of both horny and spicular sponges occur in a fossil state.

SPO'NGIADÆ. Regarding sponges as Apolypiferous Zoophytes, composed of flexible or rigid skeletons enveloped in a gelatinous mass, productive of inward currents through small surface pores, and outward currents through continuous canals, we may proceed to analyse the large group of organic forms possessing these characters, by the nature and arrangement of the skeleton, for the gelatinous part (though perhaps conservable, if due care be used) is not probably capable of being examined so as to furnish distinctive and recognisable characters.

Dr. Grant pointed out the principles of this analysis, by his observations on the nature and arrangement of the horny fibres, the calcareous and siliceous spicula, and the formation and distribution of the pores and orifices of sponges. Dr. Fleming ('British Animals') gives the following genera, under the family of *Spongiadæ*:—*Tethya*, *Halichondria* (including *Spongilla* of Lamarck), *Spongia*, *Grantia*. (*Siphonia*, *Choanites*, and *Ventriculites* of Parkinson and Mantell are included in *Halichondria*.)

Blainville ('Actinologie') arranges under the head of *Amorphozoa*—*Alcyonellum*, *Spongia*, *Calcispongia* (*Grantia*, Fleming), *Halispongia*, *Spongilla* (*Ephidatia*, Lamouroux), *Geodia*, *Cœloptychium* (fossil), *Siphonia*, *Myrmecium* (fossil), *Scyphia*, *Eudea* (fossil), *Halirrhoa* (fossil), *Hippalimus* (fossil), *Cnemidium* (fossil), *Lymnorea* (fossil), *Chenendopora* (fossil), *Tragos* (fossil), *Manon* (fossil), *Ierea* (fossil), *Tethium*.

Very few of these genera, adopted from Schweigger, Goldfuss, and others, can be considered as at all sufficiently determined, because the constituent structures of the fossil masses, on which alone they can be justly founded, have, in most cases, been altogether left unexamined. When the modern achromatic microscope shall have been directed upon them, with such perseverance as Mr. Bowerbank ('Proceedings of Geol. Soc.,' 1840) has employed on the spicular structures of the sponges imbedded in or constituting the nodules of flint in chalk, so that the forms of the anastomosing fibres or stiffening spicula, the sections and distribution of the canals, &c., can be certainly defined, a great benefit will arise to this branch of zoology, and an equal advantage for geology.

I. Groups of which the Constituent Structure is known.

Spongia.—Mass soft, elastic, more or less irregular in shape, very porous, traversed by many tortuous canals which terminate at the surface in distinct orifices. Substance of the skeleton cartilaginous, fibres anastomosed in all directions, without any earthy spicula.

Ex. *S. communis*. (Blainville, 'Actinologie,' pl. 93, fig. 3.)

Calcispongia, Blainville (*Grantia*, Fleming; *Luchelia*, Grant).—Mass rigid, or slightly elastic; of irregular form, porous, traversed by irregular canals, which terminate on the surface in distinct orifices. Substance of the skeleton cartilaginous, fibres strengthened by calcareous spicula. The spicula are seldom simple, often triradiate in figure.

Ex. *C. compressa*. (Montague, 'Wern. Trans.,' vol. ii.)

Altogether, Fleming and Blainville admit five species of this genus as determined. They occur on the British and other northern shores.

Halispongia, Blainville (*Halichondria*, Fleming).—Mass more or less rigid or friable, irregular, porous, traversed by tortuous irregular canals, which terminate at the surface in distinct orifices. Substance cartilaginous, fibres strengthened by siliceous (generally fusiform or cylindrical) spicula.

Ex. *H. papillaris*, Grant. ('New Edinb. Journal,' vol. ii.)

Blainville admits fourteen species. Fleming, who includes in it the fresh-water *Spongilla* (*Ephydatia*, Lamouroux), counts eighteen species. In what manner the immense number of species of sponges mentioned by Montague and Lamarck are to be distributed among these three groups, which ought to be considered families rather than genera, does not appear.

The remarkable siliceous sponge [SPONGIA] examined by Mr. Stutchbury of Bristol, would appear justly entitled to constitute a new genus.

Spongilla, Lamarck and Blainville (*Ephydatia*, Lamouroux).—Mass more or less rigid or friable, irregular, porous, but not furnished with regular orifices to internal canals.

Ex. *S. fluviatilis*, Linn.; *S. lacustris*, Linn. For the animal nature of these fresh-water sponges the argument is less complete than for the marine tribes. By experiments as to the effect of light on them, Mr. John Hogg ('Linn. Trans.') has endeavoured to show that they are influenced by this agent in the same manner as plants are, and that their green colour depends upon exposure to it.

II. Groups depending on Characters of Surface or general Figure.

Geodia, Lamarck.—Mass fleshy, tuberous, irregular, hollow within, externally incrusted by a porous envelope, which bears a series of orifices in a small tubercular space.

Ex. *G. gibberosa*, Schweigger. (Blainville, 'Actinologie.')

Cœloptychium, Goldfuss.—Mass fixed, pedicled, the upper part expanded, agariciform, concave, and radiato-porose above, flat and radiato-sulcate below. Substance fibrous.

Ex. *C. agaricioideum*, Goldfuss. ('Petrefactenkunde,' pl. 9.) From the chalk of Westphalia.

Siphonia, Parkinson.—Mass polymorphous, free or fixed, ramose or simple, concave or fistulous above, porous at the surface, and penetrated by anastomosing canals, which terminate in subradiating orifices within the cup.

Ex., living, *S. typum*. (Blainville, 'Actinologie.,' pl. 95.) Sicily.

Ex., fossil. *S. pyriformis*, Goldfuss. ('Petrefactenkunde,' tab. 6, fig. 7, *a*, *b*, *c*, *d*, *e*.)

Siphonia abound in the Greensand Formation.

Myrmecium, Goldfuss.—Mass subglobular, sessile, of a close fibrous texture, forming ramified canals which radiate from the base to the circumference; summit with a central pit.

Ex. *M. hemisphericum*, Goldfuss. ('Petref.,' tab. 6.)

Scyphia, Oken.—Mass cylindrical, simple, or branched, fistulous, ending in a large rounded pit, and composed entirely of a reticulated (firm) tissue.

Ex., living, *S. fistularis*, Esper. (Tab. 20, fig. 2.)

Ex., fossil, *S. mammillaris*, Goldf. ('Petref.,' tab. 2, fig. 1.)

Eudea, Lamouroux.—Mass filiform, attenuated, subpedicellated at one end, the other enlarged, rounded, with a large terminal pit; surface reticulated by irregular lacunæ, minutely porous.

Ex. *E. clavata*, Lamouroux. ('Gen. des Polyp.,' tab. 74, fig. 1-4.)

Halirrhoa, Lamouroux.—Mass turbinated, nearly regular, circular, or lobate; surface porous; a large central pit on the upper face.

Ex. *H. costata*, Lamouroux. ('Gen. des Polyp.,' pl. 78.) From the Oolite of Caen.

Hippalimus, Lamouroux.—Mass fungiform, pedicellated below, conically expanded with a central pit above; surface porose, and irregularly excavated.

Ex. *H. fungoides*, Lamouroux. ('Gen. des Polyp.,' pl. 79.) From the Oolite of Caen.

Cnemidium, Goldfuss.—Mass turbinated, sessile, composed of close fibres and horizontal canals, diverging from the centre to the circumference; a central pit on the upper surface, cariose in the exterior, and radiated at the margins.

Ex. *C. lamellosum*, Goldf. ('Petref.,' tab. 6.)

Lymnorea, Lamouroux.—Masses mammillated, finely porous and reticulated, agglomerated within a common calyciform wrinkled adherent base.

Ex. *L. mammillosa*, Lamouroux. ('Gen. des Polyp.,' tab. 79, fig. 2.) From the Oolite of Caen.

Chenendopora, Lamouroux.—Mass conical, infundibuliform, external surface sulcated across; internal face porose.

Ex. *C. fungiformis*, Lamouroux. ('Gen. des Polyp.,' pl. 75.) From the Oolite of Caen.

Tragos, Schweigger.—Mass composed of dense close coalescing fibres; surface covered by distinct scattered orifices.

Ex. *T. difforme*, Goldfuss. ('Petref.,' tab. 5, fig. 3.)

Manon, Schweigger.—Mass composed of reticulated fibres, pierced on the upper face by distinct encrusted circumscribed orifices.

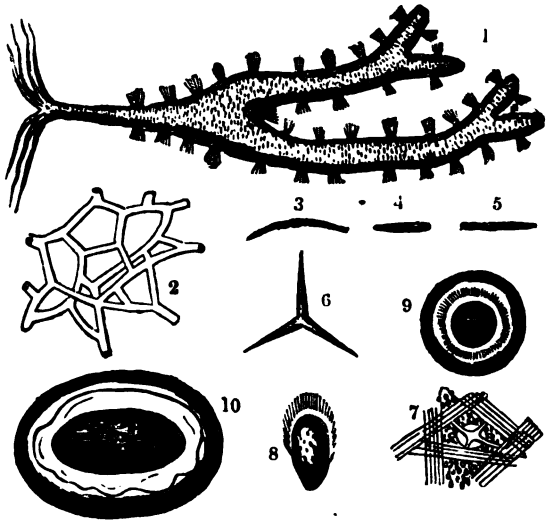
Ex. *M. tubuliferum*, Goldf. ('Actinologie,' pl. 95.) From the Chalk of Maastricht.

Ierea, Lamouroux.—Mass ovoid, subpedioulated, finely and irregularly porous, pierced on the upper part by many orifices, the terminations of internal tubes.

Ex. *I. pyriformis*, Lamouroux. ('Gen. des Polyp.,' tab. 78.) From the Oolite of Caen.

Tethium, Lamarck.—Mass subglobose, tuberose, composed of a cariose firm substance, strengthened by abundance of simple (siliceous ?) spicula fasciculated and diverging from the centre to the circumference.

Ex. *T. lyncurium*, Marsigli. ('Actinologie,' pl. 91, fig. 3.) [SUP.]



(From Dr. Grant.)

1, *Spongia oculata* (British), showing the orifices and currents outwards; 2, anastomosing horny substance of *Spongia communis*; 3, silliceous spiculum of *Spongia papillaris*; 4, of *Spongia cinerea*; 5, of *Spongia panicea*; 6, calcareous spiculum of *Spongia compressa*; 7, transverse section of a canal of *Spongia papillaris*, to show the structure and the ova passing along the canal; 8, ovum of *Spongia panicea* seen laterally—the ciliæ are anterior; 9, the same seen on the end, with a circle produced by the ciliary action; 10, young *Spongia papillaris*, grown from an ovum which had ceased to move about.

SPONGIOLE, or SPONGELET, is a term applied by De Candolle to the extremities of the ultimate fibrils into which the roots of all plants are divided. [ROOT.]

SPOONBILL. [PLATALEA.]

SPORANGIUM (from σπορά, a sowing, and ἄγγος, a vessel), a term first employed by Hedwig to designate the capsule of Mosses, and since applied very generally in cryptogamic botany to that part of the reproductive apparatus which contains the spores. It is used in almost all the cryptogamic tribes synonymously with the terms Theca, Capsule, Conceptacle, Folliculum, Involucrum, Sporocarpium. The multiplication of names applied to parts performing the same functions in the various tribes of *Cryptogamia* has often led to much inconvenience; and it is much to be desired that writers on this department of botany would agree to the adoption of a few well-defined terms, that would apply to the whole of this class of plants.

In the Ferns the sporangia are seated in the back of the frond, forming little heaps called Sori. [SORUS.] They are small brittle compressed bags, consisting of cellular membrane, and are partially surrounded by a thickened ring called the gyrus. By means of this ring the sporangia burst, and emit the spores which they contain.

In *Ophioglossaceæ*, a small tribe of ferns, there are no sporangia, the spores being contained in two lines parallel with the midrib of the fertile frond, and are emitted when the frond unfolds itself.

In *Lycopodiaceæ* the sporangia are seated in the axils of a bract upon the fruit-stalk, and either burst by distinct valves or are indehiscent. In this order there are two kinds, the one containing minute powdery granules, the other containing only three or four roundish fleshy bodies. The contents in both cases are considered sporules.

In *Marsiliaceæ* the sporangia form a Sporocarpium. [SPOROCARPIUM.]

In *Salviniaceæ* they are of two kinds: in the one kind the sporangia are composed of a thin reticulated membrane, and contain one or six and nine granules in their interior; in the other kind the granules are attached by pedicles to a central column, and are much smaller than the first. These latter have been supposed to be male organs, and the former female organs.

In the Mosses the sporangia are open and unshaped, and are mostly elevated on a slender stalk called the Seta. The brim of this organ is furnished with an elastic ring called the Annulus, and it has an interior organisation called Peristomium. This internal part of the sporangium has been called by Endlicher the Sporangidium. In the small section *Andræaceæ* the sporangia are closed, and split into four valves. Linnæus supposed the sporangia were the male organs of the Mosses.

In the *Jungermanniaceæ* the sporangium has no central column, as in the Mosses, nor does it open by an operculum. It is a valvular brown case elevated upon a cellular frequently twisted seta. It is filled with spiral fibres, called Elaters, among which the sporules lie intermixed. The spiral fibres by their hygrometric properties open the sporangium, which is composed of four valves, and in this way the spores escape.

In *Marchantiaceæ* the sporangium is placed, in some, beneath a fungus-like receptacle, which is covered by a calyptra; and in others it is buried in the substance of the frond or seated upon it.

Sporangium is not applied to the reproductive organs of Lichens, but the analogues of this organ in these plants are what are called the Shields, or Apothecia, which are filled with little tubes called Asci, in which the sporules are contained. There is also another form of the reproductive organs in Lichens, called Soredia, which are little heaps of powdery grains scattered over the surface of the plant, which are also the analogues of the sporangia.

In the *Algæ*, the sporules are scattered in most instances throughout the substance of the plant, so that they have no proper seed-case or sporangium; but whenever the sporules are collected together into one spot, and covered over by a distinct case, this is called a sporangium.

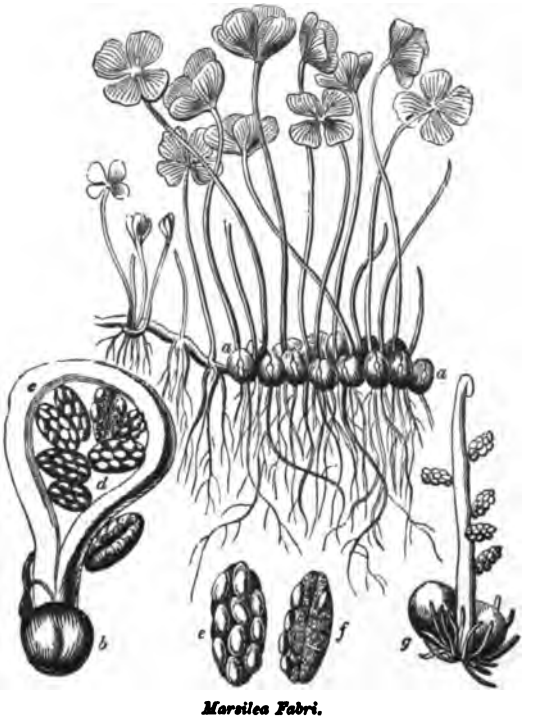
Among the *Fungi* the spores are frequently disseminated throughout the cellular tissue of the plant, so that they have no particular organ to contain them. Some of the *Fungi* however consist of a hollow case containing spores, as the Lycoperdons and Sphærias, and the case consisting of the whole plant is called by many writers the sporangium.

SPORENDO'NEMA, a genus of Plants belonging to the natural order *Fungi*, and the tribe *Mucedines*. It is exceedingly simple in its organisation, consisting merely of sporidia disposed in rows within the tubular pellucid flocci. There are two species of this form of mould; the one, *S. Caseï* (Red Cheese-Mould), is found on cheese, presenting little red tufts, which, under the microscope, exhibit the flocci somewhat branched and woven together. The other species, *S. muscæ*, is called Fly-Mould, and is found on the bodies of flies in the autumn of the year. It consists of flocci glued together, forming little white-lobed tufts, which make their appearance between the plates of the abdomen of the insect. This is one of the few instances of plants being parasitic on animals. This however has been denied, and some writers assert that the fly-mould is nothing more than a diseased secretion from the body of the fly. But Fries, Berkeley, and other cryptogamists, have recognised this mould as a plant.

SPORES. [SPORULES.]

SPOROCARPIUM (from σπορά, a seed, and καρπος, fruit), a term proposed by Link, and very generally adopted by German cryptogamic botanists, to express a combination of sporangia when placed near together, and more especially when any number of sporangia are inclosed in a common membrane.

Sporocarpium in this sense has been applied by Endlicher to the organ containing the reproductive organs in the order *Marsileaceæ*. To this part the name Involucre has been given by many writers. The sporocarpium of *Marsilea* when cut into exhibits several cells, which contain little granular bodies. In the course of time these granular bodies are projected from the sporocarpium, which splits into two valves, being arranged around a mucilaginous cord, which when it first appears is curved round, as seen at *c* in the accompanying drawing of *Marsilea Fabri*. This mucilaginous cord eventually becomes



Marsilea Fabri.

a a, Sporocarpia or Involucre seated in the axils of the leaves; *b*, sporocarpium bursting; *c*, a mucilaginous curved cord, to which the sporangia are attached; *d*, the sporangia; *e*, the same removed from the cord, exhibiting the ovules; *f*, reverse side, showing the anthers; *g*, the mucilaginous cord straightened, and the sporangia seated on it.

straight (*g*), bearing upon it the granular bodies arranged in a spiral whose expression is ⅗. The granular bodies, or sporangia, consist of two parts: first, the upper surface, which presents a number of small globular bodies, *e*, called ovules, and are surrounded by a little projecting hood surmounted by a papilla; and, second, the under surface, which presents a number of little membranous sacs, which are filled with grains resembling pollen, and hence have been called anthers.

SPOROCHNUS. [ALGÆ.]

SPORULES, or SPORES, the minute organs in Cryptogamic or Flowerless Plants from which new plants are produced, answering to the seeds in the Phanerogamic or Flowering Plants. Although these organs perform the same office in the economy of the plant as seeds, yet they differ essentially in the relation they bear to the new plant. Although in some instances they stand in the same relation to the young plant as seeds, yet they not uncommonly are found to be the homologues of buds. They generally differ from seeds in their origin, structure, and germination.

The situation of the sporules is exceedingly various. In the *Fungi* and *Algæ* they are frequently diffused throughout the substance of the plant without any proper covering or receptacle. In the higher forms, as the Mosses, Ferns, Jungermannias, &c., they are contained in a special organ called the Sporangium. [REPRODUCTION IN PLANTS AND ANIMALS; SPORANGIUM.]

SPRAT. [CLUPEIDÆ.]

SPRENGELIA. [EPACRIDACEÆ.]

SPRING-BUCK. [ANTILOPEÆ.]

SPRINGS. [WATER, CYC.; SPRINGS, SUP.]

SPRINGS, MINERAL. [WATER.]

SPRUCE-FIR. [ABIES.]

SPUR-WING, a name for *Parra Africanæ*. [RALLIDÆ.]

SPURGE-LAUREL. [DAPHNE.]

SQUA'LIDÆ, a family of Fishes of the section *Chondropterygii* In this family, which includes the various species of Sharks, the branchiæ are attached by their outer margin to the skin, and the water taken in for respiration makes its escape through narrow outlets corresponding in number to that of the interspaces between the branchiæ: the number of these openings is usually five. So far the present fishes agree with the Ray or Skate family [RAIIDÆ]; but the peculiar rhomboidal form of the body renders it easy to distinguish the Rays, which moreover have a peculiar cartilage arising from the nasal part of the skull, and extending towards and even meeting the anterior part of the crest of the pectoral. This character is pointed out by Müller and Henle, who state that it is found in all the Ray tribe, and also in *Rhinobatis* and *Pristis*, whereas there is no trace of it in any Shark.

In the Sharks the body is elongated, and tapering gradually from the head to the tail, or but little dilated in the middle. The muzzle is rounded or pointed, depressed, and projects over the mouth; the nostrils are situated on the under side of the muzzle, in the form of oblique openings, which vary somewhat in figure, according to the species. The fins generally consist of two dorsals, two large pectorals, two ventrals, an anal fin, and a caudal, the form of which is peculiar.

The portion of the tail of the Shark which supports the tail-fin is almost always bent upwards at an obtuse angle with the body; the fin itself may be divided into three parts—a superior, an apical, and an inferior portion; that which runs along the upper surface is usually narrow; that on the under surface is broader, but decreases in width to its point of junction with the apical portion, which is more or less dilated at the extremity and obliquely truncated. Such is the most common character of the tail and tail-fin in the present fishes, and one which is not found in any recent fishes not belonging to the Chondropterygian group.

The Male Sharks are smaller, and differ externally from the Females in possessing two elongated appendages, one of which is attached to the hinder edge of each of the ventral fins, the uses of which are not known. Some species of sharks bring forth their young alive, whilst others are inclosed in oblong semitransparent horny cases, at each extremity of which are two long tendrils. These cases are frequently found on the sea-shore, and are called Sea-Purses, Mermaids' Purses, &c. They are deposited, observes Mr. Yarrell, by the parent shark near the shore in the winter months. The convoluted tendrils, hanging to sea-weed or other fixed bodies, prevent the cases being washed away into deep water. Two elongated fissures, one at each end, allow the admission of sea-water; and the young fish ultimately escapes by an opening at the end, near which the head is situated. For a short time the young shark continues to be nourished by the vitelline fluid contained in the capsule attached to its body by the connecting pedicle, till having acquired the power of taking food by the mouth, the remains of the ovum are taken up within the abdomen, as in birds and some other animals.

"A curious peculiarity has been observed in the young both of the Sharks and Skates during a very early stage of their existence. From each of the branchial apertures branchial filaments project externally; each filament contains a single minute reflected vessel, in which the blood is thus submitted to the action of the surrounding medium. The appendages are only temporary, and the blood of the fish is afterwards aërated by the true gills. This very interesting discovery, which, I believe, is of recent date, forcibly reminding us of the temporal external branchiæ in the young Batrachian Reptiles in the tadpole state, has been observed by Mr. Richard Owen in the Blue Shark (*Carcharias glaucus*); by Mr. John Davy, in the Torpedo; and by Dr. Allen Thompson, of Edinburgh, in the Thornback. Cuvier had previously noticed it, and, in the 'Règne Animal,' has referred to a figure, published by Schneider, of a very young shark in this condition, for which, regarding it as the normal state of the fish, that industrious pupil of Bloch had proposed the name of *Squalus ciliaris*." (Yarrell.)

The teeth of the Sharks are arranged in several series, one within the other, of which the outermost row is that in use; the other rows are decumbent, and serve to replace the foremost when injured. Their form varies much in the different species, and even those of the upper and lower jaw are often very dissimilar. Though very variable however, they most commonly exhibit modifications of a triangular form, are sharply pointed, and have the lateral edges sharp and frequently serrated. It is upon the modifications observable in the form of the teeth, the form of the snout, mouth, and lips, and of the caudal fin; the existence or absence of the eyelid (membrana nictitans), spiracles, and of the small depression on the root of the tail; the situation of the branchial openings, and of the dorsal fins, &c., that the various divisions of the present family are formed.

The *Squalidæ* and *Raiidæ* have long occupied the attention of Professor Müller and Dr. Henle, who have conjointly published an excellent work on these groups, 'Systematische Beschreibung der Plagiostomen.' The characters of the various genera into which they divide the Sharks are here given. At the head of the Sharks these authors place the *Scyllia*, a group in which the species have the teeth small and pointed, and with one, two, or more lateral denticles; an anal and two dorsal fins; the first dorsal placed behind or opposite, but never before the abdominal fins; the spiracles are distinct in all, and tolerably large in most of them; the eyelid (membrana nictitans) is wanting. To this section belong, as it would appear, all the oviparous sharks.

Scyllium, Cuv.—This genus is restricted to such species as have the anal fin placed nearer to the head than the second dorsal fin. Eleven species are known, of which three are found on the British coast: the Small Spotted Dog-Fish (*S. canicula*), the Large Spotted Dog-Fish (*S. catulus*), and the Black-Mouthed Dog-Fish (*S. melanostomum*). (Yarrell.)

Pristiurus, Bonap., differs from *Scyllium* in having a long snout, and also in possessing a series of larger scales, arranged like the teeth of a saw on the upper edge of the tail. It contains but one species.

Chiloscyllium.—In this genus the anal fin is placed farther back than the second dorsal, and the last branchial opening approximating to the fourth. The under lip is broad and membranaceous, and separated from the skin of the throat by a kind of furrow; the upper nasal valve bears a cirrhus. Four species are known.

Hemiscyllium, Müller and Henle.—Here the situation of the fins is the same as in *Chiloscyllium*; the nose and mouth as in *Scyllium*. One species.

Crossorhinus, Müller and Henle.—Remarkable for a great number of small membranaceous lobules situated between the nostrils and the first branchial opening. The mouth is nearly at the extremity of the muzzle; the two dorsal fins are placed towards the posterior end of the animal, the first of them being situated above, and a little behind the abdominal fins. This genus is founded on the *Squalus lobatus* of Bloch, the only known species.

Ginglymostoma, Müller and Henle.—It has small spiracles; the two last branchial openings approximating to each other; the first dorsal fin above the abdominal fins, and the second dorsal opposite the anal. In adult specimens the inferior part of the fold bordering the corners of the mouth is distinctly separated from the skin of the lower jaw by a vertical furrow. The number of lateral denticles to the teeth is four on each side. One species.

Stegostoma, Müller and Henle.—In this genus the first dorsal fin begins a little before the abdominal ones. The branchial openings are as in *Chiloscyllium*. A large and thick wreath or rim conceals the upper jaw, and the opening of the mouth, which is placed transversely: the nasal valves are reduced to lateral edges of this wreath. The teeth are in the form of trifid leaves. Type and only species of the genus, *Squalus fasciatus*, Bloch, Schn.

The second division of Sharks contains species having, like the *Scyllia*, an anal and two dorsal fins, and five branchial openings; but the first dorsal fin is always placed between the pectoral and abdominal fins.

A large group is distinguished by the possession of a membrana nictitans, by the situation of the second dorsal fin, which is opposite the anal one, and by the situation of the branchial openings, the last or last two of which are always placed above the base of the pectoral fins. They are divided as follows:—

A. Without Spiracles.

a. Teeth flat, sharp, the edges serrated or smooth.

1. *Carcharias*, Cuv.—Teeth flat, sharp, and serrated on each side, either in the upper jaw only, or in both jaws. Spiracles are never met with in the adult specimens, though the rudiments of these organs may be observed in the fœtus of a few species. Twenty species of this genus are known, three of which are British: *C. glaucus*,

the Blue Shark, *C. vulgaris*, the White Shark, and *C. vulpes*, the Fox-Shark, Thresher, Sea-Fox, or Sea-Ape.

2. *Scoliodon*, Müller and Henle, differs only in having the teeth of both jaws alike: the points of these teeth are directed towards the corners of the mouth; their edge is smooth, and they have a truncated protuberance, which is either smooth or indented on the exterior side of the base. Five species.

3. *Zygæna*, Cuv.—The species of this genus are remarkable for having the sides of the head greatly produced in a horizontal direction, from which circumstance they have received the names of Hammer-Headed Sharks. The teeth are as in *Scoliodon*, but in adult specimens they are distinctly serrated. Three species are known. *Z. malleus*, the Hammer-Headed Shark, is taken on the coasts of Britain.

These three genera have the valve of the intestine longitudinal and rolled, an incision near the extremity of the elongated upper lobe of the caudal fin, and a small dimple at the root of the fin.

b. Teeth pointed, and with lateral Denticles, as in *Scyllium*.

1. *Triænodon*, Müller and Henle.—Teeth with a denticle on each side, which on the exterior side of most of those of the lower jaw is double. Caudal fin, as in *Carcharias*, with a dimple at the root. One species.

2. *Leptocharias*, Andrew Smith.—Teeth numerous, one or two lateral denticulations on each side. The dimple near the caudal fin wanting, and the inferior lobe of the fin scarcely indicated. The nasal valve elongated into a cirrhus. One species.

B. Possessing Spiracles.

a. Teeth flat, sharp, serrated or not serrated.

1. *Galeocerdo*, Müller and Henle.—Teeth strongly serrated on the exterior edge, finely on the interior. Spiracles small. A dimple on the root of the tail: the upper lobe of the caudal fin elongated, with two incisions. Valve of the intestines short, as in *Carcharias*. Two species.

2. *Loxodon*, Müller and Henle.—Teeth without serrature, as in *Scoliodon*. Spiracles very small. Valve of intestine, dimple of the tail, and caudal fin, as in the preceding genus; but the upper lobe of that fin with only one incision. One species.

3. *Galeus*, Cuv.—Teeth in both jaws serrated on the exterior edge, inclined outwardly. Tail as in *Carcharias*, but wanting the dimple. Valve of intestine spiral. One species is known, *G. vulgaris*, the Common Tope, and this frequents the British seas.

b. Teeth pointed as in *Scyllium*.

Triakis, Müller and Henle.—Teeth as in *Triænodon*. Dimple of the tail wanting: the inferior lobe of the caudal fin not distinct. One species.

c. Teeth pavement-like, or presenting a general continuity of surface, as in the Skates.

Mustelus, Cuv.—Spiracles large. Inferior lobe of the caudal fin very short. Membrana nictitans rudimental. Valve of intestine spiral. One species is known, *M. lævis*, the Smooth-Hound, and is recorded as British.

The remaining genera have no trace of the membrana nictitans, and belong to the second section *Lamnoidea*, which have the branchial openings large, all situated before the pectoral fins. Spiracles small. Caudal fin in the form of a crescent, with a lateral keel and a distinct dimple, and the small anal and second dorsal fins opposite each other.

1. *Lamna*, Cuv.—Head pointed, conic; spiracles extremely small; teeth long, pointed, with two lateral denticles, indistinct or wanting in young individuals. The third tooth of the upper jaw, sometimes also the fourth or fifth, smaller than the rest. There are two species, one, *L. cornubica*, the Porbeagle, or Beauman's Shark, occurs on the British coasts.

2. *Oxyrrhina*, Agassiz.—Teeth long and thick, like nails, without lateral denticles, the anterior ones introverted; the third tooth of the upper jaw small and short. Two species.

3. *Carcharodon*, Andr. Smith.—Teeth as in *Carcharias*, serrated on both edges; the third tooth of the upper jaw smaller. One species.

4. *Selachus*, Cuv.—Teeth very small, narrow, conic, and numerous; snout short. One species, the *S. maximus* of Le Pelerin, the Basking Shark of Yarrell's 'British Fishes.' It is found in British seas.

5. *Rineodon*, Andr. Smith.—Teeth exceedingly small, pointed; mouth at the apex of the snout.

The following three genera differ as much from each other as from the preceding group, and, in the opinion of Messrs. Müller and Henle, should in a system be regarded as the types of families.

Triglochis, Müller and Henle.—Branchial openings large, spiracles small, as in *Lamna*. The first dorsal fin stands before the abdominal fins: the second dorsal between the abdominal and anal fins, and they are all tolerably large; teeth long, pointed, with one lateral denticle, or two on each side. This is probably the genus *Odontaspis* of Agassiz.

Alopecias.—Head, dorsal and anal fins, and spiracles, as in *Lamna*; but the branchial openings small, and the last above the pectoral fins; the upper lobe of the caudal fin extremely elongated; a dimple on the tail, but no lateral keel; teeth sharp, triangular, without serrature or protuberance; intestinal canal spiral. One species.

Cestracion.—Branchial openings as in *Alopecias*; second dorsal fin between the anal and abdominal ones, like *Triglochis*; spiracles small; teeth arranged in pavement; the anterior rows small and pointed; a bony spine before each dorsal fin. One species.

The third division of Sharks comprises those species which, like the preceding divisions, have an anal fin, but they have only one dorsal. It contains two genera, which are distinguishable by the number of branchial openings. They are the *Hexanchus* and *Heptanchus* of Rafinesque. In the former genus there are six branchial openings, and in the latter seven.

In the fourth division there is no anal fin; the membrana nictitans is wanting, but the spiracles are present. It is divided into two groups, according to the presence or absence of certain bony spines. The first is called *Acanthorhinus* by De Blainville, and contains species which are provided with a bony spine in front of each dorsal fin. It is divided into four genera.

1. *Acanthias*, Bonap.—Teeth alike in both jaws, with a transverse edge, the point directed outwardly. Four species, one occurs on the British coasts, *A. vulgaris*, the Picked Dog-Fish, Bone-Dog, or Hoe.

2. *Spinax*, Bonap.—Teeth in the lower jaw as in the preceding genus; teeth of the upper jaw with an elongated point in the middle and two shorter points on each side.

3. *Centrina*, Cuv.—Teeth of the lower jaw nearly straight, leaf-like, with a serrated edge, and a flat triangular point; those of the upper jaw also straight, but more narrow, conic, pointed, and forming a cluster in the central portion of the maxilla. One species.

4. *Centrophorus*, Müller and Henle.—The lower teeth with a transverse edge indistinctly serrated, the point of each being directed towards the corner of the mouth: the point of the upper teeth is directed downwards; they are equilateral, and without any serrature. One species.

The group without spines to the dorsal fins (*Scymnus*, Cuv.) comprises three genera:—

1. *Scymnus*, Müller and Henle.—Teeth in the upper jaw straight and narrow; in the lower jaw crooked, pyramidal, and equilateral. The first dorsal fin before, and the second behind, the abdominal fins. Two species, one of which, the Greenland Shark (*Scymnus borealis*), is occasionally found on the British coasts.

2. *Læmargus*, Müller and Henle.—Fins situated as in the preceding genus. Lower teeth with a transverse edge, as in *Acanthias*; upper teeth narrow, conic, straight, or curved outwardly. Three species.

3. *Echinorhinus*, Blainv. (*Goniodus*, Agassiz).—First dorsal fin opposite the abdominal fins. Teeth in both jaws broad and low, the edge nearly horizontal. The lateral edges with one or two transverse denticles. One species is British—*E. spinosus*, the Spinous Shark.

The fifth and last division contains but one genus (*Squatina*), of which there are two species. They have no anal fin; the mouth is protractile, and at the apex of the muzzle. The eyes are placed on the dorsal surface of the head, and not at the sides as in other sharks. The muzzle is obtuse, the body is broad and depressed, and the pectoral fins are very large. Both the dorsal fins are situated behind the ventrals. To this genus belongs the Angel-Fish of British authors, the *Squatina angelus* of Dumeril, Cuvier, &c. It is very frequent on the southern coasts of Britain.

(Yarrell, *British Fishes*.)

SQUALORA'IA, a genus of Fossil Fishes. [FISH.]

SQUAMA, in Botany, a Scale, is a term applied to parts which, strictly speaking, are not bracts or leaves, and are arranged upon a plant in the same manner as the scales of fishes and other animals. Almost all the organs that are thus designated are parts of the plant which stand in the position of leaves, but are not developed sufficiently when seated on the stem to become bracts or true leaves, or, when forming parts of the flower or fruit, to become sepals, petals, stamens, &c.

SQUATAROLA. [CHARADRIADÆ.]

SQUATINA. [SQUALIDÆ.]

SQUID. [CEPHALOPODA.]

SQUILL, SQUILLA. [SCILLA.]

SQUILLA. [STOMAPODA.]

SQUILLERICHTHUS. [ERICHTHUS.]

SQUIRRELS. [SCIURIDÆ.]

STA'AVIA, a genus of Plants belonging to the natural order *Bruniaceæ*, which was so named by Thunberg after Staaf, one of the botanical correspondents of Linnæus. The genus consists of several small shrubs, which are indigenous at the Cape of Good Hope, and are remarkable for their flowers being arranged in heads resembling those of some of the *Compositæ*. Calyx with the lower part of its tube attached to the ovary; petals 5, stamens 5, inserted into the calyx; capsule crowned by the calyx, dicscious, cocci bivalved at the apex, and 1-seeded. A few specimens are cultivated in our greenhouses, and may be propagated from cuttings in sand covered with a bell-glass.

STACHYS (from *σταχύς*, a spike), the name of a genus of Plants belonging to the natural order *Lamiaceæ*, or *Labiatæ*. It has a 5-toothed, 10-ribbed, nearly equal, acuminate, subcampanulate calyx; a corolla with the tube as long as the calyx, or longer; upper lip erect, or spreading, a little arched; lower lip usually longer, spreading, and 3-lobed; the middle segment large, entire, or emarginate; 4 stamens; bifid style with stigmas at each apex; fruit an achenium. The species

are very numerous, above 100 being enumerated. They are herbs or under-shrubs, with their flowers arranged in whorls. The majority of them are European plants.

S. betonica, Common Betony. Stems erect, rather pilose; lower leaves on long petioles, and crenated; upper leaves sessile, toothed; uppermost ones linear, quite entire; whorls many-flowered; bracts ovate; corolla twice as long as the calyx. This species is the *Betonica officinalis* of Linnæus. It is now a species of the genus *Stachys*, but it was formerly a species of the genus *Betonica;* but the characters which constituted the difference between the latter and the former having been considered too trifling to constitute separate genera, the genus *Betonica* has been abolished by later botanists. The Common Betony is a native of Europe and some parts of Asia, inhabiting woods, heaths, and pastures. It is very plentiful in Great Britain. It was formerly much used in medicine, and is now a popular remedy for some complaints. When taken fresh it is said to possess intoxicating properties. The leaves have a rough bitter taste, and are slightly aromatic. The roots are nauseous and very bitter, and when taken act as purgatives and emetics.

S. lanata, Woolly Woundwort. Whole plant clothed with dense silky wool; leaves oblong, narrowed at both ends; floral leaves small, the upper ones of which are shorter than the whorls; whorls many-flowered; bracts linear-lanceolate, the same length as the calyx; calyx incurved, toothed; corolla woolly. This plant is a native of Europe, in the neighbourhood of the Mediterranean. Dr. Sibthorp found it in Laconia, where it is called Στραχύς by the modern Greeks. This plant is remarkable for its woolly covering, as well as the *S. Germanica* (German Woundwort), on which account they have been introduced into our gardens. Many other species are covered with hairs so as to give them a powdery-looking woolly character, as the *S. alpina*, *S. Italica*, &c.

S. coccinea, Scarlet Hedge-Nettle. Stem erect, clothed with soft villi; herbaceous ovato-lanceolate petiolate leaves; flowers 6 in a whorl; corolla pubescent, three times as long as the tube. This is the most beautiful species of the genus, having large dark scarlet flowers an inch in length. It is a native of Chili and Peru. It must be cultivated as a greenhouse plant, and is readily increased by cuttings or parting its roots.

S. palustris, Marsh Woundwort, or Clown's All-Heal. Stems erect, pubescent, herbaceous; leaves subsessile, oblong, crenated, wrinkled, hispid; whorls with 6 or more flowers; calyx with lanceolate acute teeth; corolla twice as long as the calyx. It has pale purple flowers, with a variegated lower lip of the corolla. This plant is a native of Europe, Asia, and North America. It is abundant in watery places, by road-sides, in meadows, and corn-fields in Great Britain. It is called Clown's All-Heal by Gerard. The young shoots and the roots also, when cooked, form an excellent esculent. On the farm it is a weed that should be well looked after, as it exhausts the soil and increases very rapidly.

S. sylvatica, the Hedge Woundwort, is another common British species, differing from the last in having stalked leaves which are cordato-ovate shaped. It inhabits woods, hedges, and shady places. This herb is very pungent, and has an unpleasant fetid smell.

S. Corsica, Corsican Woundwort. Procumbent, pilose; leaves with petioles; flowers in 2-4-flowered whorls; corolla twice as long as the calyx, lower lip large. This is a pretty little plant worthy of cultivation. It has downy, rosy-white, or pink flowers, which are large for the size of the plant. It is a native of corn-fields in Corsica and Sardinia.

S. lavandulæfolia, Lavender-Leaved Woundwort. Leaves of the stem oblong, lanceolate with petioles, floral leaves sessile; whorls 2-6-flowered; teeth of calyx longer than corolla. It is a native of the Caucasus, in dry stony places. It is shrubby in its habit, and is well adapted for rock-work.

STACHYTARPHA (from στάχυς, a spike, and ταρφύς, dense), the name of a genus of Plants belonging to the natural order *Verbenaceæ*. It is known by its tubular 4-toothed calyx; hypocrateriform unequal 5-cleft corolla with a curved tube; 4 stamens, 2 of which are fertile. The species are natives of South America and the West India Islands. Many of them have been described as Vervains, but they are distinct from that genus. They are herbaceous or shrubby, and many of them are handsome plants.

S. Jamaicensis, Jamaica Bastard-Vervain, is an under shrub, with scattered hairy branches; leaves nearly two inches long, oblong-ovate, coarsely and sharply serrated, quite entire at the base, with the midrib beset with hairs; the spike is dense, bearing flowers of a lilac colour, and having ovate bracts which are shorter than the calyx. This plant is a native of the West India Islands, and has there a reputation something like that which distinguished our common Vervain.

STACKHOUSIA. [STACKHOUSIACEÆ.]

STACKHOU'SIACEÆ, *Stackhousiads*, a small order of Plants belonging to the Syncarpous group of Polypetalous Exogens. They are herbaceous plants, with simple, entire, alternate, sometimes minute leaves, with lateral very minute stipules. The flowers are arranged in spikes, each flower having 3 bracts. The calyx is 1-leaved, 5-cleft, equal, tube inflated; petals 5, arising from the top of the tube of the calyx, the claws forming a tube which is longer than the calyx; stamens 5, arising from the throat of the calyx; ovary superior 3-5-lobed; fruit dry, with albuminous seeds and erect embryo. This order was constituted by Brown, and its nearest relations are with *Celastraceæ* and *Euphorbiaceæ*. From the first it differs in the possession of stipules, the cohesion of the petals, and the deep-lobed ovary; from the last, in the structure of the fruit, and in the position of the seeds. All the species are natives of Australia. The only genus of the order at present is *Stackhousia*, which was named in honour of John Stackhouse.

Stackhousia monogyna.

1, Spike with flowers; 2, cutting, with leaves; 3, calyx, corolla, and bracts; 4, petals, showing their union to form a tube; 5, stamens arising from calyx; 6, ovary and styles.

STAG. [CERVIDÆ.]

STAG-BEETLES. [LUCANIDÆ.]

STA'GMARIA, a genus of Plants belonging to the natural order *Terebinthaceæ*. It was named by Mr. W. Jack, assistant-surgeon in the East India Company's service, and author of 'Malayan Miscellanies,' from the Greek word στάγμα, 'a dropping fluid.' The tree *S. verniciflua*, which is the *Arbor vernicis* of Rumphius, and the Kayo Rangas of the Malays, is full of acrid resinous juice, and is a native of the Eastern Islands, but not very abundant in Sumatra, though occasionally found in the neighbourhood of rivers.

The calyx is tubular, with the limb irregularly ruptured, deciduous. Petals 5, longer than the calyx, obtuse, spreading, subreflexed. Stamens 5, alternating with, but inserted above, the petals into the stipe-like torus. Filaments filiform, equal to the petals in length. Anthers oblong. Ovary stipitate, 3-lobed, lobes 1-seeded, 1-2 of which are usually abortive. Styles 1-3, terminating the lobes of the ovary. Stigmas obtuse. Berry kidney-shaped, furrowed, 1-seeded, with a warty rind. Embryo exalbuminous, erect; cotyledons united; radicle incurved. The genus is nearly allied to *Rhus*, but besides the difference indicated in the above character, it has simple leaves, which are without stipules.

The wood of the tree is of a fine dark colour towards the centre. The bark exudes a resin which is extremely acrid, causing excoriation and blisters when applied to the skin; in this, as well as in becoming black when exposed to the air, it resembles the *Melanorrhœa*, Cashew-Nut Tree, Poison-Oak, and many others of the *Terebinthaceæ*. According to Rumphius, this tree yields the celebrated Japan lacquer, or varnish, and he considers it the same with that of Siam and Tonquin. Loureiro however represents the latter to be the produce of an *Augeia*. Mr. Jack says the varnish of Siam and Cochin-China is probably the best, but that of Celebes and of Java, which is the produce of this tree, is also employed for the same purposes, and cannot be much inferior, as it bears an equally high price. Rumphius says the exhalations of this tree are considered noxious, and the people of Macassar, and of other parts of Celebes in particular, entertain such dread of it, that they dare not remain long under it, much less repose under its shade. As however it furnishes the celebrated varnish, the Chinese and Tonkinese boldly repair to the tree, but employ caution in collecting the resin. This they do by inserting into the trunks two pieces of bamboo, sharpened at their points, in such a manner as to penetrate the bark in a somewhat oblique direction. These remain all night, and are extracted before sunrise the next morning, the trees yielding no juice during the day. This fluid resin bears a high price, being sold in Tonkin and Camboja for 30, 50,

or 60 dollars, the pecul of about 133 lbs., but in many of the provinces of China for 200 or 300 dollars.

The varnish is prepared for use by boiling it with an equal weight of the oil of Tang-yhu, which is a Chinese tree allied to the *Mimusops Elengi*, from whose fruit an oil is prepared. The proportions are varied according to the purposes for which the varnish is required. Sometimes dry pigments are added for the sake of red or other colours. The Japanese are the most skilful in preparing and ornamenting all kinds of work with this varnish, and their black lacquered works are conveyed to all parts of the world.

(Jack, *Malayan Miscellany*, No. 3, reprinted by Sir W. Hooker.)

STALACTITE and STALAGMITE. Stalactitic Carbonate of Lime occurs chiefly in long masses suspended from the roofs of caverns in limestone rocks. Stalactites appear to be continually forming; water containing carbonate of lime held in solution by carbonic acid, trickling through crevices in the roofs of the caverns, gradually during its exposure to the air loses its carbonic acid, and consequently deposits its carbonate of lime; the water passing over the portion first deposited gradually adds to it, and eventually gives the carbonate of lime its great length and stalactitic character. The flatter deposits, called stalagmites, are formed on the floor of the cavern by the water there depositing that portion of its carbonate of lime which is not separated during the formation of the stalactite. Stalactitic Carbonate of Lime is met with in the veins of lead-ore in Durham and Northumberland. Caverns are sometimes nearly filled with these deposits, which in some cases are of very large dimensions. The most remarkable instances of their occurrence in Britain are in the cavern at Castleton in Derbyshire, and Macallaster Cave in the Isle of Skye. The grotto of Antiparos in the Archipelago, the Woodman's Cave in the Harz in Germany, and that of Auxelle in France, are striking instances of their formation in other countries.

Besides the occurrence of this variety of carbonate of lime in the stalactitic form, it is sometimes met with reniform and tabular, and in other imitative shapes. The fracture is sometimes perfectly lamellar, occasionally fibrous, the fibres diverging from a centre, with a pearly or silky lustre, and sometimes resinous or waxy. The colour varies from white to grayish, brown, red, and yellowish-white. Opaque, but frequently translucent.

The Oriental Alabaster, much employed by the ancients in statuary and the formation of vases, appears to be of stalactitic origin.

STALAGMITES (from σταλαγμός, a dropping), the name of a genus of Plants belonging to the natural order *Clusiaceæ*, or *Guttiferæ*. It has polygamous or bisexual flowers; 4-5 sepals, which are persistent and bractless; 5 petals alternating with the sepals; 4-5 united stamens, the bundles flat, elongated, and divided at the apex into several short antheriferous portions opposite to the petals, and alternating with 5 large truncated glands; the anthers are 2-celled, bursting longitudinally; the ovary is 3-5-celled, with 1 ovule in each cell; stigma 3-5-lobed; the fruit a berry. The species are trees natives of the East Indies and Ceylon, and belong to the family which produces the gamboge of commerce. Dr. Wight states that one of the species, the *S. ovifolia*, which is a native of Ceylon, yields a true gamboge, which is employed in commerce. It is known by its oval shining leaves, its lateral fascicled flowers, male and hermaphrodite mixed. Its anthers are arranged in 6 or 8 bundles, and it possesses a 3-celled 1-3-seeded ovary.

STAMENS, in Botany, the organs which constitute the last whorl but one of the series which form the flower in plants, the pistil with its parts forming the last or innermost whorl. These organs were called by the older botanists Apices, and by English writers Chives. They constitute the male organs of the flower, and are formed principally of cellular tissue. They are composed in most cases of three parts: 1, the Filament, a long slender organ, on the summit of which is placed—2, the Anther, which is a little case, mostly double, containing—3, the Pollen, which is composed of little grains constituting the fructifying influence of the plant.

The Stamen, in theoretical Botany, is considered, as well as the other parts of the flower, a modification of the leaf. Although its form, structure, and functions differ so much from the leaf, it is not difficult to point out the series of modifications by which the one is converted into the other. In many plants the leaves cannot be distinguished near the flowers from the bracts, and these again cannot be distinguished from the sepals forming the calyx; whilst the calyx often insensibly passes into the corolla, and parts of flowers are often seen possessing both the characters of sepals and petals. In the case of the White Water-Lily, a good example is offered of the passage of petals into stamens, thus completing the series of changes from leaves to stamens. In this plant a gradual contraction of the inner petals is seen to take place at their upper parts, the cellular tissue becomes coloured, and partakes of the character of pollen-grains, and these changes become more and more decided till the whorl of stamens is fully established in the centre of the plant. Many other plants might be cited as affording examples of the same changes, as *Calycanthus*, *Illicium*, &c. These changes occur naturally in the above plants, but a more decided exemplification of the conversion of these organs will be found in what are called monstrous or double flowers, which are the result of cultivation. If, for instance, a garden rose is taken, it will be found that the natural position of the stamens in this flower is occupied by petals, and in many the character of half-stamen and half petal may be clearly seen. In other double flowers the same backward change may be observed of petals into sepals, and so on.

In the change that has thus taken place of the leaf into the stamen, the filament of the latter represents the midrib of the former, whilst the anther and its pollen are modifications of the lamina and cellular tissue of the leaf. It is well known that the cellular tissue of the upper and under surface of the leaf differs very considerably, and it is to these parts that the anterior and posterior cells of the anther are analogous. On this point Schleiden has proposed the questions as to whether there is any corresponding difference in the character of the pollen in the anterior and posterior cells; whether they possess the power of fructifying; and whether in dicecious plants it might not be ascertained that the one produced pollen grains that would engender male embryoes, and the other grains that would produce female embryoes.

In their normal position in the flower the first row of stamens are always alternate with the petals; and as these organs are alternate with the sepals, the stamens are opposite the latter. If there is a second row of stamens, they will be alternate with the first, and thus of course opposite the petals. It however frequently happens, as in the primrose, that there is only one row of stamens, and yet opposite the petals. In such cases the anomaly is accounted for by supposing that the first row has not been developed, and consequently the second stand in their original position, that is, alternate with the aborted row. When there are only five petals and ten stamens, as in *Silene*, the latter are supposed to form a double row.

The stamens are said to arise from various parts of the flower, and according to the part of the flower from which they arise terms have been applied to express this origin, which are of great importance in systematic botany. When the stamens arise from (or, as it is often expressed, are inserted into) the calyx or corolla, they are said to be Perigynous; when they arise from under the pistil or ovary, Hypogynous; when from the pistil itself, Epigynous. The classes and subclasses of the natural system of Jussieu are subdivided according to the existence of these distinctions in the families of plants. The above terms however must not be supposed to express the fact that the stamens do really originate in the parts from which they are said to arise or are inserted into. The fact is, the stamens always arise from a point in the axis of the flower between the petals and ovary; and when attached to these or other parts, it must only be looked upon as an adhesion of one organ to another. Thus when it is said that the stamens are inserted into the calyx of the flower of the apple, it is meant that they adhere to the calyx up to a certain point, from whence they appear to rise. The same must be said of their connection with other parts.

The Filament of the stamen is the representative of the petiole or midrib of the leaf, and in structure and function resembles that organ, and is not any more essential to the existence of the stamen than the petiole is to the leaf. It is composed of very delicate cellular and woody tissue, with which are intermixed a few bundles of spiral vessels. It is mostly filiform and cylindrical in shape, and in most instances without colour. In some plants, as the *Canna*, and in the whole of *Zingiberaceæ*, the filaments are hardly distinguishable from petals except in the possession of anthers at their apex.

The filaments are often combined into a single mass, the anthers being separate; when this is the case, they are said to form a brotherhood, and the term Adelphia is applied to them. When there is only one such combination, the stamens are said to be Monadelphous, as in *Geranium*; when there are two such unions, or even if only one stamen is separated from the rest, they are called Diadelphous, as in *Fumaria*, *Vicia*, *Lathyrus*, &c.; when there are more than two, as in *Hypericum* and *Melaleuca*, they are Polyadelphous. The filaments are sometimes of different lengths; when two are tall and two are short, as is seen in the whole of the natural family *Lamiaceæ*, they are called Didynamous; if four are long and two are short, as is seen in the family of *Cruciferæ*, they are Tetradynamous.

The number of stamens in flowers is expressed by a Greek numeral being prefixed to the word androus: thus flowers with one stamen are Monandrous; with two stamens, Diandrous; with three stamens, Triandrous, and so on.

It was on the number of stamens, and their arrangement and relations, that Linnæus founded the classes of his celebrated sexual or artificial system of the arrangement of plants. [SYSTEM, SEXUAL.]

For the function of the stamens, see REPRODUCTION IN PLANTS AND ANIMALS.

STAPE'LIA, the name of an extensive and curious genus of African Plants, given to it by Linnæus in honour of John Bodæus a Stapel. This genus belongs to the natural order *Asclepiadaceæ*, and possesses the following characters:—Corolla rotate, 5-cleft, fleshy, in the inside of which is a double nectary, consisting of two rows of leaves; the inner leaves, of which there are five, are subulate; the outer leaves are broader and undivided; the anthers are simple at top; the pollen masses are fixed by their base, having one of their edges cartilaginous and pellucid; follicles two, smooth; seeds numerous, comose. Most of the species of this genus are natives of the Cape of Good Hope. They are succulent plants without leaves, frequent covered over with dark tubercles, giving them a very grotesc

appearance. From uncertain points of their succulent stems large flowers expand themselves, exhibiting a variety of colours, and marked in the most grotesque manner. In most instances the flowers give off very unpleasant odours, which have been compared to carrion, rotten cheese, putrid water, and other unpleasant-smelling substances. These odours however have not prevented their being very generally cultivated on account of their singular and beautiful flowers. The genus is at present imperfectly understood, and many species that were originally referred to *Stapelia* are now placed under a variety of other genera, as *Podanthes*, *Tridentea*, *Orbea*, *Piaranthus*, *Huernia*, &c. The great diversity in the form, colour, size, and structure of the flowers of these plants, have afforded the means of distinguishing a large number of species, but the whole have a family likeness which is possessed by few genera. We shall therefore only give two or three examples.

S. hirsuta, Hairy Stapelia, or Carrion-Flower. Corolla with the segments villously ciliated with white hairs, and the base villous from red hairs, the segments ovate, acute, and transversely corrugated; segments of outer whorl of nectary acute, lanceolate, of the inner spreading. The stem is angular and erect, the flowers appearing at its base. The corolla is very large, of a dark chocolate-crimson colour, streaked with yellow; the marginal fringe resembles a gray fur; the nectaries are red. The whole flower is the size of a French rose. The smell of this plant is so like that of carrion, that flesh-flies deposit their ova in the flower, and when the maggots are produced they are starved for the want of food. Sir John Hill wrote an essay to prove that the fly which attacked these plants was a peculiar species, whose larvæ lived on the flower, which seems to have been an error of observation, but for which Fabricius, the entomologist, spoke of him as "damnandæ memoriæ Johannes Hill." This plant is a native of the Cape, and is one of the earliest species brought to Europe by the Dutch.

S. pulvinata, Cushion-Flowered Stapelia, has a procumbent stem, with quadrangular erect branches, at the base of which the flowers appear; the segments of the corolla are roundish, wrinkled transversely, ciliated; bottom of corolla elevated, covered with hairs. This is the most elegant of the species, and, notwithstanding its unpleasant odour, the Dutch natives of the Cape call it the Arabian Rose. The corolla is very large, and its segments are of a deep violet-colour, variegated with whitish transverse wrinkles, and red at the bottom.

S. Gordoni, Gordon's Stapelia. Stem with square branches and tubercles ending in a spine; corolla orbicular, slightly 5-cleft, segments broad, roundish, acuminated. It has erect long follicles which are solitary, and thus form an exception to the rest of the genus. The flowers are very large, almost three inches in diameter, of a brownish yellow-colour with a whitish centre; the segments of the nectary are black in the middle, and white on the edges.

STAPES. [Ear.]

STAPHYLEA (from *σταφυλή*, a bunch of grapes), the name of a genus of Plants, the type of the natural order *Staphyleaceæ*. It has a coloured 5-parted calyx, with an urceolate disc at the base; five upright petals; five stamens standing round the disc; an ovary with from two to three styles, with a small stigma; a membranaceous swelled capsule with two or three cells, and one or two seeds in each. This genus has six species, of which one is a native of Europe, one of North America, one of Japan, two of Jamaica, one of Peru, and one of the Himalayas.

S. pinnata, Common Bladder-Nut, is known by its pinnated leaves, petioles without glands, two styles, and bladdered capsules. It is a native of woods and thickets in the middle and south of Europe. It is admitted into the 'British Flora,' on the ground of its occurring occasionally in hedges and thickets in Yorkshire. It is frequently planted in shrubberies as an ornamental shrub, for which it is well adapted. It has a firm white wood, which adapts it well for various kinds of turning. The seeds are eatable, and act as a mild aperient: this arises probably from the oil they contain. The flower-buds, when gathered young, are pickled, and eaten as capers.

S. trifolia, Three-Leaved Bladder-Nut, is characterised by its ternate leaves, and its petals longer than the calyx. It is the species of North America, where it is found on dry hills in rocky situations from New York to North Carolina. It is also frequently cultivated as an ornamental shrub, and its wood and seeds may be used for the same purpose as the last.

S. Emodi is an Indian species: it was found by Dr. Royle in the Himalayas, at an elevation of 7000 feet. (Royle, 'Ill. Him. Bot.,' p. 166.)

STAPHYLEA'CEÆ, *Bladder-Nuts*, a small natural order of Plants belonging to the Syncarpous group of Polypetalous Exogens. They are shrubs with opposite pinnate leaves, having both common and partial petioles, and the flowers arranged in terminal stalked racemes. The calyx has five sepals, which are imbricated in æstivation; petals five; stamens five, alternate with the petals, perigynous; ovary 2- or 3-celled, seated on a disc; fruit membranous or fleshy, frequently deformed by the abortion of some of its parts; exalbuminous roundish ascending seeds, with a bony testa, large hilum, and thick cotyledons. There are only three genera and ten species belonging to this order, which are inhabitants of the warmer and temperate parts of the earth. Only one species, the *Staphylea pinnata*, is found in Europe. This order was separated by Lindley from the order *Celastraceæ*, with which it is most nearly allied, but from which it is distinguished by its opposite pinnated stipulate leaves. One of the genera, *Turpinia*, has unisexual flowers. The species do not possess active properties. The seeds of all contain a mild oil, which may be expressed. [Staphylea.]

Turpinia paniculata.

a, branch showing the opposite leaves (also the unisexual monœcious flowers of this genus); *b*, tricoccous fruit; *c*, female flower; *d*, transverse section of fruit; *e*, section of seed.

STAR OF BETHLEHEM. [Ornithogalum.]

STAR-APPLE. [Chrysophyllum.]

STAR-FISHES. [Asteriadæ; Asterias; Echinodermata.]

STAR-NOSE. [Condylura.]

STARCH is a substance which is found very generally present in the vegetable kingdom. It occurs in the forms of irregularly-shaped granules inclosed in the cells of plants. It is easily detected in the cells of plants under the microscope, by the addition of a small quantity of solution of iodine, which immediately gives to the starch-granules a blue colour. [Secretions of Plants.]

Starch can be readily separated from the tissues of plants, on a large scale, by bruising them, and stirring them in water; when left at rest the cellulose of the tissue falls to the bottom of the vessel, and the starch floats in the water. If the water containing the starch is now poured off, and allowed to stand a few hours, the starch will fall to the bottom of the vessel, and is easily collected. In this way it is obtained for commercial and dietetical purposes. Starch is thus found to be diffusible through water, but not soluble in it. It differs then from cellulose, on the one hand, by its diffusibility through water; and on the other, from dextrine, sugar, and gum, by its insolubility. In composition it resembles these substances, and during the growth of the plant it is evidently converted into one or the other [Dextrine] according to the necessities of the plant. It contains carbon, hydrogen, and oxygen (C_{12}, H_8, O_8,), and belongs to that series of substances to which the term Dextrine has been applied. In certain groups of plants, intermediate substances between those mentioned have been obtained. Thus, in the Lichens, a substance exists which resembles starch in many of its properties, but does not assume its definite granular form. This is called Lichenin. [Lichenin.] Another substance also closely approaching starch in its general characters is Inulin. This substance is not coloured blue by iodine, and has other distinctive properties. [Inula.] It is found in the various species of *Inula*, and has also been detected in other plants.

From these facts we may gather that Starch is the result of the chemical activity of the plant-cell at particular stages of its growth. It is one of those secretions to which the name assimilable is applied, and is evidently capable of undergoing great changes during the life of the plant. It is almost constantly present during the earlier stages of cell-growth, so much so as to lead to the supposition that its presence is universal during certain stages of the life of the plant-cell. In some plants and parts of plants however it rapidly disappears, being either converted into sugar or cellulose, or some of the numerous unassimilable secretions of plants. That the latter takes place very frequently is rendered probable by the discovery that caoutchouc and gutta percha can be artificially manufactured from starch, whilst it has long been well known that starch may be converted into sugar and gum.

Starch differs from sugar in its not being fermentable. It is however readily convertible into sugar by agents which induce fermentation. It has even been supposed that the protein of the plant-cell acts chemically in converting starch into sugar during germination, and the term Diastase has been applied to the proteinaceous matters found in connection with the starch of germinating seeds.

Starch occurs usually in the cells of plants in the form of granules. In the earlier stages of their growth these are attached to the sides of the cell, or to portions of the endoplastic protein wherever they may be placed. In most cases these granules are simple or single; but when they are developed near each other a union is formed of one or more, and the result is a compound granule. Schleiden also describes Amorphous Starch, and states that in some plants the sides of the cells are lined with a layer of starch having no definitely-formed granules. In the majority of starch-granules a little spot may be seen which is called the hilum, and has been by some regarded as a nucleus or central point of the formation of the granule. It does not however seem to bear this relation in all cases.

Much difference of opinion exists as to the true nature of the starch-granule. Some observers have supposed that it consists of a series of flattened plates or dishes laid one upon the other, the result of successive depositions of starch matter. This view will be seen to be erroneous if the starch-granule is submitted to heat, or sulphuric acid, when it will be found to unfold and exhibit itself in the form of a vesicle or bag. From this it appears that this bag is compressed in the ordinary state of the starch, and its sides being folded in, gives it the appearance of dishes.

At one time it was supposed that starch was characteristic of the vegetable kingdom. Virchow has however demonstrated its existence in connection with cellulose in a large number of animals. Bush first pointed it out in the human brain. It has been found also in the human blood; and with cellulose and sugar it can no longer be regarded as truly characteristic of the vegetable kingdom.

(Schleiden, *Principles of Scientific Botany; Quarterly Journal of Microscopical Science*, vols. i., ii., and iii.)

STARLING. [STURNIDÆ.]

STA'TICE (from the Greek στατική, intended to be used in the active sense, 'to stop,' so named from its supposed property of restraining hæmorrhages), a genus of Plants belonging to the natural order *Plumbaginaceæ*. It has spiked flowers with a 5-parted corolla, the calyx scarious above, the capsules not bursting.

S. Caroliniana has narrow obovate leaves on long petioles, smooth, veinless, obtuse, mucronated, level, and flat on the margin; the scape is round, smooth, slightly scaly, and terminated by a panicle of numerous branches, which bear the flowers on the upper side only; the flowers are alternate, erect, mostly in pairs, but appear singly in consequence of one expanding before the other; the calyx is funnel-shaped, scarious, and pink at the edge, 5-angled, the angles ciliate, and ending in long sharp teeth; the petals are obtuse, longer than the calyx, and of a bluish purple colour. This species is a native of North America, where it is called Marsh Rosemary. The root is a very powerful astringent, and is used as an application in aphthæ and similar affections of the mouth and fauces; it has been employed with success in Cynanche Maligna.

S. Limonium, Sea-Lavender, is a British species, and has much divided corymbose branches curved outwards; the ultimate subdivisions short, unilateral, ascending, and densely flowered; the calyx-segments entire, acute, with intermediate teeth; the outer bracts pointed and small. The roots possess astringent qualities.

S. rariflora is found near the sea in England and the coast of Galloway; it has oblong-lanceolate stalked leaves, the branches divided, the panicle ascending or incurved, the ultimate subdivisions elongated with unilateral rather distant flowers; the calyx-segments acute, denticulate, with intermediate teeth; the bracts obtuse, the outer ones large, the margins tinged with pink.

S. spathulata has spathulate leaves narrowed into a broadly winged stalk; the calyx-segments blunt, entire, and without intermediate teeth.

S. reticulata has spathulate leaves narrowed into a flat stalk, mucronate behind the point; 3-ribbed below; the scape panicled almost from the base with numerous slender zig-zag much-divided branches, of which the lower are barren; the calyx-segments acute, denticulate. It is found in muddy salt marshes in Norfolk.

(Babington, *Manual of British Botany*; Lindley, *Vegetable Kingdom*.)

STATYRA. [LAGRIDÆ.]

STAUNTO'NIA, a genus of Plants belonging to the natural order *Menispermaceæ* and tribe *Lardizabaleæ*, named after Sir George Staunton. This genus is remarkable as being one of those which is common to China and the Himalayan Mountains, and has hence afforded useful inferences respecting the districts where the tea-plant might be successfully cultivated. The genus is characterised by having monœcious flowers; the male having a 6-leaved calyx, with the leaflets in two rows; petals 6 or wanting; stamens 6, opposite to the petals, distinct or monadelphous; anthers adnate, opening outwards; rudiment of ovary. The female flower has the calyx of the male; no petals; 6 sterile dwarfish stamens; ovaries 3, distinct, oblong, with many ovules; stigmas sessile, simple-flowered. Berries often fewer than 3, divaricate, fleshy, opening longitudinally on their inner side. Seeds numerous, oblong-ovate, or reniform; embryo minute in base of a fleshy albumen; radicle inferior. The species are divided into two sub-genera—*Stauntonia* being without petals and having monadelphous stamens: *Holboellia* having 6 gland-like petals and the stamens free. The species form large climbing shrubs, with alternate petiolate peltately digitate leaves. Leaflets leathery in texture, 3-nerved, very entire, with all the petioles swelled and jointed at both extremities; racemes fascicled, axillary, a few flowered at the base of the branches. Flowers white, externally purple, fragrant. Berries large and purple. The Himalayan species are found in Nepaul and in 30° N. lat., at elevations of 5000 and 6000 feet. Their fruit, having a sweetish pulp, is eaten by the natives of these mountains, and they might no doubt be acclimated in the gardens of this country, as they experience a considerable degree of cold at the elevations where they are found.

STAUROLITE, *Staurotide*, *Grenatite*, a Mineral consisting of a silicate of alumina and iron. It occurs crystallised, the primary form being a right rhombic prism. Cleavage parallel to the lateral planes, and both diagonals. Fracture conchoidal, uneven. It scratches quartz with difficulty. Colour reddish-brown; streak white. Transparent; translucent. Lustre vitreous and somewhat resinous. Specific gravity 3·724. The crystals often intersect each other. It does not fuse by the blow-pipe; with borax it is slowly converted into a dark green transparent glass. It is found in France, Spain and Portugal, Switzerland, and North America. The analysis of a specimen from St. Gothard, by Klaproth, gives—

Silica	37·50
Alumina	41·00
Oxide of Iron	18·25
Oxide of Manganese	0·50
Lime	3·00
	——100·25

STAUROTIDE. [STAUROLITE.]

STAVESACRE. [DELPHINIUM.]

STEAMER-DUCK. [DUCKS.]

STEARIN. [ADIPOSE TISSUE; FAT.]

STEATITE, *Soapstone*, *Speckstein*, *Talc-Steatite*, a Mineral consisting principally of hydrated silicate of magnesia. It is met with massive in amorphous masses, which sometimes contain crystals of this substance of the form of quartz and calcareous spar, and which are probably pseudomorphous. Structure compact. Fracture uneven, splintery. Soft, and has a greasy feel. Colour yellowish, greenish, and grayish-white. Streak shining. Dull. Translucent on the edges. Specific gravity 2·604 to 2·632. Before the blow-pipe it is infusible either alone or with additions. It occurs plentifully in Baireuth, Saxony; in Cornwall, in Scotland, and many other parts of the world. According to Klaproth it consists of:—

	Baireuth.	Cornwall.
Silica	59·50	45·00
Magnesia	30·50	24·75
Alumina	—	9·25
Oxide of Iron	2·50	1·00
Water	5·50	18·00
	——98·00	——98·00

STEATORNIS. [GUACHARO-BIRD.]

STEENHA'MMERA, a genus of Plants belonging to the natural order *Boraginaceæ*. The calyx is divided into 5 deep segments. The corolla bell-shaped, with a short cylindrical tube with 5 minute protuberances in its throat. The stamens protrude beyond the throat, the filaments elongated.

S. maritima, the only British species, differs but little from *Lithospermum* except in habit. It has a procumbent branched stem, ovate-acute leaves, with rough hard dots, glabrous, fleshy, and glaucous, having a taste resembling oysters. The nuts are smooth. The flowers in racemes, and of a purplish-blue colour.

STEIN-BOC. [ANTILOPEÆ.]

STEINMANNITE. [ANTIMONY.]

STELLA'RIA (from 'stella,' a star), a genus of Plants belonging to the natural order *Caryophyllaceæ*, and the section *Alsineæ*. The calyx has 5 sepals; the corolla is composed of 5 petals, which are either bifid or bipartite; the stamens are 10 in number; the ovary simple, with indefinite ovules; styles 3, and the fruit a capsule with 6 valves. There are 67 species of this genus enumerated. Most of them are weeds, which are distributed over all parts of the world. Eight of them are found in Great Britain. In common with the whole order to which they belong, they possess no active properties. Few of them are thought worthy of cultivation, and when planted in gardens they require but little care.

S. Holostea, the Greater Stitchwort, is a British species, and is the handsomest plant of the genus. It has a nearly erect stem; lanceolate acuminated finely serrated leaves; inversely heart-shaped bifid petals, twice as long as the calyx. It is often planted in gardens as a border flower, for which, on account of its early delicate white flowers, it is well adapted.

S. media is the Common Chickweed, which is so common and abundant on road-sides and waste places all over Europe. It is characterised by its procumbent stems possessing an alternate line of hairs between each pair of leaves. It has small white flowers, which

are open almost all the year. It is frequently eaten as a pot-herb, and small birds are very fond of its seeds.

S. cerastoides, and *S. scapigera*, the Alpine and Many-Stalked Stitchworts, are both of them British plants, and are sometimes cultivated in pots.

STELLA'TÆ, the name of a natural order of Plants formed by Ray. The verticillate arrangement of the leaves of the plants of this order gives them a starlike appearance, whence the name. The order is called by Lindley *Galiaceæ*. [GALIACEÆ.]

STELLERIDIANS. [ASTERIADÆ; ASTERIAS; ECHINODERMATA.]

STELLE'RUS. [CETACEA.]

STE'LLIO. [DRACONINA.]

STELLITE. [PREHNITE.]

STEM. [EXOGENS.]

STEMMATOPUS. [PHOCIDÆ.]

STENELYTRA, the third family of Heteromerous *Coleoptera* in the arrangement of Latreille. *Helops*, *Cistela*, *Dercæa*, and *Œdemera* are examples. They are usually oblong convex insects, with long legs and antennæ, which are thickened at their extremities. They live under the bark of old trees, or on leaves and flowers. [HETEROMERA.]

STENEOSAURUS, a genus of Fossil Saurians.

STENO. [CETACEA.]

STENOCERUS. [IGUANIDÆ.]

STENOCINOPS. [MAIIDÆ.]

STENODACTYLUS. [GECKOTIDÆ.]

STENODERMA. [CHEIROPTERA.]

STENOPS. [LEMURIDÆ.]

STENOPUS. [PALEMONIDÆ.]

STENORHYNCHUS. [MACROPODIDÆ; PHOCIDÆ.]

STENOSOMA. [ISOPODA.]

STEPHANOMIA. [ACALEPHÆ.]

STERCORARIUS. [LARIDÆ.]

STERCU'LIA, a genus of Plants which gives its name to the natural order *Sterculiaceæ*, which sometimes forms a section of the order *Byttneriaceæ*. The name is derived from 'sterculus,' as that from 'stercus,' some of the species being remarkable for the strong and disagreeable odour of their leaves or flowers. The genus is characterised by having polygamous or monœcious flowers; calyx 5-lobed, somewhat coriaceous; petals wanting; stamens monadelphous, disposed in a short sessile or stipitate urceolus; anthers adnate, ten, fifteen, twenty, in one or two rows; solitary or ternately aggregate; ovary stipitate or sessile; carpels follicular, five, or fewer from abortion, distinct, 1-celled, one- or many-seeded, opening on the inner side; seeds disposed in two rows along the suture of the carpels; sometimes, when the carpels have opened and become spread out, the seeds appear to be arranged along the sides of a leaf-like membrane; seeds with fleshy albumen, and flat, leafy, equal cotyledons. The species consist of various-sized trees, with soft timber, which are found in the tropical parts of the world, with simple or compound leaves and axillary panicles or racemes of flowers. Many of them are of considerable use in the countries where they are indigenous.

Like the order to which they belong, several species are mucilaginous; and others yield fibre, which, from its tenacity, is made into ropes. Some yield a gummy exudation resembling tragacanth, and which is sometimes substituted for it: thus the gum called Tragacanth, which is sometimes imported from Sierra Leone, is said by Dr. Lindley to be yielded by a species which he called *S. Tragacantha*, the *S. pubescens* of others. So Dr. Roxburgh states Kuteera Gum, which is often substituted for tragacanth, to be produced by *S. urens*, a tree of the mountains of the Coromandel coast. Dr. Royle however states that the kuteera gum of many parts of India is yielded by *Cochlospermum Gossypium*.

S. guttata yields a bark, from which the natives of Malabar prepare flax-like fibres, of which the natives of Wynaad make a sort of clothing.

S. acuminata is a native of the tropical parts of the western coast of Africa, where its seeds are everywhere known by the name of Cola or Kola, and are mentioned by most travellers. They are much esteemed by the natives, who take a portion of one of them before each of their meals, as they believe that these seeds increase the flavour of anything they may subsequently eat or drink. They are about the size of a pigeon's egg, are bitter in taste, and may be supposed to have some stomachic properties.

The seeds of *S. macrocarpa* and of *S. heterophylla* are also called Cola on the African coast. In Asia, in the same way, the seeds of *S. Balanghas*, are described by Rumphius as being roasted and eaten by the natives of Amboyna, while the capsules are burned for the preparation of the colouring matter called Cassoumba. The seeds of *S. urens* and of *S. fœtida* are likewise eaten in India after having been roasted, as are those of *S. chicha* in Brazil. Those of *S. alata* are also said to be used as a cheap substitute for opium in the district of Silhet; but this statement, implying the presence of narcotic principles, requires careful examination before it can be received as a fact, as we generally find an accordance rather than so great a difference in the properties of species of the same genus.

STERCULIACEÆ, *Sterculiads*, a natural order of Plants belonging to the syncarpous group of Polypetalous Exogens. The plants belonging to this order are trees or shrubs, with alternate, stipulate, simple, often toothed leaves, with a variable inflorescence, and a stellate pubescence. The calyx is either naked or surrounded with an involucre, consisting of five sepals, with a valvular or nearly valvular æstivation; five petals, hypogynous, often saccate at the base; stamens definite or indefinite, and monadelphous; anthers 2-celled; the pistil consists of five carpels, often surrounding a columnar gynophore; fruit a capsule with three or five cells; seeds often winged, sometimes woolly; albumen oily or fleshy, and embryo straight; cotyledons either flat and plaited, or rolled round the plumule.

The order thus defined includes several groups of plants, which have by many writers been made to form distinct orders. *Sterculiaceæ* are most nearly allied to *Malvaceæ*, from which they differ in the possession of 2-celled anthers. From *Dipteraceæ* and *Tiliaceæ*, to which they are allied by the valvate æstivation of the calyx, they differ in the possession of monadelphous stamens. The subdivisions of this order are marked by very evident peculiarities of structure:—

Helicteræ have an irregular calyx and corolla.

Sterculieæ, no petals, and definite stamens placed at the end of a long column.

Bombaceæ, a calyx with a ruptile dehiscence, usually woolly seeds, and the cells of the anthers anfractuose.

Dombeyæ, a part of the stamens sterile, and flat well-formed petals.

Byttnerieæ, a part of the stamens sterile, and small petals bagged at the base.

Lasiopetaleæ, a petaloid calyx and rudimentary petal.

Hermannieæ, spirally twisted petals with only five stamens, and those opposite the petals.

Sterculiaceæ are natives of India, Australia, the Cape of Good Hope, and South America, with the West Indies. Most of its subdivisions have however a very definite geographical range.

Sterculieæ are found in India and equinoctial Africa. The genus *Sterculia* contains many species that are used as food or medicine. [STERCULIA.]

Sterculia chicha.

a, branch with leaves and apetalous flowers; *b*, monadelphous stamens surrounding pistil; *c*, ovary, style, and stigma; *d*, section of fruit, showing its five cells.

Byttnerieæ are principally natives of South America and the West Indies; about one-seventh of the species are found in the East Indies, and the same proportion in Australia. To this group belongs the plant that produces the cocoa [THEOBROMA] of commerce. These plants, like the whole of the order and its allies, abound with mucilage, and are often used in medicine as demulcents. The fruit of *Guazuma ulmifolia* possesses a mucilaginous pulp, and is eaten in Mexico by

autumn. It was met with in Chusan by the late expedition, and seeds sent home by Dr. Cantor, which have been sown in the Horticultural Society's Garden at Chiswick. The fruit of this tree furnishes the Chinese with candles, and oil for their lamps. The seed-vessels and seeds are bruised, and then boiled in water. The fatty particles rising to the surface are skimmed off, and on cooling condense into tallow. To give it greater consistence some wax is added, together with linseed-oil, in the proportion of three parts to ten of the tallow. The candles made with it are beautifully white. Sometimes they are coloured red by the addition of vermilion. These candles are sometimes said to be coated with wax procured from another Chinese tree (probably *Ligustrum lucidum*), which forms an external crust and prevents them running. This tallow is also employed in medicine instead of lard.

STILPNOMELANE, a Mineral, occuring in crystalline, lamellar, and fibrous masses. Cleavage in one direction. Colour greenish or black. Streak greenish to liver brown. Lustre vitreous. Hardness 3·0 to 4·0. Specific gravity 3·27 to 3·4. It is found at Obergrund and Zinkmantel, in Silesia. Its analysis by Rammelsberg gives—

Silica	46·500
Protoxide of Iron	33·892
Alumina	7·100
Lime	0·197
Magnesia	1·888
Water	7·000
	——96·577

STILT-PLOVER. [CHARADRIADÆ.]

STINGS, in Botany. [HAIRS.]

STINT. [SCOLOPACIDÆ.]

STIPA, a genus of Grasses belonging to the tribe *Stipaceæ*. It has stalked florets, the paleæ coriaceous, the inner entire. *S. pennata*, the only British species, has a very long twisted feathery awn, with a glabrous base. It is a very beautiful plant, and is common in our gardens. Found on rocks in Long Seadale near Kendal. [GRAMINACEÆ.]

STIPES, in Botany, a term applied to almost all parts of a plant performing the functions of a stalk, with the exception of the petiole and flower-stalk.

STIPULES, in Botany, are those organs which are found at the base on each side of the axils of the leaves of plants. They are not of constant occurrence, not being found in all plants, but where they occur they frequently characterise a whole family, as in *Leguminosæ*, *Rosaceæ*, *Malvaceæ*, &c. These organs are frequently very like leaves, and present themselves in the various forms in which leaves are found. But they are always to be distinguished from leaves by their position at the base of the leaf-stalk. In many cases they are green, like the leaf; they sometimes have petioles, and are sometimes sessile and cut into teeth, lobes, &c. In the Mimosas the stipules frequently degenerate into hardened spines. In the family of *Polygonaceæ* they are membranous, and being united together they form a sheath around the stem, which is called an 'ochrea.' The stipules in *Cucurbitaceæ* assume the character of tendrils, and in *Trapa natans* they appear under the form of elongated filamentous bodies.

The stipules appear to be modifications of the leaves, but may always be distinguished from these organs by their being placed at the base of the leaf-stalk. Another distinction would also be found in their not possessing buds in their axils.

STITCHWORT. [STELLARIA.]

STIZOLO'BIUM, a genus of Plants which was so named by Persoon, from στίζω, to prick, and λοβός, a lobe or pod, from the pods of the several species being covered with hispid hairs. The species have now been removed chiefly to *Pachyrhizus* [DOLICHOS] and to *Mucuna;* of the latter of these *Stizolobium* now forms a sub-genus. The principal species are mentioned under COWITCH and MUCUNA. Cowitch is no doubt a corruption of the Hindustanee name Kiwach, which is the *Mucuna prurita* of Hooker, indigenous in various parts of India, but usually confounded with *M. pruriens*, a native of the West India Islands. The Indian *M. prurita* is distinguished by its smaller leaves, its more obtuse leaflets, the middle one being more truly rhomboidal, its flowers more constantly in threes, and by its legumes being much broader, compressed, and free from any raised line on the back of the valve, whilst in the American *M. pruriens* the pods are narrower, terete, and keeled on the valves. Another valuable but little known species is *M. utilis*, the Pois Noire of the islands of Mauritius and Bourbon, and thought to be a native of Arabia. It is universally employed in the above islands for enriching the soil for the cultivation of sugar. The thick covering of herbage with which the soil becomes covered, must be useful in preventing the soil from becoming parched, while the whole crop, being afterwards ploughed in, is found to be eminently useful in enriching the soil. The seed has been introduced into India and is spreading over the country.

STOAT. [MUSTELIDÆ.]

STOCK. [MATTHIOLA.]

STOCK-DOVE. [COLUMBIDÆ.]

STOMACH. One of the most constant characters by which animals are distinguished is the possession of an internal digestive cavity, in which their food is received and subjected to a peculiar chemical change before it is appropriated to the nutrition of the different parts of the body. In some animals the chemical change is effected in every part of the cavity; in others it goes on in one portion of it exclusively, and this portion is named the Stomach.

The Human Stomach is a membranous sac of an irregularly conical form, which lies almost transversely across the upper and left portion of the abdominal cavity. [ABDOMEN.] Its larger extremity is directed to the left, its smaller to the right. To the left it is in contact with the spleen; to the right with the liver: above it is covered by the diaphragm, and, at about one-third of the distance from its left to its right extremity, it communicates, by an orifice called the Cardia, with the œsophagus: at its right end it opens by another orifice, named Pylorus, into the intestinal canal. Of these orifices the pyloric lies rather lower than the cardiac: they are separated from each other by the upper and shorter border, or small arch, of the stomach, the greater part of the cavity being formed as if by the dilatation of the left side of the œsophagus into a great cul-de-sac and great arch, which form the left and inferior boundary of the stomach.

The coats or walls of the stomach are composed of three distinct membranes, connected by a firm but very extensible cellular tissue. The external or peritoneal coat is a layer of fine compact cellular tissue, woven into a thin membrane, and covered by a fine cuticle or epithelium, from which, like all the other organs within the abdominal cavity, it obtains a perfectly smooth and polished surface. The peritoneum invests every part of the stomach except the upper and lower borders, where there are spaces in which the trunks of the blood-vessels run, and from each of which the peritoneum is continued in a double layer to form the greater and less omenta. [OMENTUM.] Its only purpose seems to be to permit the stomach to move easily upon the adjacent organs.

Between the peritoneal and the internal or mucous membrane, there is a stratum of loose cellular tissue, in which are inlaid the fibres of the middle or muscular coat. This is composed of three different sets of fibres, resembling in their structure those of most involuntary muscles. [MUSCLE.] The fibres in the first and most superficial layer run longitudinally: they are continued from those of the outer coat of the œsophagus, which, at the cardia, expand or radiate, and pass in fasciculi at some distance apart, from left to right, along both the anterior and posterior surfaces of the stomach. The second layer is composed of circular fibres which form numerous fasciculi, each of which encompasses a considerable portion of the circumference of the stomach. The third and internal layer consists of two principal fasciculi of muscular fibres, which proceed from the cardia and expand over the great cul-de-sac and middle portion of the organ.

The interior or mucous coat of the stomach is that in which the essential apparatus for the production of the digestive material is placed. To the naked eye it appears a soft spongy membrane, about one-tenth of an inch thick, with a polished slippery surface. After death it varies considerably in its colour, but during life has a light pinkish tinge, and, accordingly as the stomach is distended or contracted, is either perfectly smooth or is thrown into various deep and irregular but chiefly longitudinal wrinkles. At the pylorus it forms a deep fold, between the two layers of which are strong fasciculi of circular muscular fibres: these constitute the Pyloric Valve, by which the aperture between the stomach and the intestines is guarded. At the cardiac orifice the boundary between the mucous membrane of the stomach and that of the œsophagus is marked by a jagged line, at which the thick and opaque epithelium of the latter terminates, and the much finer epithelium lining the stomach commences.

The more intimate structure of the mucous membrane can be seen only with the aid of the microscope. If its surface be examined with a lens whose magnifying power multiplies about forty diameters, it appears to be covered by minute polygonal fossæ, from 1-100th to 1-350th of an inch in width, surrounded by narrow sharp-edged borders, to which little leaf-like processes are sometimes attached. At the bases of each of these fossæ there are, at least during digestion, from six to ten minute apertures leading into tubes which pass vertically into the substance of the mucous membrane. A thin section of the membrane, made perpendicularly to its surface, shows that nearly its whole substance is composed of these tubes, which are minute cylindrical glands, opening on the surface in the fossæ just described, but closed below, and set compactly side by side in groups. They vary in length from one-fourth of a line to nearly a line, the longest being situated near the pylorus. Near their bases they measure about 1-300th of an inch in diameter, and near their orifices about 1-500th of an inch. Their lower closed extremities sometimes seem (but only seem) a little convoluted or baccated. They lie in every part of the mucous membrane, but are largest and most densely set, so that they are actually in contact, near the pylorus; a few of them are branched, two or more tubules opening by a single orifice. The small blood-vessels pass vertically in the cellular tissue between the groups of tubules from the submucous tissue to the surface of the stomach, on which they form an angular network, marking out the borders of the shallow fossæ.

The walls of these little tubular glands are composed, near the surface of the stomach, of a fine structureless membrane, and at the deeper part of minute nucleated cells adhering by their edges. Their office seems to be the production of cells containing the fluid for

digestion. In different parts of the stomach, and at different times, they vary in the nature of the substance which they contain; and it seems probable that these variations depend on whether the tubes are, or are not, engaged in producing digestive fluid. Those which are so occupied are completely filled with cells in different stages of development; those which are inactive are empty, and have their walls lined internally by epithelium, similar to that which invests the interior of the stomach. In the production of the cells containing the digestive fluid, small granules are first generated in the deeper part of each tubular gland: these, coalescing by twos or threes form nuclei, on which the cells are developed according to the ordinary mode of formation of primary cells. The cells are of an oval form, about 1-2000th of an inch in length; and, as fast as they are produced, they are pushed towards the orifices of the tubes, from which, while digestion is going on, they are discharged in such numbers as to form, with a small quantity of fluid separated at the same time, the thick layer of mucus by which the whole interior of the stomach is lined, and by which the portions of food are invested. In the intervals between successive acts of digestion, it seems probable that the orifices of the tubules are closed by small portions of epithelium similar to that by which they are lined, and which are elevated and broken through for the discharge of the cells as soon as the active process commences.

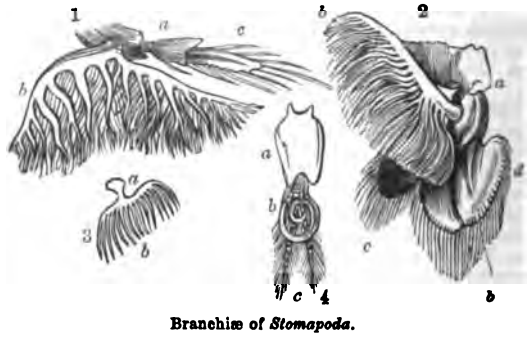
During digestion there are also often found, just beneath the surface of the mucous membrane, around either the cardiac or pyloric orifice, and along the lesser arch of the stomach, a number of small closed sacculi, filled with an opaque white fluid containing cells, which, when their contents are matured, burst and discharge them into the interior of the stomach. But the exact office of these bodies (which have been generally described as the gastric follicles, or lenticular glands of the stomach) is not known; they are certainly not always present, but probably are produced rapidly while digestion is going on, and, having discharged their contents, are again rapidly absorbed. [INTESTINES; DIGESTION; FOOD.]

STOMAPODA. M. Milne-Edwards comprises in the order *Stomapoda* all the Podophthalmous *Crustacea* which are deprived of thoracic branchiæ lodged in internal cavities.

This division is entirely composed of Swimming Crustaceans, whose body is elongated, and whose general form often approaches closely to that of the Macrourous Decapods; but in those animals the concentration of the rings of the head and thorax is carried less far. In the greater part of the *Stomapoda* the ophthalmic and antennular rings are not confounded with the rest of the head, and they even sometimes acquire a remarkable development. As in the other *Podophthalma*, there always exists a Carapace, which is formed by the enlargement of the dorsal arch of the antennary or mandibular rings; but the dimensions of this buckler vary greatly. Sometimes it covers nearly the whole of the thorax, and only leaves exposed a portion of the last ring of that part of the body; sometimes, whilst it prolongs itself above the thoracic rings, it only adheres to those which are near the mouth, and leaves the others free and complete under its lower surface. In other cases it does not reach the four or five last rings of the thorax, which then resemble those of the abdomen. In form it varies too much for general description. The Thorax is generally elongated, and entirely composed of segments moveable upon each other. Sometimes all the rings of this part of the body are united into a single piece. The conformation of the Abdomen varies still more; this portion of the body presents in general nearly the same disposition as in the Macrourous Decapods, and terminates by a great caudal fin composed of appendages of the sixth ring and the following segment; but in some Stomapods the abdomen is rudimentary. The disposition of the limbs is equally variable. The Eyes are always carried on a first pair of moveable appendages, the length of which is often very considerable, and whose disposition is essentially the same as in the Macrourous Decapods. The first pair of Antennæ are rather long, and terminate in two or three multiarticulate filaments; their peduncle is always cylindrical, and they can never be bent back under the front as in the Brachyurous Decapods. They are inserted below the eyes, near the median line, or externally to the base of those organs. The second pair of antennæ vary still more; their conformation however generally approaches that in the *Crangonidæ*. The basilary joint of their peduncle nearly always carries above a great ciliated blade, and they terminate by a long multiarticulate filament. In the greater part of the Stomapods they are inserted outside the first pair, nearly on the same transversal line. The distance which separates the mouth from these appendages is generally very considerable; and the carapace never recurves below, so as to form round that aperture a well determined frame serving to lodge the jaw-feet, as in the greater part of the Decapods. In the majority the buccal apparatus is more simple than in the preceding order, and is only composed of an upper lip, a pair of mandibles, a lower lip, two pairs of jaws, and a single pair of jaw-feet; these last organs are either altogether wanting, or are transformed into natatory feet, and nearly always the seven following pairs of limbs are all so formed as to constitute natatory or prehensile feet. It is also worthy of note, that in the Stomapods the second pair of jaws never carry at their base a lamellar appendage analogous to the valvule, which, in the Decapods, fulfils functions so important in the mechanism of respiration; and this modification of structure is a natural consequence of the absence of a respiratory cavity which includes the thoracic branchiæ, as in the preceding order.

There are generally seven or eight pairs of Feet, often presenting the same mode of conformation. They are nearly always provided with an appendage, which may be considered as the analogue of a palp. There is often found also at the base of many of the anterior feet another soft and vesicular appendage, which has sometimes the form of a biscuit, and which represents the flagrum, an organ which, in the greater portion of the Decapods, is lamellar and of a horny consistence; but which, in certain Shrimps, presents a structure similar to that in the Stomapods. Three of the last pairs, or a greater number, are always natatory; the first pair, or even the first four, are often prehensile; but they never terminate in a didactylous pincer, as in the Decapods: they are subcheliform, that is to say, nothing more than a moveable claw which falls on the preceding joint. The greater part of these organs are approximated to the mouth, or even applied against it; a disposition which has been the cause of the appellation Stomapods. The abdominal members present nothing peculiar; their number is nearly always six pairs.

The Branchiæ of the Stomapods are always external, and present in general a more complicated structure than those of the Decapods. Instead of being composed of lamellæ, or simple filaments, they are formed of cylinders ranged in parallel order, giving origin to other smaller cylinders, which, in their turn, are equally fringed. Sometimes these ramose branchiæ are fixed at the base of the thoracic feet, and suspended under the thorax; but in general they spring from the basilary joint of the abdominal false feet: in some of the order they are reduced to a rudimentary state; in others nothing is to be seen which can be considered as a special organ of respiration; and, in such cases, there is every reason to believe that this function is exercised by the general surface of the teguments.



Branchiæ of *Stomapoda*.

1, one of the branchiæ of *Thysanopoda*: *a*, base of the posterior foot; *b*, branchiæ; *c*, palp.

2, a branchia of *Squilla*: *a*, base of the false foot; *b*, branchia; *c*, *d*, the two terminal branches of the false foot.

3, *a*, one of the branches of this ramose branchia; *b*, the branchlets (ramuscles).

4, one of the abdominal false feet of *Cynthia*: *a*, basilary joint; *b*, branchia; *c*, lamellar appendages.

The apparatus of Circulation differs much from that of the Decapods. In the *Squillæ*, the only Stomapods which have been anatomically examined, the heart, instead of being nearly quadrilateral, and situated towards the middle of the thorax, has the form of a long cylindrical vessel, which extends throughout the length of the abdomen; the arteries which spring from this tubular heart are distributed in a peculiar manner; and the principal venous sinuses, instead of being situated on the thorax, occupy the abdomen.

The Stomach of some Stomapods presents vestiges of the solid framework, which, in the Decapods, is armed with teeth serving to bruise the aliments in the interior of the digestive cavity; but in general nothing similar is to be found. The structure of the Liver also varies; and in those species in which the organs of generation have been examined, remarkable peculiarities have been observed in their disposition. The Nervous System in this order presents also modifications which have not been found in the Decapods; but its disposition varies too much to enable M. Milne-Edwards to say anything general of it.

M. Milne-Edwards divides the *Stomapoda*, after the example of Latreille, into three families:—the Caridoides, the Bicuirassés and the Unicuirassés.

I. Caridoid *Stomapoda*.

The Crustaceans arranged by M. Milne-Edwards under this family bear a close resemblance in their general form, he observes, to the family of Salicoques; and indeed till lately their position had been in the order *Decapoda*, where they constituted a small and peculiar family under the name of *Schizopoda*.

The body is thick, and slightly compressed laterally. Head confounded with the thorax, and all the rings of the last-named part (with the exception, sometimes, of the last, or of the last two) completely united together and soldered above with the carapace. Abdomen considerably developed, and terminating by a great fin composed

of five laminæ, or blades, disposed in a fan-shape, as in the Macrourous Decapods. The carapace descends on each side against the base of the feet; covers the whole, or nearly the whole, of the thorax, as well as the head; and presents only a rudimentary rostrum in front; there is no moveable plate in place of this frontal prolongation, as in *Squilla*, and the ophthalmic ring is in general very short and naked. The disposition of the eyes, of the antennæ, and of the pieces of the mouth, varies. The thoracic plates are all slender, natatory, and resemble each other; but their number varies much. The abdomen is composed, as ordinarily, of seven rings, the first five of which carry natatory false feet; whilst the seventh forms, with the appendages of the sixth segment, the caudal fin: these last appendages consist each of a small very short basilary joint, and of two great terminal plates disposed as in the Macrourous Decapods. Finally, the conformation of the respiratory apparatus varies; sometimes the branchiæ do not exist; sometimes vestiges of them are found at the abdominal false feet; and sometimes they are, on the contrary, very much developed, and suspended under the thorax. (Milne-Edwards.)

M. Milne-Edwards divides the Caridoids into two small tribes, the Mysians and the Luciferians.

1st Tribe. Mysians.

This tribe resembles the Salicoques so closely, that till lately the species forming it had been arranged under the Macrourous Decapods, where they constituted the family designated Schizopods.

The carapaçe extends to the base of the ocular peduncles, and presenting in general in the middle of the front a rudimentary rostrum. Antennæ inserted on two lines, and formed as in the Shrimps, excepting only that the lamellar appendage of the second pair is less. Mouth situated very near the base of these last, and composed essentially of a labrum, a pair of mandibles furnished with a palpiform stem, a lower lip, and two pairs of lamellar jaws. To this family belong the genera *Mysis*, *Cynthia*, and *Thysanopoda*.

Mysis.—Body narrow, elongated. Carapace covering the anterior extremity of the trunk as well as the greater part of the thorax, and bent down on each side so as to apply itself against the base of the feet. It is free laterally, and does not adhere to the last rings of the thorax; anteriorly it is narrowed considerably, and terminates by a small flattened and very short rostrum; its posterior border is deeply notched. Eyes large, short, and with their base hidden under the anterior part of the carapace. Internal antennæ inserted below the eyes, near the median line; peduncle of the same form as in the Shrimps, and carrying at its extremity two multiarticulate and rather long filaments. The second pair of antennæ inserted below the preceding, and equally directed forwards; the first joint of their peduncle gives origin to a very elongated lamellar appendage, which is ciliated on the internal border that covers the base of those organs, as in the Shrimps. The two succeeding joints of the peduncle are slender and cylindrical, and the terminal filament is filiform, multiarticulate, and longer than the upper antennæ.

There is no vestige of branchiæ, either at the vault of the sides or at the base of the feet, or at the lower surface of the abdomen, and the only appendage which would seem to be modified in its structure so as to become more proper than the rest of the body to fulfil the functions of an organ of respiration, is the flagrum of the first pair of jaw-feet, whose disposition, for the rest, is nearly the same as in a great number of crustaceans provided with branchiæ.

On account of their peculiar appearance, the species of this genus have been called Opossum Shrimps. The pouch which contains their eggs, and which have secured for them this name, is thus described by Mr. J. V. Thompson:—"Attached to the base of each of the inner divisions of the two posterior pairs of feet in the female, is a large concave scale, strongly pectinate in front, of which the posterior is the outermost, largest, and most concave, lapping considerably over the anterior scale, so as to admit of a considerable extension of the size of the pouch which they form by meeting each other in front, in order to accommodate its capacity to the growth of the ova and young brood. In the male, in place of the valvular pouch of the female, we perceive attached to the inner part of the last pair of feet only, a single small hollow scale on each side, ciliate in front, and provided with a marginal row of slender hooks at the apex; these are probably an appendage of the male organs, which have a similar situation in the Shrimps."

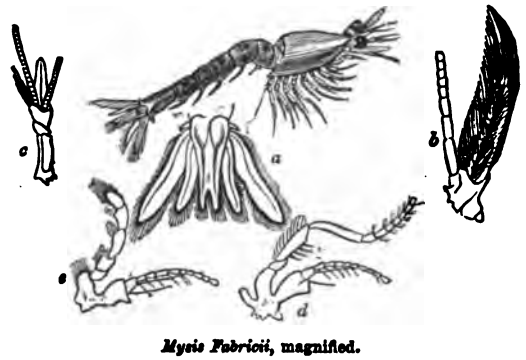
Within this pouch in the female, the eggs, or rather embryoes, Mr. Thompson informs us, are received when excluded from the ovarium, and enveloped in a mucous or subgelatinous secretion, and gradually developed without any visible attachment to the parent. "The ova when first received into the pouch are considerably more advanced than those of the Shrimps, Crabs, &c., on their first expulsion, and by no means so numerous, a circumstance more than compensated by the rapidity with which one brood succeeds another during the whole of the spring and summer months. The number of broods produced by one individual, as well as the time occupied in their evolution, have not been determined; but the changes which the embryo undergoes in configuration are sufficiently obvious. In the present instance these cannot be considered as metamorphoses, but simply a gradual development of parts; hence the *Schizopoda* may be regarded as one exception to the Crustaceans undergoing transformations, another character by which they are separable from the true Shrimps, &c. The first change which is perceptible in the ova after their reception into the maternal pouch is a slight elongation at one end, and the appearance of two short members on each side; this elongation, which proves to be the tail, increasing in length, shortly after becomes forked at the end, accompanied by a proportional growth in the four lateral members, and which are the rudiments of two pairs of antennæ in the perfect animal; the embryo going on thus with a progressional development from day to day, begins to assume a more complete form, and an approximation to that of the parent, in which stages the divisions of the abdomen, the tail, the pedunculate eyes, and the various members are sufficiently distinct; a still more close resemblance to the perfect animal is attained before the young are finally excluded, which is effected by the parent spreading open the valves of its pouch, when the whole brood emerge at once into the ambient element, and, in most of the species, continue associated with the community from which they sprang. The slight differences which they now present (and which are necessary to be known in order to preclude the possibility of their being mistaken for individuals of a different species) affect only the inner rows of feet, the subabdominal fins, the outer antennæ, and the tail; the first of these, in place of the multiarticulate termination, have but one or two short joints and a curved claw superadded to the end of the tibiæ, and hence this division of the limb is shorter in proportion; the subabdominal fins consist only of a linear joint surmounted by a few bristly hairs; the outer antennæ differ in no other respect than in the ciliated scale which is attached to their base being shorter and less developed, as is also the brush of hair in the males; the three intermediate scales of the tail are proportionally shorter, but yet present the character peculiar to the species in their form, indentations, and appendages, so as to testify the acuteness of Dr. Leach in having fixed upon this part to distinguish the species from each other. What is further remarkable in the embryoes is the way in which they are arranged within the pouch from the moment they assume an elongated form; their heads being towards the breast of the mother, with the curvature of the tail part suited to that of the outline of the pouch, and the large size and blackness of their eyes."

The species of *Mysis* swim freely in the sea in numerous troops, and are particularly abundant in the north, where, according to Otho Fabricius, they constitute a principal portion of the food of the Whale-Bone Whales (*Balænæ*). Captain James Ross, R.N., states that *Mysis flexuosus* (*Cancer flexuosus*, Müll.), though but sparingly found in the seas of Europe, inhabits some parts of the Arctic Ocean in amazing numbers, and constitutes the principal food of the prodigious shoals of salmon that resort thither in the months of July and August, and upon which the inhabitants of Boothia depend, in great measure, for their winter store of provisions. He further observes, that it is also the chief food of the whale, by which such a prodigious quantity of fat is produced in the body of that immense animal.

M. Milne-Edwards divides the genus *Mysis* into the following sections:—

1. Species which have the middle blade of the caudal fin bifurcated.

M. spinulosus, Leach. It is the *Praunus flexuosus*, Leach; *Mysis Leachii*, Thompson ('Zool. Res.'). It is found in the British Channel and the coasts of La Vendée. (Milne-Edwards.)



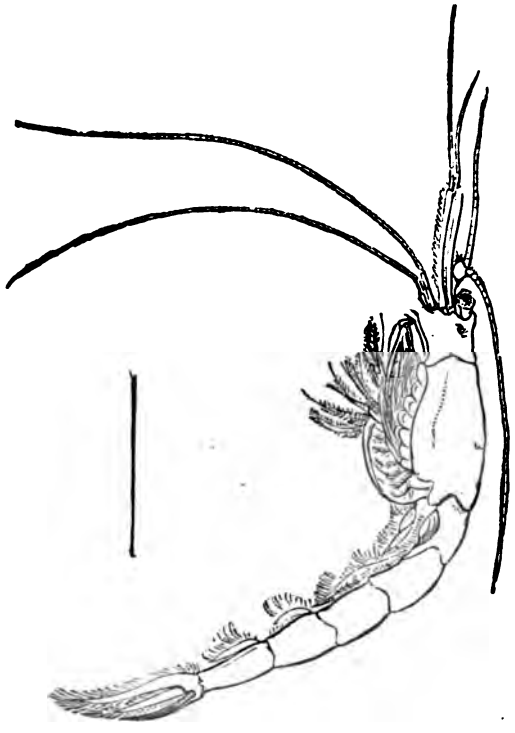
Mysis Fabricii, magnified.

a, the last ring of its body, or its terminal fin; *b*, base of a lateral antenna; *c*, base of an intermediate antenna; *d*, one of the second pair of jaw-feet; *e*, one of the first pair. These parts highly magnified. (Desmarest.)

2. Species which have the median blade of the caudal fin entire at the end.

M. vulgaris is common on the Irish coast. It abounds in the Lee, even up to Cork, from the early part of spring to the approach of winter, according to Mr. Thompson, who states that during the still period of the tide at low water, they repose upon the mud and stones at the bottom of the river, and, as the tide rises, may be observed

forming a wide belt within its margin, the youngest swimming nearest to the shore, the oldest farther out and in deeper water. They appear, he adds, to be mostly females, the males being few in proportion, and they swim in a horizontal position, contributing towards the food of various young fish, from which they frequently escape by springing up out of the water.



Mysis vulgaris, magnified. (Thompson.)

Cynthia, Thompson.—Body slender, and of the same form as in *Mysis;* but the carapace of *Cynthia* is smaller, and terminates anteriorly by a small rostral prolongation; behind it a certain number of thoracic rings are exposed. Eyes stout and short, of moderate length. First pair of antennæ excavated at their base to make room for the eyes; their peduncle is stout, and they have two terminal filaments. The second pair of antennæ are inserted below the preceding, as in *Mysis*, but they are much smaller; the lamellar appendage which covers their base is shorter than the peduncle of the upper antennæ. Conformation of the buccal apparatus nearly the same as in *Mysis;* palpiform stem of the mandibles very large; second pair of jaws lamellar, and divided on the internal side into many lobes.

C. Thompsonii, a native of the Atlantic Ocean, between Madeira and the Antilles. (Milne-Edwards.)

Thysanopoda (Milne-Edwards).—External form resembling that of *Mysis*. Body presenting the same divisions as in the Macrourous Decapods. Carapace, which covers the head, hiding also the whole of the thorax. Abdomen, whose length much exceeds that of the cephalo-thorax, extended backwards, and composed of seven segments, the three median of which present on their posterior and superior borders a small spine, directed backwards. Carapace terminated anteriorly by a small pointed rostrum, which does not reach to the extremity of the eyes, whose peduncles are stout and short. Antennæ four in number, inserted on two lines, and nearly equal in length; the upper with a peduncle recurved at its base, to receive the eyes, and composed of three cylindroid joints; they are terminated by two rather long filiform stems. Base of the lower antennæ covered by a long lamellar scale, the extremity and internal border of which are ciliated, the terminal stem presenting nothing remarkable. Mouth situated at a small distance from the point of the insertion of the lower antennæ, and surrounded, as ordinarily, with a rather stout labrum, a bifid tonguelet, and a pair of mandibles, which are armed on their internal border with some pointed teeth, and carry a short and flattened palp, divided into three joints. Two pairs of jaws are applied on the mandibles and tonguelet.

T. tricuspida is the only species known. Length about 15 lines. It was found far at sea, in the Atlantic Ocean, by M. Reynaud.

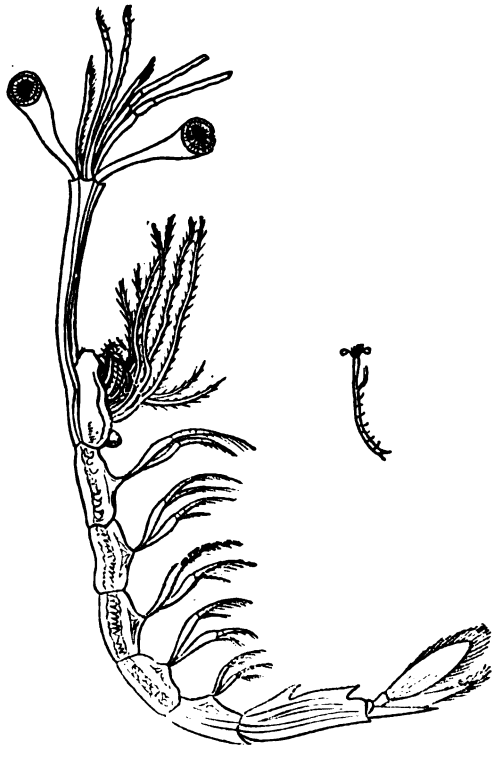
M. Milne-Edwards thinks that the genus *Podopsis*, or Hammer-Headed Shrimp of Thompson, may belong to this family; but he observes, that it is too imperfectly known to warrant the assignment of precise characters to it. This crustacean, which was found in the Atlantic Ocean, and is phosphorescent, is figured and described in the interesting 'Zoological Researches' above quoted.

2nd Tribe. Luciferians.

M. Milne-Edwards observes that the genus *Lucifer*, established by Mr. Thompson, is one of the most singular known. One of the most remarkable traits of this crustacean is the excessive length of the anterior portion of the head; the extreme brevity of the part of the body occupied by the mouth, and constituting the thorax; and the great development of the abdomen.

The general form of the body is nearly linear. Eyes and antennæ carried at the extremity of a long, slender, and cylindrical prolongation, which is much longer than all the rest of the cephalo-thoracic portion of the body, and seems to be formed principally by the antennary ring. A small carapace covers the whole of the posterior portion of the cephalo-thorax, and presents nearly the same form as in *Mysis*. The first pair of antennæ are slender, short, and terminated by a multiarticulate rudimentary stemlet; the second pair are inserted below, close to the preceding, and are equally slender: near their base is seen a small lamellar appendage, but their mode of termination is unknown. Mouth projecting, and situated behind the base of the prolongation which carries the eyes, &c.

L. Typus. This species differs from the only other *Reynaudii* (which was found in the Indian Ocean by M. Reynaud) in the form of the median piece of the caudal fin, which is lamellar, and without any notch below, in the more considerable length of the middle blades, and in the apparent absence of a separation between the carapace and oculiferous prolongation.



Long-Headed Shrimp (*Lucifer Typus*), magnified, and of its natural size. (Thompson.)

II. Bicuirassed *Stomapoda*. [PHYLLOSOMA.]

III. Unicuirassed *Stomapoda*.

The abdomen is well developed, and is composed of seven moveable segments, the last of which constitutes a very large caudal blade. The eyes are stout and convex (renflés) towards the end; the first pair of antennæ are inserted below and behind their peduncle, and are composed of a cylindrical peduncle formed of three joints and terminated by three filaments, which are ordinarily multiarticulate. The second pair of antennæ are inserted behind and outside the preceding, and are provided with a great lamellar appendage fixed on a stout and cylindrical joint, at the extremity of the first joint of their peduncle, which also carries in front a filament, which is ordinarily multiarticulate. The mouth is rather distant from the antennæ, and carried on a nearly triangular eminence, the base of which corresponds with the insertion of the prehensile feet. The upper lip is large, projecting, and semicircular. The mandibles are directed downwards, and terminate by two toothed branches, one of which ascends in the back part of the mouth, towards the stomach; the palpiform stem which carries these organs is small and sometimes null. The lower lip is large, and partially covers the extremity of the mandibles. The jaws are very small, and applied exactly against the mouth; the first pair terminate by a kind of hook directed inwards, and armed with spines

along the internal border of their second joint; there is also a small rudimentary palpiform appendage. The second pair of jaws are lamellar, nearly triangular, and composed of four or five joints placed end to end; nothing resembling a flabelliform appendage is to be seen. The members which belong to the seventh cephalic ring, and which ordinarily constitute the anterior jaw-feet, do not seem to belong to the buccal apparatus. They are very much elongated, and form a pair of slender feet, generally enlarged towards the end, the uses of which are not known.

M. Milne-Edwards divides this family into two small tribes, Erichthians and Squillians.

Tribe 1. Erichthians. [ERICHTHUS.]

Tribe 2. Squillians.

Corresponding with the genus *Squilla* of Fabricius, and the majority of authors, this tribe comprehends, according to M. Milne-Edwards, the genera *Squilla* (containing the *Squillæ*, properly so called), *Gonodactylus*, and *Coronis* of Latreille. All these crustaceans have, observes M. Edwards, the greatest resemblance to each other, and the differences upon which these genera are established have not perhaps as much importance as was once thought.

The Squillians are, of all the podophthalmous crustaceans, those in which the various constituent rings of the body are the most equally developed and the most independent of each other. With the exception of those which immediately surround the mouth, all these rings are more or less moveable on each other, and the greater part are complete. The carapace neither covers the first two rings of the head nor the last four rings of the thorax, and constitutes a horizontal buckler nearly quadrilateral, which is divided longitudinally into three lobes, more or less distinct, by two longitudinal furrows. In front of this buckler is a small triangular and moveable plate, which seems to be a dependence of it, and which covers the antennular ring; its form varies, and as it may be an element in specific differences, M. Milne-Edwards terms it the frontal plate. The ring which carries the eyes is small, nearly quadrilateral, and moveable on the succeeding segment; the eyes are large, short, and convex. The antennular ring is also nearly quadrilateral and moveable, but larger, and gives insertion to the internal antennæ by its anterior border on each side of the ophthalmic ring. These appendages are directed forwards; their peduncle is long, slender, and composed of three cylindrical joints, and they terminate in three multiarticulate filaments of moderate length. The second pair of antennæ are inserted under the anterior border of the carapace, on each side of the antennular ring, and are formed nearly the same as in the Erichthians; the first joint of their peduncle is large and short, and continues itself with an articulation equally stout, which carries at its extremity a great oval blade, analogous to the palp or middle branch of the thoracic limbs, and the basilary scale of the external antennæ of the shrimps; the internal branch, which ordinarily is greatly developed, remains here slender, and so small that it only seems to be an appendage of the middle branch; it springs from the anterior angle of the common basilary joint, and presents a peduncular portion, composed of two cylindrical joints and of a terminal multiarticulate filament.

The internal structure of the Squillians differs considerably from that of the Decapods. The heart, instead of being quadrilateral, and inclosed in the middle part of the thorax, has the form of a long vessel, rather enlarged anteriorly, which extends nearly throughout the length of the abdomen as well as of the thorax, and which furnishes laterally in each of the rings which it traverses a pair of arterial branches; by its anterior extremity, this dorsal vessel gives origin to three branches, which seem to be the analogues of the ophthalmic and antennary arteries of the Decapods; and posteriorly it terminates by a small artery which penetrates into the last abdominal segment.

The stomach is very large, and advances into the head very far before the œsophagus, which is vertical and extremely short.

The organs of generation are situated above the digestive apparatus.

The nervous system presents nearly the same disposition as in the greater portion of the Macrourous Decapods; in the abdomen the ganglions are well developed, and the cords double; it is the same with the thoracic ganglions of the three last pairs, but all those of the anterior portion of the thorax are united in a single oval mass.

Squilla (Rondeletius).—M. Milne-Edwards points out that the true *Squillæ* are probably more carnivorous than the other crustaceans of this tribe, for they are furnished with much more powerful offensive arms. The claw which terminates their raptorial feet has a falcular form, the sharp edge of which is provided with long pointed teeth, and can be received into a groove of the corresponding border of the hand, which is equally compressed, and in general armed with spines on its prehensile border. The three last pairs of thoracic feet carry a slender, cylindrical, and elongated appendage, which represents the palp. The body is in general more slender and narrowed behind the carapace than in the other Squillians.

Squillæ are found in the British Channel, but the species which are numerous are abundant only in the seas of warm regions; they keep in general at a distance from the coast, and at considerable depths. Their abdominal false feet are continually in motion, and they swim with great swiftness, striking the water with their powerful tail.

Squilla, seen from above.

M. Milne-Edwards divides the true *Squillæ* into two sub-genera:—1, Squilles Fines-Tailles; and, 2, Squilles Trapues.

1. Slender *Squillæ*.

The species arranged under this sub-genus are remarkable for the narrowing of the posterior portion of their thorax and the gradual enlargement of the abdomen. The sub-genus is divided by M. Milne-Edwards into the following sections:—

α. Species whose abdomen presents above neither crests nor large tubercles, and has its last segment twice and a half as wide as it is long; rounded and hardly dentilated.

S. maculata. Length from 10 to 12 inches. It inhabits the Asiatic seas.

β. Species whose abdomen presents above many longitudinal crests, or large elongated tubercles, and has its last segment in general nearly as long as it is wide.

* Rostral plate not covering the ophthalmic ring.

S. Mantis. Length 6 or 7 inches and upwards. It is found in the Mediterranean.

** Rostral plate entirely hiding the ophthalmic ring.

S. Perussaci. Length about 4 inches. It is found on the coasts of Sicily.

2. Stout *Squillæ*.

This sub-genus has the body very convex, all of a size, without any notable narrowing at the back part of the carapace.

S. stilifera. Length about 3 inches. It is a native of the island of Mauritius.

Gonodactylus (Latreille).—The principal distinction of this genus from the last group lies in the mode of conformation of the raptorial feet. The last joint of these organs, in lieu of having the form of the claw lamellar and strongly dentated, is straight, styliform, more or less convex at its base, and presents at most only vestiges of teeth on its prehensile border, which is enlarged. In general the convexity of the basilary portion is very considerable, and suffices to distinguish those crustaceans at the first glance.

* Rostral plate armed on the median line with a long spiniform tooth.

G. Chiragra. Length about 3½ inches. The species are found in all the seas of warm climates: the Mediterranean, American coasts, Seychelles Islands, near Trincomalee, and Tongataboo.

** Rostral plate rounded and nearly pointed in front.

G. Scyllarus. Length about 4½ inches. It is found in the Indian Seas and on the coasts of Mauritius.

Coronis (Latreille).—This form does not appear to M. Milne-Edwards to differ sufficiently from the *Squillæ*, properly so called, to authorise its generic separation; but as he had not observed it himself, he continues to retain it as a genus. The following is Latreille's character:—Lateral and posterior appendage of the third joint of the last six feet (the adactylous and thoracic) in form of a membranous blade or battledore (pallette), which is nearly orbicular and a little bordered (rebordée).

C. Scolopendra. (See Guerin, 'Iconographie,' pl. 24, fig. 2.)

STOMATE'LLA. [HALIOTIDÆ.]

STOMATES (from the Greek στόμα, an 'opening,' or 'mouth'), in Botany, are small longitudinal openings occurring in the epidermis of plants, and usually bounded by two or more lunate or kidney-shaped vesicles.

The first botanist who observed the existence of Stomates was Grew, who, in his 'Anatomy of Plants,' published in London in 1682, gave an imperfect representation of these organs, and stated that they existed on several parts of plants, but he gave them no special name. Malpighi afterwards described their existence in the epidermis of *Marchantiaceæ*, where they are very large, but entirely overlooked them in the higher plants. Guettard was the next writer who noticed them, and believing them to perform the office of glands, called them 'glandes miliaires' (glandulæ miliares). Saussure also thought them glandular bodies, and called them cortical glands. Hedwig and Gleichen were the first to give accurate drawings of them; and from that time their existence excited general attention, but they received a variety of designations. Hedwig called them Spiracula and Pori Exhalantes; De Candolle, Pores Corticaux; Krocker, Rimæ Annulatæ; Mirbel, Pores Elongées. Sprengel and other German writers designate them as Spaltöffnungen; Rudolphi called them Pores of the Epidermis; Link proposed the name Stomata, which has since been adopted by De Candolle, Brongniart, and Mirbel in France, and Lindley and Henslow in England. Link has however since proposed the name of Hautdrüsen (skin-glands), and this term is adopted by Meyen and later German botanists.

The structure of the Stomates is best seen in the monocotyledonous plants, in which they generally occur of a larger size. They are quite imperceptible to the naked eye, but may be discovered by a lens of low power. In general they will be found to consist of two kidney-shaped bodies, which are merely cells of cellular tissue filled with a green matter, and from this circumstance contrast with the transparent cuticle in which they are placed. The kidney-shaped bodies lie with their incurved edges presented to each other, and their extremities unite with each other so that they leave between them a little oval chink or opening. This opening communicates with the parenchyma of the leaf or other organ underneath the cuticle, and at this point the cellular tissue is loose, and frequently a large cavity is observed, into which the Stomate opens. Nees von Esenbeck, Brown, and others denied at first that the space between the lunate bodies was an opening, but the observation of later writers seems to have proved this point. (Lindley, 'Introd. Bot.,' p. 52.) This difference among observers may perhaps be explained by the fact that the kidney-shaped bodies have a power of contracting and dilating, and thus closing or opening the space between them. This was first observed by Comparetti, and has since been confirmed by other writers.

The Stomates are not all composed of two cells; those of *Marchantia*, according to Mirbel, are composed of four or five cells, which are arranged circularly, forming an upper outer rim of the Stomate. Sometimes additional cells are found above these, but they differ little, except in their arrangement, from the cells of the tissue by which they are surrounded. This is one of the simplest forms of Stomate. In *Nerium oleander* the Stomates consist of cavities in the cuticle, which are filled up with little hairs. Dr. Lindley has described in *Nepenthes* two sorts of Stomates, "the one oblong, semitransparent, and almost colourless, with numerous pellucid globules in the cavity of the cells; the other roundish, much more opaque, and coloured red." Although the form of the Stomates is most frequently elliptical, they are sometimes quite spherical, as in *Oncidium altissimum*, and Link has noticed them of a quadrangular form in *Yucca gloriosa*.

The Stomates are mostly arranged irregularly upon the surface of the epidermis, occupying generally about equal distances from each other. There are however some remarkable exceptions. In the grasses, for instance, and some other monocotyledonous plants, the Stomates are arranged in regular rows, which run parallel with the bundles of woody tissue which enter into the composition of the leaf. In *Phormium tenax* and in *Pinus* the Stomates are also arranged in a longitudinal series. In *Begonia spathulata* the Stomates on the under surface of the leaves are collected together in the form of little rosettes. The same is seen in *Crassula cordata* and *C. arborescens*.

Stomates are found on plants whenever there is a distinct epidermis, and they exist on nearly all the parts of a plant exposed to the light. In the lower cryptogamic plants, as mosses, *Fungi*, Lichens, and *Algæ*, they have never been found. Plants growing in the dark do not possess them, nor are they present on roots or the ribs of leaves. They are found on the bark of herbs and trees, but in the latter only whilst the bark is herbaceous. In those plants which live under water, as the *Zostera*, *Ceratophyllum*, and *Potamogeton*, they are not found. Those parts of the leaves of some plants which are concealed under the ground, as in the onion, &c., have no Stomates. All the parasitical plants which have not a green colour, as the *Orobanchaceæ*, *Lathræa*, and *Monotropa*, are destitute of Stomates, whilst those which are green, as the *Loranthus*, have abundance. They are only rarely found upon the filaments of the stamens, the anthers, or the styles. With the exception of *Canna*, they have not been found on the seeds of plants, nor are they present on fruits, except such as are membranous.

Stomates are not always present on both surfaces of the leaves. They are however much more frequently absent on the upper than on the under surface of the leaf.

The number of stomates contained in a given surface varies very much in different species and families of plants. Many observers have occupied themselves in counting them, and the following table gives the result of some of the observations of Sprengel, Krocker, Thomson, and Lindley on this point:—

Name of Plants.	Observer.	Number of Stomates in a square inch.	
		Under side.	Upper side.
Lilium album	Sprengel	17,280	3,556
L. bulbiferum	Hedwig	83,000	not counted
Tradescantia discolor	Sprengel	9,000	—
Alisma Plantago	Thomson	16,000	12,000
Andromeda speciosa	——	32,000	none
Hydrangea quercifolia	——	160,000	none
Sempervivum Tectorum	——	6,000	10,710
Rumex acetosa	——	20,000	11,088
Viscum album	——	200	200
Prunus Lauroceranus	Lindley	90,000	none
Orinum amabile	——	20,000	20,000
Stapelia (stem)	——	—	15,000
Cactus (stem)	——	—	15,000
Aloe (leaf)	——	20,000	25,000
Yucca	——	40,000	40,000
Pinus halepensis	Krocker	2,700	—
P. Abies	——	3,600	—
Aloe nigricans	——	7,200	—
Citrus aurantium	——	409,824	—
Solanum sanctum	——	448,704	—

Brown is of opinion that the figure, number, and size of the Stomates might often be made use of to indicate the affinities of genera and natural families of plants, and has proved that this is the case in *Proteaceæ*. Schleiden has pointed out the relations and differences of these organs in *Cactaceæ*, *Coniferæ*, *Piperaceæ*, and other orders.

Many different views have been taken of the function of Stomates. That they are organs by which the process of exhalation is carried on as a vital process, there is much reason to suppose. They exist in the greatest abundance in those parts of plants in which this operation is going on, they are also most abundant in membranous leaves, which are known to exhale most, and are deficient in succulent leaves, in which there is little exhalation. It was long ago observed by Comparetti, that the mouths of the Stomates were open by day and closed at night, and this is quite in accordance with what we know of the action of light on the function of exhalation. It is more active in the day, and the mouths of the Stomates are opened to allow of the exit of the vapour. Another argument in favour of this view is derived from the non-existence of Stomates in those families of plants in which no proper transpiration takes place. There is no doubt that the surface of plants absorb moisture when atmospheric conditions are favourable, and it is probable that under those circumstances the Stomates become organs of absorption.

(Meyen, *Pflanzen Physiologie;* Lindley, *Int. Bot.;* De Candolle, *Organographie Végétale;* Brongniart, *Ann. des Sc. Nat.*, 1834.)

STOMATIA. [HALIOTIDÆ.]

STO'MIAS, a genus of Fishes belonging to the family *Esocidæ*. They are distinguished by the muzzle being very short, the mouth very deeply cleft, the opercula reduced to small membranous laminæ; the maxillaries fixed to the cheek; the intermaxillary, palatine, and maxillary bones are rather sparingly furnished with teeth, and these are long and hooked, and similar teeth are observable on the tongue. The body is elongated, the ventral fins are placed very far back, and the dorsal fin is placed opposite the anal fin, on the hinder extremity of the body.

Only two species of this genus are known, both of which are inhabitants of the Mediterranean. One, *S. barbatus*, has been so called on account of its having a long barbule on the chin. Both species are of a black colour, but have numerous rows of small silver spots on the abdomen.

STONECHAT. [SAXICOLA.]

STONECROP. [SEDUM.]

STONESFIELD SLATE, a small band of rock separating the Great Oolite from the Inferior Oolite. The accumulation of organic remains in this formation is one of the most remarkable phenomena

known regarding the distribution of the fossils in the Oolitic Rocks. Coniferous, Cycadeous, and Filicoid Plants; Lamelliferous Corals, Conchifers, Gasteropods, Cephalopods, Crustaceans, Insects, Ganoid Fishes, Terrestrial and Aërial Saurians, Marsupial *Mammalia;* all these occur together, and suggest to the naturalist a variety of inferences and speculations. Viewed in their most general relations, the slaty beds of Stonesfield appear to be deposits produced in the sea near the shore in shallow water, at points to which fresh-water currents might send, at intervals, some of the spoils of the land. The Marine Conchifers are often found with valves united, and otherwise in conditions which indicate residence on or near the spot where they are buried; but the broken state of the Land Plants, the scattered elytra of Insects, the detached state of the teeth and bones of Fishes, Saurians, and *Mammalia*, seem the effect of transport from some distance. A great distance cannot well be supposed, for in that case we must imagine the course of a great river, and look for its effects over much wider areas than that of the Stonesfield Fossils. There are several rather similar deposits, and perhaps of the same or nearly the same geological date, in the Oolitic series of Northamptonshire and Yorkshire, but they seem to be due to separate areas of littoral agitation. The Fauna and Flora represented by these fossils is similar to that which now exists in Australia, and has suggested the conclusion that in Australia we have now a condition of the earth's surface such as existed in Europe during the deposition of the Oolitic beds. [Oolite.]

STORAX. [Styrax.]

STORKS. [Ciconia.]

STRAMONIUM. [Datura.]

STRAND-WOLF. [Hyænina.]

STRAPWORT. [Corrigiola.]

STRATA. In Geology, both the separately deposited layers of rock, and the rocks formed of these similar layers, accumulated together, have received the name of Strata. Dr. William Smith uses the term in the latter sense, and in general this is the meaning attached to it in those useful tabular expositions of the 'Series of Strata,' in various districts of the globe, which are now familiar to geologists. In special and local descriptions of rocks, the several beds are commonly enough called Strata (Couches, French). As a general scheme showing the rank frequently assigned to these and other terms, the following view may be useful, the most comprehensive term being to the left:—

Systems, Formations, Strata, Beds, Laminæ.

The terms Series and Group are very conveniently employed to collect under one head for purposes of reasoning, any of the laminæ, beds, strata, formations, or systems (or parts of one formation and parts of another), without any other limit than that imposed by the principle of grouping. For instance, the Belemnitic Series of strata includes the Lias Formation, Lower, Middle, and Upper Oolite Formations, and the Greensand and Chalk Formations; it includes two systems of Strata: by the Trilobitic Series of strata we may understand the whole of the Palæozoic Deposits, excepting perhaps the Magnesian Limestone and the oldest of the Slaty Rocks. [Stratification; Geology.]

STRATA, ALTERED. [Altered Strata.]

STRATIFICATION. Mineral masses, separately deposited, and arranged into parallel layers under the influence of gravitation, compose a large portion of the known rocky crust of the earth, and are called Stratified Rocks; other masses, in which no such successive deposition and tendency to be bounded by originally horizontal surfaces is traceable, are locally prevalent, and receive the name of Unstratified Rocks. They are generally supposed to be of igneous origin; the former are mostly known to be the fruit of sedimentary aggregation under water. To each class there are exceptions. Parts of certain limestone rocks, formed in water, as modern coral reefs, are really not at all or very slightly stratified; and certain melted rocks which have spread in successive sheets like lava over ancient surfaces, or have been forced by great lateral pressure between really stratified rocks, often assume the stratiform aspect. Without now dwelling on these and several other exceptional cases, it is our purpose to present a general view of the present state of knowledge of the phenomena of stratification, as exhibited in rocks which show clearly the fact of their mineral particles having been separately subject, during the aggregation of the mass, to the influence of gravitation, while partially supported in media lighter than themselves, as water and air, and generally influenced by lateral movements, such as occur in a state of nature in those almost universal fluids.

1. Let us suppose a case of a shower of comminuted mineral matter falling through a limited section of air on the ground. It will be collected in a conical form, the slopes of the cone having reference to the velocity of descent of the sandy particles, the mutual support they yield one to another, and the form of the surface on which they fall. Omitting these sources of variation, the slopes of the conical heap will be generally within moderate limits of uniformity, and the inclination of these slopes constitutes what is called the 'angle of rest.' A second shower of such sandy matters falling uniformly will cover the cone with a parallel sheath, and thus conical strata may result from such operations repeated. (*Fig.* 1.) The nearest analogy to this type of stratification occurs in a volcanic cone; where however

Fig. 1.

Vertical section of strata formed by conical superposition (theoretical).

the showers of ashes falling not uniformly, but in different quantities in different directions, the result is a streamy or imperfectly concentric stratification, characteristic of the cause, and presenting on a cross-section an appearance as in *fig.* 2.

Fig. 2.

Horizontal section of strata formed by falling of ashes round a vertical axis irregularly.

2. If further we suppose a shower of ashes or sands to be much affected while falling by horizontal currents of air, in this case the supposed conical heaps of *fig.* 1 will be drifted so as to show stratification inclined or dipping from the windy quarter. (*Fig.* 3.) Similar effects might follow the drifting of sand which had fallen into heaps.

Fig. 3.

Laminated deposits of sand by the effect of wind.

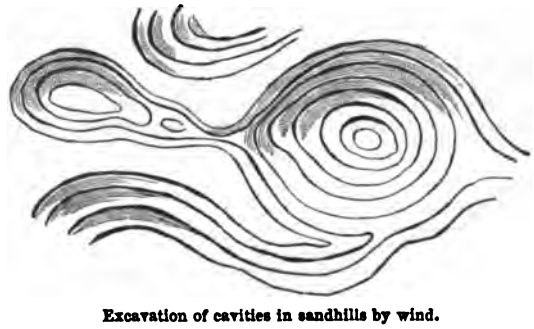
If the currents of air changed their direction at intervals, there would arise complication of the strata—oblique stratifications—such as are often seen in sandy rocks and sand-hills; and these would be more or less distinct as the interval between the winds had been marked by vegetation, sediment, or any other cause of consolidation of the surfaces. (*Fig.* 4.)

Fig. 4.

Oblique lamination in sand and gravel.

3. On surfaces of loose sand once deposited, under whatever of the influences stated, winds have the power of producing other effects: winds eddying among the inequalities of partially grass-grown sand-hills excavate in them circular, oval, or irregular pits, and make ridges and crests of fantastic forms. (*Fig.* 5.) Winds also wear away by

Fig. 5.



Excavation of cavities in sandhills by wind.

horizontal action the edges of these basins and crests, and make appearances of level stratification, as water which changes level wears its banks in parallel lines. Winds also by their peculiar action on fluid or loose masses, which move with a different velocity from the current of air, produce undulations on the surface of the sand lying across the current, and much resembling the 'ripple or current mark' (which is a secondary phenomenon from the same cause) on the beds of sand below agitated water.

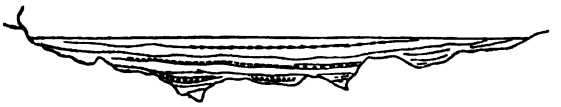
The falling velocity in air of the different sorts of mineral particles which enter into the composition of rocks is not materially different, even if the masses be considerably unequal in size; but both in regard

to falling in water and drifting by wind or water, the specific gravity and the magnitude of the masses require to be taken into account.

For our present purpose it is sufficient to observe that in a mixture of pebbles and sand, subject to drifting, there is an angle of ascent which limits the movement of the pebbles, and yet allows the sands to pass on. Hence, on the sea-coast, the almost stationary pebbly beach is margined on the landward side by parallel ridges of moving sand-hills, and thus a separation is effected of the bases of conglomerates and the bases of sandstones.

If now, instead of comminuted materials falling through air on the land or drifted by wind over its surface, we imagine such materials falling on and sinking in lakes perfectly calm, or the sea always in motion, other effects will follow, and other forms of stratification will result. In a calm lake the sediment may be supposed to fall vertically downwards, and, except the bed of the lake be very irregular, to settle in layers or strata of considerable uniformity. The least lateral movement, by mixing the suspended matter through the water, would tend to widen the deposit, and to fill up the inequalities of the lake-bed, so that by many repetitions a very irregular subaqueous surface would be equalised and levelled. This effect is perhaps actually witnessed in the sediment called trass which lies in the valley of Brohl, near Andernach; this is apparently derived from volcanic dust stratified in the water which received the shower of ashes. (*Fig.* 6.) Besides

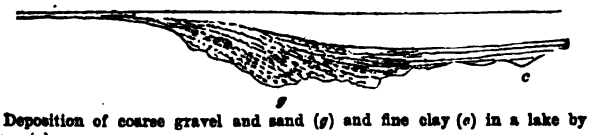
Fig. 6.



Arrangement of ashes falling in a lake.

showers of ashes, lakes and the sea receive comminuted mineral substances from shores wasted by tides and storms, and from rivers which transport detritus from the interior of the country. In a very calm lake the sediment from the influx of rivers subsides under the influence of gravitation downwards and communicated motion forwards, so that a kind of conical stratification in a delta continually advancing with a level top into the lake is the result. In this delta the arrangement of the strata is probably such as to exhibit successive layers dipping forward into the lake, but there may also be some more horizontal lines depending on the separation of the coarser and finer sediment, owing to their unequal falling velocity in water. Moreover the coarser sediment will fall near the point where the stream enters, and the finer will be longer suspended in water, be transported farther, and rest on more horizontal surfaces, and thus a new complication of the strata will arise, as represented in *fig.* 7.

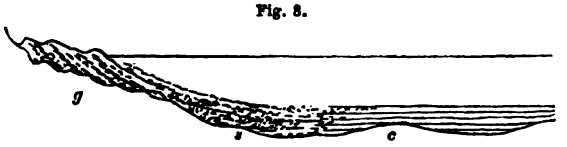
Fig. 7.



Deposition of coarse gravel and sand (*g*) and fine clay (*c*) in a lake by a river (*r*).

The earthy materials poured into the sea by rivers follow the same general laws of distribution, but are subject to the additional effects of tides and storms. The effects of these agencies are exhibited in great distinctness on coasts which confront violent winds and the full oceanic flow, and which are margined by pebbles and sands. The sands with ripple-marked surfaces gently inclined extend to some distance below low-water, the pebbles spread upwards in more steeply inclined banks thrown up and left by the breakers in heaps, long parallel ridges, and terraces. A contemporaneous surface of deposition in such cases may be as represented in *fig.* 8, where clay or sand below

Fig. 8.



Gravel beaches (*g*), sand beds (*s*), and fine clay (*c*) in the sea, under the influence of the tides.

low-water, and pebbles between low- and high-water, appear in a continuous layer. Such a surface differs from that found under a calm lake by the concave slope of its pebbly laminæ toward the shore, while the lake deposit has convex slopes in the same part.

Such appearances, at least partially, may perhaps be recognised among the strata accompanying coal, and in other groups of rocks where the unequal size of the granular materials and ancient exposure of these to littoral agitation supply the necessary conditions.

Near the shore various causes locally in operation are known to produce on the sea-bed that oblique and variously-directed lamination which has been already noticed as an effect of wind (*fig.* 4), and may be seen as an ordinary occurrence in the sections of diluvium, and in the banks of rapid rivers which change irregularly their channel. (Lyell, 'Principles of Geology.') Among the stratified rocks this appearance is common. It occurs in Sussex among wealden strata supposed to be of fluviatile origin; at Nottingham in new red-sandstone, which contains no internal evidence of the nature of the water in which it was arranged; in millstone grit of Yorkshire, and in the oolite of Weston near Malton, and Old Down near Bath, which are all deposits from the sea. It is perhaps impracticable to determine by mere inspection of the oblique lamination alluded to, the exact order of phenomena which occasioned it. Tidal agitation, fluviatile violence, the force of temporary inundations, sea-currents, each and all of these may have been concerned in the phenomena of this nature, which are so frequent in pebbly sandstones, and in general we may be justified in believing that such appearances may be safely ascribed in most cases to irregular violence of shallow water; while in regard to the more regular and extended parallel lamination of ordinary micaceous sandstones, and still more the fine uniform deposits of clay and argillaceous limestone, must be referred to the wider and gentler influence, and longer suspension due to calmer, that is to say, generally deeper water, farther from shore.

The changes to which the sedimentary deposits, which were the origin of stratified rocks, have been subject since their aggregation, are so considerable, as to gain for them, in extreme cases, the distinctive title of Metamorphic Rocks.

Consolidation of mass is the first of these changes to which we may here allude. It appears to be a phenomenon principally due to pressure: as in the buried peat of Dartmoor, and the buried clays of Holderness, the originally light and uncondensed matters have been compressed to some considerable firmness, solidity, and weight; so in respect of ancient clays, mere pressure appears to be a sufficient cause for their condensed, often shaly consistence. But more than this must be appealed to for the induration of slate, coal, limestone, and sandstone. The particles of these rocks cohere with force, by a process of internal molecular arrangement; and it appears to be a fair inference from numerous facts, that among the most influential of the exciting causes of this molecular action is the internal heat of the globe—locally manifested in the induration of stratified masses in the vicinity of trap dykes and other igneous rock-masses, and generally exhibited in the hardness, symmetrical structure, and crystalloid aspect of the lower and more ancient strata, which may be supposed to have been more subject, and for a longer time than the others, to the influence of subterranean heat.

Very unequivocal signs of this action of heat appear in the vicinity of the granite rocks of Cumberland, Devon, Cornwall, Wicklow, &c., and perhaps they are seldom absent from such situations. One of the most ordinary of such effects is the development, in the mass of the stratified rocks, of peculiar crystals, as felspar near the granite of Wastdale Head, in virtue of which slates become porphyry; of hornblende and chiastolite in those of Skiddaw, just as garnets are developed in argillaceous beds near the trap rocks of Teesdale and Anglesey. [Rocks.]

Some cases of re-arrangement of particles depend on molecular action, not excited by heat, but determined to particular centres by the previous existence there of solidified bodies. Oolite is an example of common occurrence among limestones of the secondary class, and few things are more interesting to examine than a polished slab of the oolite of the mountain limestone of Bristol and Lancashire, or the pisolite of Wilts. In the centre of the spherical grains of the former, and in or near the axis of the less regular nodules of the latter, are grains of sand, bits of shells, or small foraminifera, and round these parallel coats of carbonate of lime are neatly and concentrically arranged. An extremely large and irregular pisolitic nodule gives us the link between these concretionary arrangements and the 'nodules' or 'balls' of limestone and ironstone which inclose pieces of plants, leaflets of ferns, shells, bones, or fish-scales, and lie in parallel layers in the coal-shales, lias-clays, &c. These balls are evidently formed by accretion round the organic objects which they inclose, and the process is the more curious, because the matter of the ball is usually more calcareous or more ferruginous than the surrounding matrix, and seems to have been collected from out of it by some peculiar elective attraction depending on the nature of the organic body. (*Fig.* 9).

Fig. 9.

Re-arrangement of deposited matter in nodules, round organic or inorganic masses: *s*, one of these cracked as in *Septaria*.

In addition to this process, it has frequently happened that the 'ball' has been cracked internally across by subsequent contraction during consolidation, and the cracks are filled by carbonate of lime

iron pyrites, silica, &c., introduced through the apparently solid texture of the external parts according to the peculiar circumstances of the operation. Thus by a peculiar species of electrical transfer, analogous to what is supposed in the case of mineral veins, the internal cavities become filled, and the result is the septarium, for whose formation internal heat was once deemed necessary by the advocates of the Huttonian hypothesis. (Playfair, 'Illustrations,' p. 30.) Derived from sources so various, and aggregated under aqueous agencies so diversified in respect of power and direction, it is not surprising that the stratified rocks present themselves in a variety of appearances. It is clear that in the same bed of the ancient sea, or on the same basin of the actual sea, contemporaneous surfaces of deposition might extend over calcareous, argillaceous, arenaceous, and pebbly deposits: that in different basins contemporaneous deposits might be extremely unlike; and that metamorphism, more or less important, must be allowed to have often further increased such original diversity. Yet, notwithstanding these limitations, it appears to be a fact sufficiently established that there are general characters of mineral composition and structural aggregation which are associated with the strata of each great period of the earth's history, so as more or less completely to distinguish one period from another. [GEOLOGY.]

STRATIO'TES, a genus of Endogenous Plants belonging to the natural order *Hydrocharidaceæ*. It has a 3-parted calyx and 3 petals. The male flower has 12 or more stamens surrounded by numerous abortive ones. The female has 6 deeply bifid styles. The berry is inferior, 6-celled, and many-seeded.

S. aloides, Water-Soldier, has sword-shaped triangular ciliate spinous leaves. The root creeps extensively in the mud, and sends out rigid leaves like those of an aloe. The stalk is compressed, 5 or 6 inches high, with two leaves near its summit. The flower is white and delicate. It is a very ornamental aquatic plant, and is found in ditches in the east of England. It remains under water during the greater part of the year, but raises itself to the surface on special stalks during the season for fertilising the seeds.

STRAWBERRY, the English name of the fruit and plant of the *Fragaria*, a genus of Plants belonging to the natural order *Rosaceæ*. The fruit of the *Fragaria* is one of the most delicious of our summer fruits. The name *Fragaria* is derived from the Latin *Fragum*: and the English name from the practice in this country of cultivating the plant with straw surrounding it.

The genus *Fragaria* is known in its family by possessing a calyx with a concave tube, the limb of which is 10-parted, and the outer 5 segments accessory; 5 petals; stamens and carpels indefinite, the latter placed upon a fleshy and succulent receptacle, forming the juicy and succulent part of the fruit.

The species are perennial plants, throwing out runners; the leaves are trifoliate, each leaflet being coarsely toothed; the receptacle on which is seated the carpels, and which is called the fruit, is round, and assumes a variety of colours from a scarcely perceptible pink to a dark red.

Several species of this genus have been described. Linnæus gave only two; but Wildenow admitted eight; and Don, in 'Miller's Dictionary,' enumerates fourteen. Duchesne, who is followed by many French botanists, makes only two species, and makes the species of other writers varieties of these. All of them are natives of temperate or cold climates; and are found in Europe, America, and the mountains of Asia.

F. vesca, Wood or Alpine Strawberry, has plicate leaves, pilose beneath; the sepals reflexed, and the hairs on the peduncle pressed down. It is found wild in woods and on hill-sides throughout Europe, and is abundant in Great Britain. Duchesne describes eight varieties of this species, mostly characterised by the different form of the fruit or fleshy receptacle. Many of these produce the cultivated varieties which are known in gardens. The *F. v. semperflorens* produces the Red, the White, the American, and Danish Alpine strawberries, all of which are of a fine flavour, and greatly valued. *F. v. minor* produces the Red Wood-Strawberry, or Frasier d'Angleterre, and the White Wood-Strawberry, both very fine kinds. To the *F. v. flagellis* belongs the Red and White Alpine Bush-Strawberry, but these do not produce so good fruit as the last.

F. collina, the Hill Strawberry, has the sepals erect after flowering, and the hairs on the peduncles and calyx erect. This species is a native of Switzerland and Germany, and is characterised by its producing green fruit. The varieties of strawberries which are called Green are the produce of this species. In flavour and size they are only a second-rate strawberry.

F. Majaufea, the Majaufe of the French.

F. elatior, the Hautbois Strawberry, has the sepals reflexed on the peduncle, the hairs of the peduncles and petioles extending horizontally. It is a native of North America, and is occasionally found in groves in the south of England. The shape, size, and colour of the fruit of the Hautbois are subject to great varieties, according to its mode of cultivation. It is the parent of a great number of sorts known in gardens, most of which, when properly managed, produce fruits of a first-rate kind.

F. Virginiana, the Virginian Strawberry.

F. grandiflora, Large Flowered Strawberry, is a native of Surinam, and has furnished our gardens with the sorts called Pine Strawberries.

F. Chilensis, Chili Strawberry, is a native of South America, both in Chili and Peru.

STRAWBERRY-TREE. [ARBUTUS.]

STREPSI'CERUS. [ANTILOPEÆ.]

STREPSILAS. [CHARADRIADÆ.]

STREPSI'PTERA, an order of Insects, remarkable for having the anterior wings transformed into a pair of short, slender, contorted appendages, whilst the posterior are very large, and fold in the manner of a fan. The mouth is armed with two slender acute jaws and two 2-pointed palpi. The tarsi are 2- 3- or 4-jointed. The larva is vermiform, and has no feet. The pupæ are inactive. They are all very small creatures, the largest not so long as a quarter of an inch. The larvæ are parasitic on the bodies of wasps and bees. The perfect insects are very short-lived, but very active.

These insects are the *Rhipiptera* of Latreille (*Diptera Rhipidoptera* of Lamarck). Their systematic position has been much debated.

They were first observed by Mr. Kirby, who gives the following account of his discovery:—Observing acarus-like animals infesting the abdomens of various *Andrenæ*, he attempted to remove one, and to his surprise drew from the body of the bee a white fleshy larva a quarter of an inch long, the head of which he had mistaken for an acarus. "How the animal receives its nourishment seems a mystery. Upon examining the head under a strong magnifier, I could not discover any mouth or proboscis with which it might perforate the corneous covering of the abdomen, and so support itself by suction; on the under side of the head, at its junction with the body, there was a concavity; but I could observe nothing in this but a uniform unbroken surface. As the body of the animal is inserted in the body of the bee, does that part receive its nutriment from it by absorption? After I had examined one specimen, I attempted to extract a second; and the reader may imagine how greatly my astonishment was increased, when, after I had drawn it out a little way, I saw its skin burst, and a head as black as ink, with large staring eyes, and antennæ consisting of two branches, break forth and move itself briskly from side to side. It looked like a little imp of darkness just emerging from the infernal regions. I was impatient to become better acquainted with so singular a creature. When it was completely disengaged, and I had secured it from making its escape, I set myself to examine it as accurately as possible, and I found, after a careful inquiry, that I had not only got a nondescript, but also an insect of a new genus, whose very class seemed dubious." ('Monographia Apium Angliæ,' vol. ii. p. 111.)

Stylops and *Xenos* are the only two genera belonging to this order. (Westwood, *Families of Insects.*)

STREPTAXIS (J. E. Gray), a genus of *Mollusca*, separated from *Helix* on account of the eccentricity of the penultimate whorl. [HELICIDÆ.]

STREPTOSPO'NDYLUS, H. Von Meyer's name for an extinct genus of Reptiles belonging to the Cœlospondylian tribe of the Crocodilian order in the arrangement of Professor Owen, who thus defines the vertebral characters of this highly-interesting form, the *Steneosaurus rostro-major* of Geoffroy, and the Crocodile d'Honfleur of Cuvier:—

"The distinguishing vertebral characters are a ball-and-socket articulation of the bodies of the vertebræ; but the positions of the ball and cavity are the reverse of those in the existing crocodiles, the convexity being on the anterior part of the vertebræ, and the concavity directed backwards. In the anterior vertebræ, which have the ribs articulated with the body, there is a deep pit behind the costal articular surface; the transverse process rises by four salient ridges, one from each oblique process, and the two inferior and principal ones from the base of the neurapophysis; these ridges converge at an acute angle as they ascend, and meet at the under part of the tranverse process, so as to include a triangular space, which is deeply concave. A third salient ridge ascends from the fore part of the base of the neurapophysis to the anterior oblique process, nearly parallel with the posterior of the two last-mentioned ridges, so that the side of each neurapophysis appears as if marked with the letter N in high relief. In the cervical and anterior dorsal vertebræ there are, instead of a single inferior spinous process, two ridges, which terminate each in front by a tubercle." ('Report on British Fossil Reptiles:' British Association.)

Portions of the remains of this animal have been found in the Oolite in the vicinity of Chipping Norton, among which the anterior half of an anterior dorsal vertebra belonging to this animal, and in the collection of Mr. Kingdon of that town, is minutely described in Professor Owen's report. Other vertebræ were also found.

A portion of a compressed conical hollow tooth, with a brown dense glistening dentine, resembling that of the *Megalosaurus*, was associated with the vertebræ. The length of this fragment is 2 inches 4 lines, but both ends are wanting. The breadth is 8 lines; the thickness 5 lines.

"If it really belongs to the *Streptospondylus*," says Professor Owen, "it confirms the view of the affinity of that genus to *Megalosaurus*, which has been suggested by the characters of the vertebra."

Professor Owen notices a posterior dorsal vertebra from the jet-rock

(lias shale) near Whitby (much more complete than the preceding specimen, and nearly corresponding in size with the dorsal vertebræ of the Honfleur *Streptospondylus* described by Cuvier), in the collection of Mr. Ripley of Whitby; and informs us that the third British formation in which he has determined the remains of the genus is the Wealden, specimens having been obtained from three localities, namely, Tilgate Forest, in Sussex, and Brook Point and Culver Cliff, in the Isle of Wight. The specimens, he observes, differ in size, being larger than the *Streptospondylus Cuvieri* from the Oolite, and he strongly suspects that they indicate a different species; indeed he names it *Streptospondylus major*, but remarks that the means of comparison for the satisfactory establishment of the distinction are as yet wanting. Professor Owen also makes mention of a cervical vertebra associated, as in the Mantellian Collection, with vertebræ of the *Iguanodon* and *Cetiosaurus*, which had been washed out of the submarine Wealden beds at the south side of the Isle of Wight, and thrown on shore near Culver Cliffs and Brook Point. Some idea of the size of this reptile may be derived from Professor Owen's admeasurements, which give 5 inches as the transverse diameter of the posterior concave articular surface in the Wealden, and 6 inches in the Culver Cliff specimen, whilst the transverse diameter of the body across the inferior transverse processes is 6 inches in the Tilgate, and 6 inches 6 lines in the Culver Cliff specimen, the height of the latter from the lower surface of the centrum to the hind part of the base of the spine being 7 inches 9 lines.

The foreign localities in which remains of *Streptospondylus* have been found are the Oxford clay formation at Honfleur, and the Kimmeridge clay at Havre (Cuvier); and the Lias of Altdorf (H. Von Meyer).

The form of this extinct Saurian is highly interesting, for it presents those transitional characters which, while they beautifully manifest the passage, so to speak, from one specific form to another, are too apt to lead a superficial observer to wild speculations. Professor Owen, in his luminous argument at the close of the valuable Report above quoted, against the transmutation theory—fallacy, we would venture to call it—of Maillet, Lamarck, the less learned author of the 'Vestiges of the Natural History of Creation,' and their followers, observes that if the three forms of extinct Saurians, *Ichthyosaurus*, *Plesiosaurus*, and *Teleosaurus*, whose changes of specific and generic characters have thus been speculated upon, had actually succeeded each other in strata successively superimposed in the order here set forth, some colour of probability might attach itself to this hypothesis, and there would be ground for searching more closely into the anatomical and physiological possibilities of such transmutations. Those genera however, he observes, appeared contemporaneously on the stage of vital existence; one neither preceded nor came after the other. How the transmutation theory is to be reconciled to these facts is not, he justly observes, obvious, nor to these other, namely, that the Teleosaur ceases with the oolite, while the Ichthyosaur and Plesiosaur continue to co-exist to the deposition of the chalk, and disappear together alike unchanged; the Ichthyosaur manifesting as little tendency to develop itself into a Plesiosaur as this to degrade itself into the more fish-like form of the Enaliosaurian type.

"If," says Professor Owen, "it were urged that the *Streptospondylus*, or crocodile with ball-and-socket vertebræ, of which the remains occur in later secondary strata, when the Teleosaur had ceased to exist, might be a modification of the apparently extinct Amphicœlian Crocodile, in which the vertebræ had undergone a progressive development analogous to that by which the biconcave joints of the vertebræ of the tadpole are actually converted into the ball-and-socket joints of those of the mature Frog, the facts of both geology and anatomy again oppose themselves to such an hypothesis; for the remains of the *Streptospondylus* occur likewise in the Whitby Lias, which is the earliest formation characterised by remains of the *Teleosaurus*; and the modification of the vertebral structure by which the *Streptospondylus* differs from its ancient contemporary, and which it retains unaltered throughout the whole series of oolitic strata, is no approximation to the ball-and-socket structure of modern crocodiles, which first appears in the *Mosasaurus* and the Eocene Crocodiles, but is the very reverse. As reasonably might we infer that the Teleosaur was an intermediate form between the *Streptospondylus* and modern crocodiles, and that the anterior ball had first subsided, and a subbiconcave type of vertebræ had been produced before the posterior ball which characterises the vertebræ of recent crocodiles was finally developed. If the present species of animals had resulted from progressive development and transmutation of former species, each class ought now to present its typical characters under their highest recognised conditions of organisation; but the review of the characters of fossil reptiles taken in the present Report proves that this is not the case. No reptile now exists which combines a complicated and thecodont dentition with limbs so proportionally large and strong, having such well-developed marrow-bones, and sustaining the weight of the trunk by synchondrosis or anchylosis to so long and complicated a sacrum, as in the order *Dinosauria*. The Megalosaurs and Iguanodons, rejoicing in these undeniably most perfect modifications of the Reptilian type, attained the greatest bulk, and must have played the most conspicuous parts in their respective characters as devourers of animals and feeders upon vegetables that this earth has ever witnessed as oviparous and cold-blooded creatures. They were as superior in organisation and in bulk to the crocodiles that preceded them as to those which came after them."

There is not the slightest ground for affirming that the procœlian gavial of the present day is in any respect more highly organised than the opisthocœlian gavial of the oldest lias. If the differences of vertebral structure in these crocodilians were contrasted in reference to their relative approximation to the vertebral structure of the higher animals, the resemblance of the ball-and-socket joints of the spine of the *Streptospondylus* to those of certain mammals would give precedence in organic perfection to the primæval gavial. If therefore the extinct species, in which the Reptilian organisation culminated, were on the march of development to a higher type, the *Megalosaurus* ought to have given origin to the carnivorous *Mammalia*, and the herbivorous should have been derived from the *Iguanodon*. "But where is the trace of such *Mammalia* in the strata immediately succeeding those in which we lose sight of the relics of the great Dinosaurian Reptiles; or where indeed can any mammiferous animal be pointed out whose organisation can by any ingenuity or licence of conjecture be derived, without violation of all known anatomical and physiological principles, from transmutation or progressive development of the highest reptiles? If something more than a slight inspection be bestowed upon the organic relics deposited in the crust of the globe, we learn that the introduction of *Mammalia* on that crust is independent of the appearance of the highest forms of reptiles. The small insectivorous mammals of the lower oolite are contemporary with the most ancient *Dinosaurus*, and are anterior to the *Iguanodon*. The period when the class of reptiles flourished under the widest modifications, in the greatest number, and of the highest grade of organisation, is passed; and since the extinction of the Dinosaurian order it has been declining. The *Reptilia* are now in great part superseded by higher classes. Pterodactyles have given way to Birds; Megalosaurs and Iguanodons to carnivorous and herbivorous *Mammalia*; but the sudden extinction of the one and the abrupt appearance of the other, are alike inexplicable on any known natural causes or analogies." (Owen.)

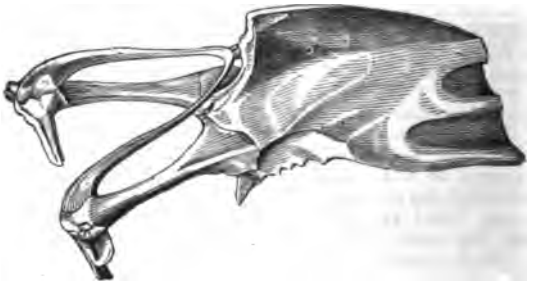
STRIATOPORA. [SUPPLEMENT.]

STRIGATELLA. [VOLUTIDÆ.]

STRI'GIDÆ, a family of Birds, including the Nocturnal Birds of Prey commonly known as Owls.

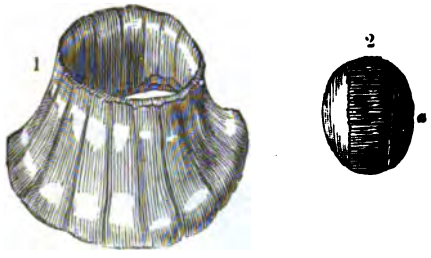
This natural family have large heads and great projecting eyes directed forwards, and surrounded with a circle or disc (more or less developed according to the nocturnal or comparatively diurnal habits of the species) formed of loose and delicate feathers; a raptorial beak; crooked claws; and a downy plumage, generally spotted, powdered, or barred with different shades of brown and yellow.

Mr. Yarrell, in his paper on the 'Anatomy of Birds of Prey' ('Zool. Journal,' vol. iii.), points out the diminished extent of surface and power in the sternum of the Owls as compared with that of the Peregrine Falcon. [FALCONIDÆ.] And he observes, that from the loose and soft nature of the plumage in these birds, as well as their deficiency in muscle and bone, rapid flight is denied them as useless, if not dangerous, from the state of the atmosphere at the time they are destined to seek their food; but, he adds, they are recompensed for this loss, partly by their acute sense of hearing, from an extension of the posterior edge of the cranium forming a conch, coupled with a very large external orifice; and partly by the beautifully serrated exterior edge of the wing primaries, which, allowing them to range without noise through the air, enables them to approach unheard their unsuspecting victim, which falls a prey to the silent flight and piercing eye of an inveterate enemy. He further remarks, that some increase and variation will be found in the strength and form of such of the Owls as depart from the type of the true nocturnal bird. In the Snowy Owl and Short-Eared Owls, which are described as occasionally taking their food by day, the furcula, Mr. Yarrell observes, is stronger and less angular in proportion than in the Wood- and Barn-Owls. The trachea, he tells us, of the different species of Owls so nearly resembles the same part in the Falcons, that a separate description is unnecessary, and the same may be said generally of the œsophagus, stomach, and intestines, as the similarity of food would appear to require. Mr. Yarrell found the two cœcal appendages considerably developed in the species of *Strix*; in the Barn-Owl (*S. flammea*), as



Sternum of Wood-Owl (*Strix Stridula*). (Yarrell.)

well as in the Short-Eared Owl, they are, he states, small at their origin, afterwards dilated, and each one inch and three-quarters in length. The crop is large, and the stomach or gizzard is considerably muscular notwithstanding the nature of their living prey. The brain is well developed in this family, and the senses of sight, hearing, taste, and smell, especially the two former, are enjoyed in a considerable degree of perfection. Mr. Yarrell observes (loc. cit.) that the external form of the bony ring in the Golden Eagle [FALCONIDÆ] will be found to extend through all the species of every genus of British birds, except the Owls, in all of which it is concave. The bony ring of the Snowy Owl has fifteen plates forming the circle, and they are considerably lengthened. The transparent cornea being placed as it were at the end of a tube is thus, he remarks, carried forward beyond the intervention of the loose and downy feathers of the head. It is this

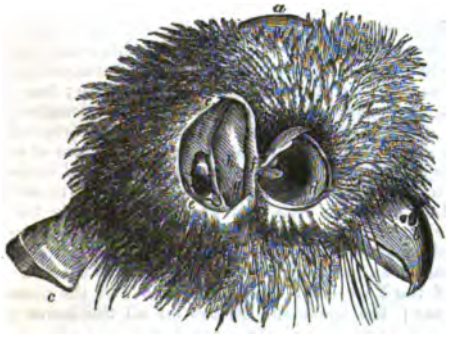


1, bony ring of a Snowy Owl; 2, crystalline lens of the same bird: *a*, the anterior surface, less convex than the posterior one. (Yarrell.)

position of the eyes, observes the same author, giving a particular fulness and breadth to the head, which has gained for the Owl the intellectual character universally awarded to it. The concave facial disc of feathers with which they are surrounded materially aids vision by concentrating the rays of light.

Head of Barn-Owl (*Strix flammea*).

The sense of hearing appears to be very acute in the *Strigidæ:* they not only look, but listen for prey.



Head of a young White or Barn-Owl (*Strix flammea*).

The down pressed backwards and forwards, to expose the auditory passage and operculum. *a*, cranium; *b*, bill perforated by the nostril; *c*, neck; *d*, eye; *e*, termination of external skin surrounding the orifice of the ear; *f*, anterior flap or opercular fold of the ear; *g*, part of the tympanic or quadrate bone; *h*, membrana tympani. ('Cat. Mus. Coll. Chir.,' vol. iii.)

Smell, taste, and touch appear to be developed nearly as they are in the *Falconidæ.* Preparations of the structure of the *Strigidæ* are to be seen in the Museum of the Royal College of Surgeons of England in London.

Foot of White or Barn-Owl (*Strix flammea*).

Zoologists are generally agreed in the position assigned to the Owls. In Belon and Gesner we find them next to the diurnal birds of prey. In the work of the former the Cuckoo indeed intervenes; but the external similitude between that species and the birds of prey accounts for the intervention. In Gesner the Shrikes come between the diurnal and nocturnal predacious birds.

Willughby divides the birds of prey into the diurnal and the nocturnal, placing in the last subdivision of the former the Butcher-Birds and Birds of Paradise. The latter he separates into two sections—1, the horned, or eared; 2, those without horns.

Brisson places the Owls in the second section of his third order, which consists of birds with a short and hooked bill. This second section is defined as comprising species the base of whose bill is covered with feathers directed forwards.

The genus *Strix* stands among the *Accipitres* in the 'Systema Naturæ,' between the genera *Falco* and *Lanius*, which last concludes that order of Linnæus.

Latham places the Owls at the end of the birds of prey, and so do Lacépède, Duméril, and Meyer. Illiger, on the contrary, makes the *Nocturni* the first of his order *Raptatores.* Cuvier makes them follow the Diurnes; and they immediately precede the Passereaux, among which last the Butcher-Birds hold the first place in the first family, *Dentirostres.* Vieillot arranges the Owls with the family name of Ægolians, under his second tribe (*Nocturni*) of his first order *Accipitres.*

M. Temminck places them at the end of his first order (*Rapaces*); and, in his 'Manuel' of European birds, divides the family of Owls into two divisions—1st, the Chouettes, properly so called; 2nd, the Chouettes Hiboux.

The first division, or Chats-Huants, he subdivides into two sections, placing in the first section the Accipitrine Owls, or those which see well and pursue their prey by day; and in the second section the Nocturnal Owls, which hunt in no light stronger than twilight or moonlight, and conceal themselves during the day.

In the first section of the first division M. Temminck places the following species:—*Strix Lapponica, S. nyctea, S. Uralensis, and S. funerea.*

In the second we find *S. nebulosa, S. Aluco, S. flammea, S. passerina, S. Tengmalmi,* and *S. Acadica.*

Under the second division, Chouettes Hiboux, distinguished by two tufts of feathers situated more or less forward upon the front, and capable of erection (whence their English appellation of Horned Owls), he arranges *Strix brachyotus, S. Bubo, S. Otus,* and *S. Scops.*

Mr. Vigors, who makes his first order (*Raptores*) consist of the families *Vulturidæ, Falconidæ, Strigidæ,* and *Gypogeranidæ,* says, that if we search for the connection between the *Falconidæ* and the *Strigidæ,* we shall not fail to find their affinity apparent, as is usual, in the less typical part of the two groups.

Mr. Swainson states that the divisions of the *Strigidæ* made by modern ornithologists can all be referred to one or other of the following groups:—1, Typical Owls, having the facial disc very large and complete, with large ears and (in general) an ample operculum; 2, Horned Owls, furnished with egrets and a large facial disc, but having only small or moderate-sized ears; and 3, Diurnal or Hawk-Owls, where the conch of the ear is comparatively small, and is destitute of an operculum: the head has no egrets, and the facial disc is imperfect or obsolete. The first he considers the typical group; the second the subtypical; and the third the aberrant group.

The following table gives Mr. Swainson's arrangement of the entire family:—

Strigidæ.—The Owls.

	Genera.
1. Typical Group.—Ears large, operculated, no egrets	*Strix*.
2. Subtypical.—Ears smaller, no operculum, egrets	*Asio*.
Ears small, no egrets or operculum, disc imperfect.	
3. Aberrant.—Head small, claws feathered, tail short	*Nyctea*.
Head large, claws naked, tail moderate	*Nyctipetes*.
Head small, claws feathered, tail wedged	*Surnia*.

Mr. G. R. Gray makes the *Accipitres Nocturni* the second sub-order of his first order *Accipitres*. His third family, the first of that sub-order, is formed of the *Strigidæ*, which are thus subdivided by him:—

Sub-Family 1.—*Surninæ*.

Genera.—*Surnia*, Dum. (*Syrnia*, Steph., *Strix*, Gm.); *Accaba*, Wagl. (*Surnia*, Cuv., *Strix*, Shaw); *Nyctea*, Steph. (*Nootua*, Cuv., *Nyctia*, Sw.); *Athene*, Boie (*Nyctipetes*, Sw., *Strix*, Daud.); *Huhua*, Hodgs.

Sub-Family 2.—*Buboninæ*.

Genera.—*Scops*, Sav., (*Scops*, Sav., *Asio*, Briss., *Otus*, Less., *Strix*, Linn.); *Lophostrix*, Less., *Ketupa*, Less. (*Cultrunguis*, Hodgs., *Strix*, Gm.); *Bubo*, Sibb. (*Feliceps*, Barr., *Asio*, Antiq., *Ulula*, Bonap., *Heliaptex*, Sw., *Ascalaphus*, J. Geoff., *Strix*, Linn.).

Sub-Family 3.—*Ululinæ*.

Genera.—*Syrnium*, Sav. (*Scotiaptex*, Sw., *Ulula*, Briss., *Strix*, Linn.); *Otus*, Ray (*Asio*, Briss., *Brachyotus*, Gould, *Strix*, Linn.); *Urrua*, Hodgs.; *Nyctalops*, Wagl.; *Ulula*, Cuv. (*Strix*, Gm.); *Glaucidium*, Boie (*Strix*, Linn., *Noctua*, Cuv., *Athene*, Boie); *Nyctale*, Brehm (*Scotophilus*, Sw., *Nudipedes* and *Ptilipedes*, Less., *Strix*, Bechst., *Athene*, Boie); *Ninox*, Hodgson.

Sub-Family 4.—*Striginæ*.

Genera.—*Strix*, Linn.; *Pholidus*, J. Geoff. (*Strix*, Horsf.); *Bulaca*, Hodgson.

The geographical distribution of this family is very wide; extending as high as the Polar Sea, where *Strix Nyctea* is recorded by Sabine as having been seen on the islands in the summer months, and by James Ross as having been observed about Victoria Harbour throughout the winter, where several pairs had bred in the preceding autumn; and as low at least as Port Famine in the Straits of Magellan (*Strix rufipes* and *S. nana*, &c., King). Species are found in Europe, Asia, Africa, America, and in Australia.

They feed on birds and quadrupeds, and even fish (in the case of *Strix nyctea* and *S. flammea*), according to the size of the species. Hares, partridges, grouse, and even the turkey, are attacked by the larger horned owls of Europe and America; while mice, shrews, small birds, snakes, and crabs suffice for the inferior strength of the smaller *Strigidæ*. Mr. Yarrell states that the Short-Eared Owl (*Strix brachyotus*) is the only bird of prey in which he ever found the remains of a bat.

The species are numerous, and the British Museum contains a very fine collection of them. Our limits will not permit us to do more than notice a very few. The larger horned owls are described in the article BUBO.

Strix flammea, the common White or Barn-Owl, is the Effraie, Fresaie, and Petit Chathuant Plombé of the French; Barbagianni, Alloco Commune e Bianco of the Italians; Schleierkaus, Perlschlierkauts, and Perl-Eule of the Germans; De Kerkuil of the Netherlands; Barn-Owl, White Owl, Church-Owl, Gillihowlet, Howlet, Madge-Howlet, Madge-Owl, Hissing-Owl, and Screech-Owl of the English; and Dylluan Wen of the Welsh. The upper parts are bright yellowish, varied with gray and brown zig-zag lines, and sprinkled with a multitude of small whitish dots; face and throat white; lower parts in some individuals rusty-white, sprinkled with small brown dots; in others bright white, marked with small brownish points; in others again without the slightest appearance of spots; feet and toes covered with a very short down, more scanty on the toes: iris yellow. Length about 13 inches. In the female all the tints are brighter, and more developed. The young are covered with a thick white down, and remain long in the nest. Mr. Blyth states that the first set of feathers grows very slowly, and is not moulted till the second autumn.

Varieties.—Whitish, or entirely white.

This bird is common in England and Ireland, less common in Scotland. Not common in the Orkneys, but present in some of the islands. Found in Denmark, but said not to inhabit Sweden or Norway; generally spread over temperate Europe; found in Madeira; common in Lorraine; extending in Africa from the north to the Cape of Good Hope; met with in India, Japan, and Australia.

Montagu says that this species is never known to hoot. Mr. Yarrell states that it screeches, but does not generally hoot. Sir W. Jardine declares that he shot one in the act of hooting; and that at night, when not alarmed, hooting is their general cry. It snores and hisses, and, like other owls when annoyed or frightened, snaps its bill loudly. Rats, mice, shrews, young birds, and beetles, form their food, and the mice especially suffer when the White Owl has a young brood to sustain. It has been seen to catch fish. This owl frequents churches, old buildings, and barns, often breeding in the latter, as well as in hollow trees near farmyards and villages. The nest is but a rough one, and the female lays three or four white eggs more oval than those of the Brown or Ivy-Owl, and not so large. Young have been found so late as July, September, and even December. Mr. Blyth, in the 'Field Naturalist's Magazine' (vol. i.), throws some light upon this. "A nest of the Barn-Owl last summer," says he, "in this neighbourhood (Tooting), contained two eggs, and when these were hatched two more were laid, which latter were probably hatched by the warmth of the young birds; a third laying took place, after the latter were hatched, and the nest at last contained six young owls of three different ages, which were all reared." Mr. Yarrell states that he has been frequently told by boys in the country, that they had found eggs and young birds at the same time in this bird's nest. The food is generally swallowed whole, and the bones and fur or feathers rejected in pellets called castings, as indeed is generally the case with this family.

In captivity the Barn-Owl is sociable with other birds, but will sometimes, like the dogs, hide what remains of its meat.

Barn-Owl (*Strix flammea*).

Surnia Uralensis, the Ural Owl, is the *Strix Uralensis* of Pallas; *S. liturata*, Retz; *S. macroura*, Natterer; *S. macrocephala*, Meisner; La Chouette des Monts-Urals, Sonnini; Die Ural Habichtseule, Bechstein; Habichtseule, Naumann; Uralischer und Grossköpfiger Baumkauts, Brehm.

The face is whitish; tail much graduated, much longer than the wings; all the plumage striped with large longitudinal spots and streaks.

Old of both Sexes.—The head is of considerable size; face very large, well feathered, grayish-white, marked with some blackish hairs; a large circle of white feathers spotted with brownish-black, takes its origin on the forehead, and frames in the whole face; top of the head, nape, back, and wing-coverts, marked with great longitudinal spots, which are disposed on a whitish ground; throat, front of the neck, and all the lower parts whitish, marked on the middle of each feather with a large longitudinal brown stripe; quills and tail-feathers banded with brown and dirty white alternately; seven of these bands may be counted on the tail; beak yellow, nearly hidden in the long hairs of the face; iris brown; tarsi and toes covered with white hairs marked with small brown points; claws very long, yellowish. Length of tail 10 inches and some lines; total length about 2 feet.

Young of the Year.—All the ground-colour of the plumage bright brownish-gray; the spots and stripes on all the lower parts ashy-brown; upper parts irregularly spotted with ashy-brown and light red, and variegated with oval white spots; wings and tail transversely banded with grey, the seven bands of the tail whitish-ash.

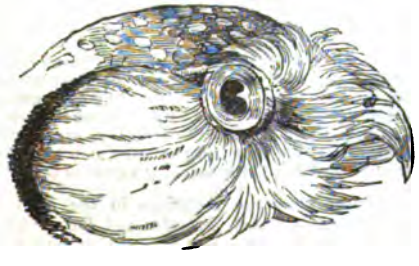
It is found in the arctic regions of the Old World, Lapland, North of Sweden, Norway and Russia, Livonia and Hungary, and Japan. Very rare in the eastern parts of Germany; very accidentally found elsewhere. Mr. Gould regards it as one of the rarest European Owls.

It eats leverets, cats, mice, ptarmigan, and small birds. The nest is formed in the holes of trees, often near the habitations of man. Mr. Gould states that the number of eggs is two; M. Temminck says three or four: they are pure white.

Ural Owl (*Surnia Uralensis*).

Surnia funerea, the Canada Owl. It is the *Strix Ulula*, Linn.; *S. funerea*, Gm.; *S. Hudsonia*, Gm.; *S. Canadensis et Freti Hudsonis*, Briss.; *S. Hudsonia*, Wils.; *S. nisoria*, Meyer; Chouette de Canada et Chouette Epervière, ou Caparacoch, and Chouette à Longue Queue de Siberie, Buffon ('Eul.' 463, a very good figure of this species, under the erroneous name of the Ural Mountains Owl); Chouette Epervière, Sonn.; Sperbereule, Meyer; Naum.; Habichteule, Bechst.; Plattköpfige and Hochköpfige Habichteule, Brehm.; Hawk-Owl of Pennant and Wilson; Little Hawk-Owl of Edwards; Paypaw Theecawsew, or Cobadecootch of the Cree Indians; Theechazza of the Copper Indians and Chepewyans; and Ood no Hseoot of the Esquimaux.

The forehead is dotted with white and brown; a black band takes its origin behind the eyes, includes the orifice of the ears as in a frame, and terminates on the sides of the neck; upper parts marked with brown and white spots of various forms; on the borders of the wings are similar white spots disposed on a brown ground; throat whitish; the other lower parts white, transversely striped with ashy-brown; at the insertion of the wings a great spot of blackish-brown; tail-feathers ashy-brown, striped at considerable distances with transversal narrow zigzags; bill yellow, varied with black spots according to age; iris bright yellow; feet feathered to the claws. Length of tail 6 inches and some lines. Total length upwards of 14 inches (Temminck); Richardson says 18 inches.



Profile of Hawk-Owl (*Surnia funerea*).

The colours of the female are less pure than those of the male, and she is rather larger.

It is found in the Arctic Circle and Arctic regions of both continents; sometimes seen as a bird of passage in Germany, more rarely in France, but never in the southern provinces.

The visual organs of this species are more able to bear the light of day, at least in dull weather, and, like the Snowy Owl, it hunts frequently in the day-time. The smaller head and less perfect facial disc, combined with these habits, have obtained for it the name of Hawk-Owl.

Hawk-Owl (*Surnia funerea*).

Surnia nyctea, Snowy or Ermine Owl. It is the *Strix nyctea*, Forster, Latham, and Gmelin; *S. candida*, Latham; *S. nivea*, Daudin; Chouette Harfang, Buffon; Chouette Blanche, Le Vaillant; Alucco Diurno, 'Stor. degl. Ucc.;' Schneekauz, Bechst.; Sneuwuil, Sepp.; Nordicher Schneekautz and Schnee Eule, Brehm; Great White Owl, Edwards; Snow-Owl, Wilson; Wapow-Keetho or Wapohoo of the Cree Indians; and Ookpeeguak of the Esquimaux.

Head small in proportion; bill black, entirely hidden by the hairy feathers at its base; plumage snow-white, but more or less variegated with transverse brown spots or stripes; the younger the bird is, the larger and more numerous are these spots and stripes; very old individuals are pure white, without any brown spot; iris fine orange-yellow; feet very well covered, so as to look almost woolly to the claws; tail rounded, not much exceeding in length the extremity of the wings. Length 24 or 25 inches. Female considerably larger than the male.

Young at the time of departure from the nest covered with brown down; the first feathers bright down.

It is found in the Arctic regions of the Old and New World, Iceland Sweden, Norway, Lapland, and the north of Europe generally.

Specimens in different stages of plumage are generally to be seen in the garden of the Zoological Society in the Regent's Park.

The following are also European species:—*Bubo maximus**, *B. Acalaphus*, *Otus vulgaris**, *O. brachyotos**, *Scops Aldrovandi**, *Surnia cinerea*, *Ulula nebulosa*, *Syrnium Aluco**, *Noctua nudipes** (Gould—*Strix nudipes*, Auct.), *Noctua Tengmalmi**, and *N. Passerina** (Gould—*Strix passerina*, Auct.).

(Those marked * are in the 'Catalogue of British Birds.' Mr. Yarrell gives *Strix passerina* and *Noctua nudipes*, Gould, as synonyms.)

Strix badia, Horsf., Wowo-wiwi, or Kalong-wiwi of the Javanese, is an Asiatic species. Dr. Horsfield states that this species, whose head is proportionally large, has a general resemblance to *S. flammea* in the distribution of its colours and external marks. The upper parts are, he observes, generally dark, and the lower of a paler hue. The neck is surrounded by a loose ornamental collar; the plumes encircling the eyes are rigid, and disposed with perfect regularity, and the legs are entirely covered. A resemblance also exists, he adds, in the lustre of their covering. It is a native of Java, in the closest forests of the district of Pugar, and the ranges of low hills south of the capital of Surakarta. (Horsfield.)

The habits of this species are nocturnal. Dr. Horsfield speaking of *S. Javanica* (which, he says, his specimens show to be merely a variety of *S. flammea*), remarks, that it is the only species of this division

which is occasionally found near villages and dwellings. "It is not however a favourite with the natives; various superstitious notions are also in Java associated with its visits; and it is considered in many parts of the island as protending evil. The other species of this division are by no means common, and the *S. badia* is one of those that are most rarely met with. It never visits the villages, but resides in the closest forests, which are the usual resort of the tiger. The natives even assert that the Wowo-wiwi approaches this animal with the same familiarity with which the Jallak (the Pastor Jalla of our catalogue) approaches the Buffalo, and that it has no dread to alight on the tiger's back." Dr. Horsfield adds, that it is never seen in confinement.

The same author states that eight species of owls from Java have been arranged in the museum at the India House; three eared-owls, and five smooth-headed.

S. Capensis, Smith, the Cape Owl. It is red brown above, scantily sprinkled with small white spots, pale ochreous red below, marked with small heart-shaped spots; face yellow-brown; cervical collar pale buff-orange, with many of the feathers, particularly on its inferior portion, tipped with brown; quills subochreous, banded with brown; eyes brownish-black; bill and feet livid or straw-yellow; legs long, upper half of the tarsi covered with feathers, lower half and toes covered with small flat circular scales, upon which are a few strong rigid bristles, claws long, dark horn-colour, slightly covered and pointed. Length 16 inches. The whole of the plumage has a silky gloss. Female considerably larger than the male, and with the colours less clear. The down of the nestling is dull cream-yellow, plumage of the upper parts during the first year darker than in adult birds. (Smith.)

Dr. Smith states that the few specimens which he saw were obtained near Cape Town, close to Table Mountain, in the rocky precipices of which they were said to have concealed themselves during the day. He adds, that the colonists recognise this bird as distinct from the Doodvogel (*Strix flammea*), which occurs abundantly throughout the whole of South Africa, and that it is at once to be distinguished by its size from the *Strix badia* of Horsfield, the species to which it is by colours most nearly allied.

Dr. Smith also figures and describes another Typical Owl (*Athene Capensis*), and an Eared Owl (*Otus Capensis*).

Noctua.—It is brown above, with a few yellowish-white spots; white beneath, varied with ferruginous spots; toes hairy.

N. Boobook (*Strix Boobook*, Boobook Owl of Latham) is an Australian species. According to Mr. Caley, "the native name of this bird is Buck-Buck. It may be heard nearly every night during winter uttering a cry corresponding with that word. Although this cry is known to every one, yet the bird itself is known but to few; and it cost me considerable time and trouble before I could satisfy myself respecting its identity. The note of the bird is somewhat similar to that of the European cuckoo, and the colonists have hence given it that name. The lower order of the settlers in New South Wales are led away by the idea that everything is the reverse in that country to what it is in England; and the cuckoo, as they call this bird, singing by night, is one of the instances which they point out."

N. maculata, described by the same authors, much resembles the species just noticed, but they are inclined to consider it distinct.

STRIGOCE'PHALUS, a genus of Fossil *Brachiopoda*.

STRINGY-BARK TREE. [EUCALYPTUS.]

STROBILI'TES, a genus of Fossil Fruits.

STROBILURUS. [IGUANIDÆ.]

STROMATOPORA. [MILLEPORIDÆ.]

STRO'MBIDÆ, a family of Marine Gasteropodous *Mollusca*, belonging to the *Alata* of Lamarck and the *Angyostomata* of De Blainville.

The genus *Strombus* of Linnæus is placed in the 'Systema Naturæ' between *Buccinum* and *Murex*.

Cuvier arranges *Strombus* next to *Turbinella* and at the end of his 'Pectinibranchiate Gastropoda.' He defines the genus *Strombus*, Linn., as comprising shells with a canal which is either straight or inflected towards the right, the external border of whose aperture dilates with age, but always preserves a sinus towards the canal, under which the head of the animal passes when it extends itself. The greater part have, he adds, this sinus at some distance from the canal.

Mr. Swainson defines the *Strombidæ*, Wing-Shells, which, in his arrangement, stand between the *Turbinellidæ* and the *Volutidæ*, thus:—

"Outer lip dilated, or thickened internally, or detached from the preceding whorl by a sinus; operculum small."

He makes the family consist of the following sub-families:—

1. *Strombinæ.*

Genera:—*Aphorrais*, Da Costa (*Aporrhais*, we suppose is meant); *Pteroceras*, Lam.; *Strombus*, Linn.; *Strombidea*, Sw.; *Rostellaria*, Lam.

2. *Coninæ.*

Genera:—*Terebellum*, Lam.; *Coronaxis*, Sw. (with the sub-genera, *Coronaxis*, Sw.; *Puncticulis* (?), Sw.; *Tuliparia*, Sw.; *Cylindrella*, Sw.; and *Conilithes*, Sw.); *Conus*, Linn. (with the sub-genera *Conus*, Linn.; *Dendroconus*, Sw.; *Textilia*, Sw.; *Theliconus*, Sw.; and *Leptoconus*, Sw.); *Conella*, Sw.; and *Conorbis*, Sw.

3. *Columbellinæ.*

Genera:—*Conidea*, Sw.; *Columbella*, Lam.; *Pusiostoma*, Sw.; *Crassispira*, Sw.; *Nitidella*, Sw.

4. *Pleurotominæ.*

Genera:—*Brachytoma*, Sw.; *Pleurotoma*, Lam.; *Clavatula*, Sw.; *Clavicantha*, Sw.; *Tomella*, Sw.

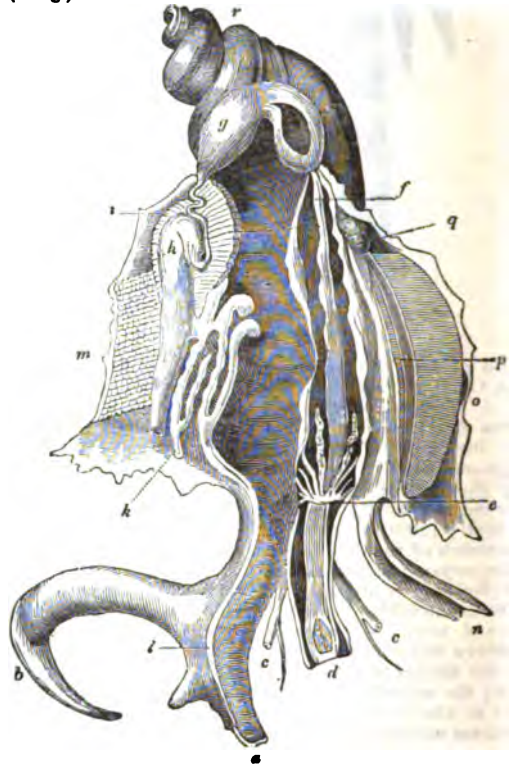
5. *Cerithinæ.*

Genera:—*Potomis*, Brong.; *Pirena*, Lam.; *Terebralia*, Sw.; *Rhinoclavis*, Sw.; *Cerithium*, Lam.

Dr. J. E. Gray makes the *Strombidæ* (the first family of his section *Ctenobranchiata*, Order 1, *Zoophaga*) include the following genera:—*Strombus*, *Terebellum*, *Pteroceras*, *Rostellaria* and *Seraphys*.

In this article the *Strombidæ* will be confined to the genera and sub-genera *Strombus*, *Pteroceras*, and *Rostellaria*.

Strombus.—Animal spiral, slightly compressed, furnished with a proboscis, at the extremity of which is the mouth opening longitudinally, and containing a lingual riband furnished with sharp points curved backwards. Tentacles cylindrical, obtuse, and short. Eyes carried upon two peduncles, which are cylindrical and stout, longer than the tentacles, and placed at their external side. Foot rather small, but enlarged forwards. Mantle forming in front a canal, which is generally rather short. Orifices of the anus and oviduct behind. Shell thick, oval-oblong, sub-involved, conical in front and behind; spire moderately elevated; aperture long and narrow, terminated anteriorly by a canal more or less long or removed; right lip dilated, and with a sinus a little behind the canal; columellar or inner lip simple, but sometimes callous. Operculum horny, long and narrow, with a terminal summit and composed of elements imbricated, as it were. (Rang.)



a

Animal of *Strombus lambis* (*Pteroceras lambis* of modern authors). Female.

a, the foot seen in its anterior part, with its groove; *b*, the operculum fixed at its posterior division; *c c*, ocular tubes with their tentacles; *d*, the proboscis open to show the tongue; *e*, the cerebral ganglion, behind which are two long salivary glands; *f*, digestive tube entering a large stomach; *g*, the stomach partially opened, and showing the orifice of the œsophagus; *h*, the intestine become filiform before it forms the very voluminous rectum; *i*, the first part of the uterus; *k*, second part of the uterus, forming meanders before opening into the groove which leads on the right side of the foot; *l*, the groove which does not exist in the males; *m*, follicles of viscosity; *n*, respiratory siphon; *o*, large branchia and its vein which goes to the heart; *p*, small and rudimentary branchia; *q*, the heart; *r*, the liver and the ovary united to the extremity of the tortillon, or turbinated part of the body. ('Voyage of the Astrolabe.')

M. Rang considers that the variations in the shell lead to the establishment of two sub-genera, *Strombus* and *Pteroceras*.

M. De Blainville divides the genus *Strombus* into the following sections:—

a. Species whose external lip becomes much dilated with age, and offers a number of digitations variable in number. Genus, *Pteroceras*, Lam. Ex. *S. Scorpius*.

β. Species whose right lip is much dilated, but without digitation. Ex. *S. tricornis.*

γ. Species whose external lip is thick, and but little or not at all dilated. Ex. *S. Auris Dianæ.*

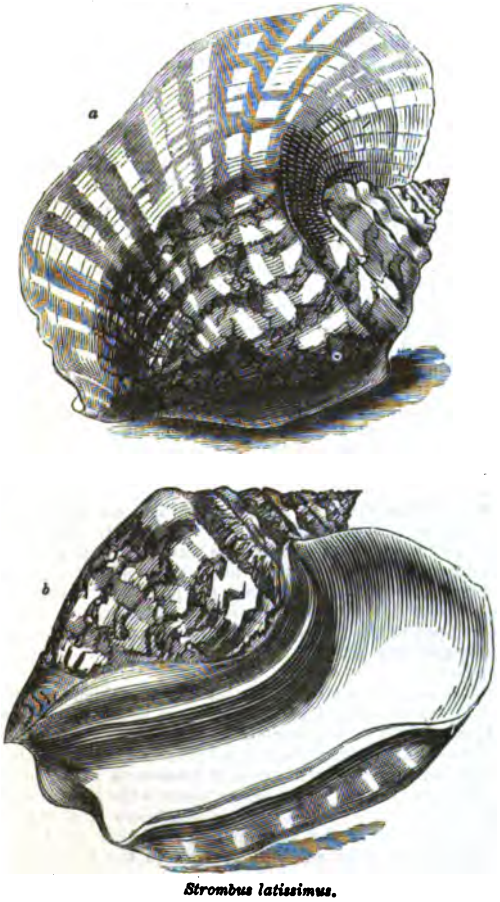
δ. Species whose right lip is not dilated, and very delicate, which makes them resemble the Cones. (Non-adult *Strombi.*)

The species are extremely numerous, and many of them are gigantic in size, the well-known *S. gigas* of the West Indies for example. Like some others of the Turbinated Testaceans, the animals of the genus *Strombus* occasionally produce pearls. Mr. Wood, in his 'Zoography,' relates that he saw a pink pearl which was taken from the body of the animal of *S. gigas*, which is fished for the table off the island of Barbadoes. The pearl was discovered by chance, while the men were employed in cleaning the fish. Its weight was 24 grains, but it would have been more valuable if it had been round. The same author states that only four of these pearls had been discovered in the vast number of shell-fish that are annually brought to market in that part of the world, though he has reason to believe that this is in some measure owing to the carelessness of the negroes, who clean their fish without consideration, and have probably in their hurry returned many a pearl to its native element with the refuse of the animal. This pearl was exactly of the same colour as the interior coat of the shell, and like it in every respect except in figure. Immense quantities of this shell are imported into this country from the Bahamas: 300,000 were imported into Liverpool alone in the year 1850. They are used in making cameos, and in the manufacture of porcelain.

The species are found in the seas of warm climates; many from those of India, and some from those under and near the equator. They are carnivorous. Species have been found at depths varying from the surface to 13 fathoms.

S. latissimus has the shell turbinated, ventricose, smooth on the back, somewhat wrinkled on the wing, brown-orange spotted with white; the spire short and nodulous; the external lip very broad, rounded above, projecting beyond the spire; the anterior margin sharp, but the side of it very thick; the aperture smooth and white, tinged with rose colour.

It is found in the East Indian seas.



Strombus latissimus.
a, seen from above; *b*, seen from below.

This fine and somewhat rare species grows to a large size, from 5 to 10 or more inches in length.

There are about 60 recent species of *Strombus* described. Five fossil forms have been described from the Chalk and three from the Miocene beds of the Tertiary.

Pteroceras.—Shell with the wing digitated, and furnished forwards with an elongated canal. There are 10 recent species, inhabitants of the Indian seas, and 100 fossil species, found from the Lias beds up to the Chalk.

P. Scorpius. Shell ovate oblong, gibbous, tuberculate, transversely rugose and knotty, 7-fingered, white spotted with rufous; the fingers rather slender, and knotted at intervals throughout their length; the anterior ones and the tail the longest, and curved; aperture violaceous-red wrinkled with white.

It is a native of the East Indian seas.

Pteroceras Scorpius.

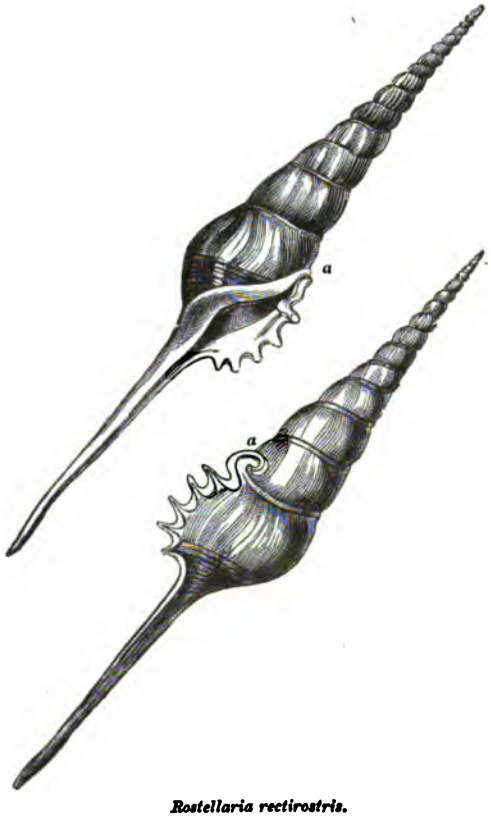
Rostellaria.—Animal imperfectly known, but bearing a considerable resemblance to that of *Murex*, according to Cuvier.

Shell fusiform or subturriculate, with an elevated pointed spire; aperture oval, canal projecting, and terminating in a pointed beak; external lip simple, dentated, digitated, or very much dilated, furnished with a sinus near the canal, and having generally a second canal ascending upon part of the spire.

The species are found in the Asiatic seas, if we except *Rostellaria Pes Pelecani* and *R. Pes Carbonis* (genus *Aporrhais*), which are found in the Mediterranean and other European seas. A very fine specimen of *Rostellaria rectirostris* was brought up in the mud lying on the fluke of an Indiaman's anchor, in the Straits of Macassar. They are carnivorous.

There are 7 recent species, and 70 fossil species. The latter range from the Neocomian beds to the Chalk.

R. curvirostris (*Strombus fusus*, Linn.), the Spindle of collectors, is by far the most common of the Asiatic species. We illustrate the



Rostellaria rectirostris.

genus by *Rostellaria rectirostris*, Lam., a name which suits this rare species well when the beak is curtailed, as it most frequently is.

a very fine specimen, as far as the beak is concerned, now in the British Museum, that usually mutilated part is much longer and better preserved than it is generally seen, and from its recurvature the name of *recurvirostris* would be more apt. Indeed it is by no means clear that there are not two species of this long-beaked kind of *Rostellaria*, one much darker than the other, and not so slender.

STROMBO'DES. [POLYPIFERA.]

STROMEYERITE, a Mineral consisting of Sulphuret of Silver and Copper.

STRONGYLUS. [ENTOZOA.]

STRONTIA, the name of an Earth, composed of Oxygen and the metal Strontium. Neither strontium nor its oxide is found pure in nature. The Salts of Strontia have a high specific gravity, varying from 3·6 to 4·0. In this respect they resemble Baryta. Two are found in the form of minerals.

Celestine—Sulphate of Strontia—occurs in modified rhombic prisms. Crystals sometimes flattened, often long and slender. Massive varieties:—Columnar or fibrous, forming layers half an inch or more thick, with a pearly lustre; rarely granular. Colour generally a tinge of blue, but sometimes clear white. Lustre vitreous, or a little pearly; transparent to translucent. Hardness 3·0 to 3·5. Specific gravity 3·9 to 4·0. Very brittle. It contains—Sulphuric Acid, 43·6; Strontia, 56·4. Decrepitates before the blow-pipe, and on charcoal fuses rather easily to a milk-white alkaline globule, tinging the flame red. Phosphoresces when heated.

It resembles heavy spar, but is distinguished by its specific characters and behaviour under the blow-pipe. It is distinguished from the carbonate by not effervescing with acids. It is found in the United States of America. Sicily affords very splendid crystallisations associated with sulphur.

The pale sky-blue tint so common with the mineral, gave origin to the name Celestine.

Celestine is used in the arts for making the nitrate of strontia, which is employed for producing a red colour in fire-works. Celestine is changed to sulphuret of strontium by heating with charcoal, and then by means of nitric acid the nitrate is obtained.

Strontianite — Carbonate of Strontia—occurs in modified rhombic prisms. It occurs also fibrous and granular, and sometimes in globular shapes with a radiated structure within.

The colour is usually a light tinge of green; also white, gray, and yellowish-brown. Lustre vitreous, or somewhat resinous. Transparent to translucent. Hardness 3·5 to 4. Specific gravity 3·6 to 3·72. The analysis gives—Strontia, 70·1; Carbonic Acid, 29·9. It fuses before the blow-pipe on thin edges, tinging the flame red; becomes alkaline in a strong heat; effervesces with the acids.

Its effervescence with acids distinguishes it from minerals that are not carbonates; the colour of the flame before the blow-pipe, from witherite; and this character and the fusibility, although difficult, from calcspar. Calcspar sometimes reddens the flame, but not so deeply.

Strontianite occurs in limestone at Scoharie, New York, in crystals, and also fibrous and massive. Strontian in Argyleshire was the first locality known, and gave the name to the mineral and the earth strontia. It occurs there with galena in stellated and fibrous groups and in crystals. It is also used for making nitrate of strontia.

(Dana, *Manual of Mineralogy.*)

STRO'PHODUS, a genus of Fossil Fishes. [FISH.]

STROPHO'MENA. [BRACHIOPODA.]

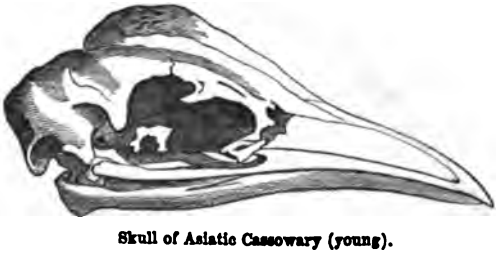
STROPHO'STOMA. [HELICIDÆ.]

STRUTHIOLA'RIA. [SIPHONOSTOMATA.]

STRUTHIO'NIDÆ, a natural family of Terrestrial Birds, in which the locomotive energy is thrown into the lower extremities, the wings being in no case adequate to raising the body into the air, and in the majority of instances merely rudimentary. In this respect the genera which compose it are the very reverse of the Humming-Birds, Swallows, Albatrosses, Tropic-Birds, and Man-of-War Bird; for in the latter the moving-power resides in the highly-developed wings, whilst the feet, especially in the Man-of-War Bird, are feeble.

The *Struthionidæ* consist of the Ostrich, American Ostrich (*Rhea*), Cassowary, Australian Cassowary, or Emu, and that extraordinary bird the Kivi-Kivi, or *Apteryx*, of New Zealand.

The anatomy of these animals is referred to in great detail by



Skull of Asiatic Cassowary (young).

Professor Owen in his paper on the 'Anatomy of the Apteryx,' in the Transactions of the Zoological Society, London. The most remarkable modifications of the skull in this family occur in the Asiatic Cassowary and the *Apteryx*. In the former the bony crest,

Skull of Asiatic Cassowary (adult).

which is so highly developed in the adult, is hardly perceptible in the young bird, but increases with age, as in the Hornbill and the Guinea-Hen. [PAVONIDÆ.]

In *Apteryx*, according to Professor Owen, the skull is chiefly remarkable for its smooth expanded elevated pyriform cranial portion, the total absence of supra-orbital ridges, the completeness and the thickness of the inter-orbital septum, the great development of the ethmoid, the small size of the lachrymal bones, and the expansion of the nasal cavity behind these bones. The tolerably semicircular occipital region differs from that of other *Struthionidæ* in the greater relative extent of its base, and in the comparatively slight lateral sinuosities due to the temporal depressions. There is no vertical notch at the upper part of the single hemispherical tubercle in the basi-occipital for articulation with the atlas, as in the Ostrich and Emu, but it is entire, as in *Rhea*; the plane of the occipital foramen also has the same aspect as in that bird, in which it is more nearly horizontal than in the Ostrich. The supra-occipital plate forms a somewhat angular projection, corresponding with the small cerebellum, and is bounded on each side by a vertical vascular groove terminated by a foramen above and below; the ex-occipitals extend outwards and downwards external to these grooves in the form of obtuse processes compressed in the antero-posterior direction, and are slightly convex behind and concave in front, where they form the back part of the wide meatus auditorius externus. The occipital bones, and also the surrounding bones, are anchylosed together. The angle between the posterior and superior regions of the cranium can hardly be said to be produced into a ridge. The superior region is smooth, convex, and separated from the temporal depressions by a narrow ridge, rather more marked than the occipital ridge. The sagittal suture crosses a little behind the middle of the upper part of the cranium. In one cranium Professor Owen found the left half of this suture persistent; but in another, that of a male, all the sutures were obliterated. The persistent sutures were more denticulated than those in the skull of a young ostrich. The superior region is continued into the lateral regions by a continuous curvature, so that the upper part of the small orbital cavity is convex, and its limits undefinable, there being no trace of supra-orbital ridge, nor of antorbital, or postorbital processes. This structure, Professor Owen observes, is quite peculiar to the *Apteryx* among birds, but affords a very interesting resemblance between it and the monotreme *Echidna*.

The base of the skull of *Apteryx* exhibits all the peculiarities characteristic of the Struthious Birds. The body of the sphenoid sends out two processes on each side externally; the posterior of these abuts against the tympanic bone, and the anterior one by a flattened oval articular surface against the pterygoid bone. Professor Owen points out that the latter processes exist, but are much more feebly developed in the Ibis, and that in most other birds, including the *Grallæ*, they are wanting, whilst they are well developed in the Lacertine *Sauria*.

The usual ornithic characters, with the Struthious modifications traceable in the individual peculiarities, are presented in the lower jaw of *Apteryx*. "The transversely expanded angular and articular extremities offer the inwardly extended process for the attachment of the pterygoidei muscles; the superior transverse plate, behind the articular surfaces, is thin and concave towards the meatus auditorius externus, and is lined by the mucous membrane of that passage, of which it forms part of the bony parietes. There are two distinct narrow oblique articular surfaces, concave in the longitudinal, and convex in the transverse directions; the internal one is the largest, and behind this there is a small excavation, into which a small process of the air-sac lining the tympanum is continued; and this is the only part of the skeleton not immediately concerned in the formation of the organs of hearing or smelling into which air is admitted. The entry to the air-cells, in the lower jaw of the Ostrich,

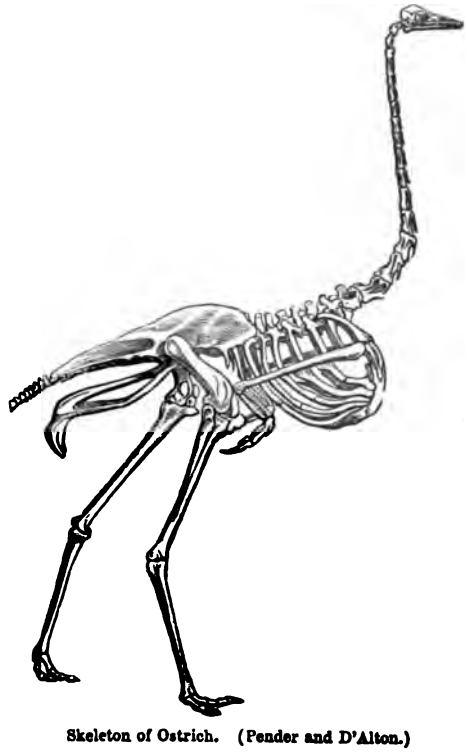
is situated in the part corresponding to the above depression or sinus in the jaw of *Apteryx*. Traces of the compound structure of the lower jaw are very evident in that of the *Apteryx*, and the limits of the angular, articular, and coronoid pieces may be in part defined. There is a linear vacancy, bounded by the surangular and angular pieces behind, and by the bifurcate commencement of the mandibular or dentary piece in front; the surangular is compressed, and sends upwards a very slightly elevated coronoid ridge. A second narrower fissure occurs between the thick opercular or splenial element and the upper fork of the mandibular piece. The opercular piece reaches to the posterior part of the symphysis, as in the Ostrich, and the rest of the lower jaw in front of this part is formed by the two anchylosed mandibulars. In the extent of this anchylosed symphysis the *Rhea* makes the nearest approach to the *Apteryx* among the *Struthionidæ*, and the two impressions which diverge from the back part to the front of the symphysis are present in both the *Rhea* and Emeu, as in the *Apteryx*. The lower jaw of the *Apteryx* differs from that of the Ibis in its greater posterior expanse, its more depressed form, the lower coronoid plate, the narrower fissure between the angular and surangular pieces, and the absence of the mesial furrow, extending in the Ibis to the end of the symphysis."

The number of the cervical vertebræ in the Ostrich is 18, in the Cassowary 16 (true), in *Rhea* 16 (not 14, as Cuvier states), in the Emeu 19, in the *Apteryx* 15 only; and in the latter there are 9 dorsal and 22 remaining vertebræ in the lumbar, sacral, and caudal regions: the spinal column of *Apteryx* is relatively stronger, especially in the cervical region, than it is in the larger *Struthionidæ*.

In the *Struthionidæ* we look in vain for the deep crista or keel which so strongly marks the well-developed ornithic character, especially in the diurnal birds of prey, the larger sea-birds above alluded to, and the Humming-Birds. Such a foundation would be worse than useless where there is none of the machinery of flying to be worked, and the utmost demand on the anterior extremities goes no farther than their aid in balancing the body when the bird runs. We accordingly find that in the larger *Struthionidæ* (Ostrich, Cassowary, &c.) the breast-bone presents a plane and uniformly arched shield-like surface, not unlike, in some of the family, the Cassowary and Emeu for instance, to a Highlander's target on a reduced scale. But in the *Apteryx* this low development is reduced to its lowest grade. In its small size, and in the total absence of a keel, it resembles, Professor Owen observes, that of the Struthious Birds generally, but differs in the presence of two subcircular perforations on each side of the middle line, in the wide anterior emarginations, and in the much greater extent of the two posterior fissures. The anterior margin, he tells us, presents no trace of a manubrial process, as in the Ostrich; on the contrary, the wide interspace between the articular cavities of the coracoid is deeply concave; in the extent of this interspace, he remarks, the *Rhea* most resembles the *Apteryx*, but its contour is almost straight; whilst in the Cassowary the space is narrower, but deeply notched. The articular surface for the coracoid is an open groove, which in the fresh state is covered with articular cartilage; and, external to the groove, the anterior angles of the sternum are produced into two strong triangular processes with the apex obtuse. The thickened costal margin, when viewed anteriorly, presents an undulating contour, from the presence of the four articular convexities, for the sternal ribs and the intermediate excavations. The sternum of the Emeu, Professor Owen remarks, presents a similar appearance. The breadth of each sternal perforation is, he adds, nearly equal to that of the intervening osseous space, and in the specimen described they were not quite symmetrical in position. The posterior notches equal in extent one half the entire length of the sternum, and the external boundaries of these notches curve towards each other. These notches exhibit a slight want of symmetry in form, position, and extent.

There is no true furcula in the *Struthionidæ*, but the Ostrich and Cassowary have on each side of the front of the chest an elongated flat bone consisting of a rudiment of the furcula, with the clavicle and scapula consolidated into one piece. The two branches of this rudimentary furcula are very short, and never united in the African Ostrich, but anchylosed with the bones above mentioned. In the Cassowary there are merely two little processes from the side of the clavicle; these are the rudiments of the branches of the fork. In the Emeu two very small thin bones are attached to the anterior edge of the dorsal end of the clavicles by a ligament, and are directed upwards towards the neck; there they are fastened to each other by a ligament, but have no connection with the sternum. In the *Apteryx* the scapula and coracoid are anchylosed; and a small perforation anterior to the articular surface of the humerus indicates the separation between the coracoid and rudimental clavicle, of which, Professor Owen states, there is not otherwise the least trace. The coracoid, he adds, is the strongest bone; and its inferior expanded extremity presents an articular convexity, adapted to the sternal groove before described. The third rib is reached by the scapula, which is a simple narrow plate of bone, an inch in length, slightly curved, and expanded at both ends, chiefly at the humeral articulation.

The true wing bones are best developed among the Struthious Birds in *Rhea*: the next best development is in the Ostrich; in the Cassowary, Emeu, and *Apteryx*, the lowest development of these bones is exhibited. In the latter the humerus is a slender cylindrical styliform bone, 1 inch 5 lines in length, and slightly bent. At the two extremities it is slightly expanded, but most at the proximal end, which supports a transverse oval articular convexity, covered with smooth cartilage, and joined by a synovial and capsular membrane to the scapulo-coracoid articulation. Beyond each end of the humeral articular surface is a small projecting tuberosity. The distal end of the humerus is articulated by a true but shallow ginglymoid joint with the rudimental bones of the antibrachium, and both the external and internal condyles are slightly developed. The slender radius and ulna, each 9 lines in length, are almost straight and cylindrical. Above the articular surface of the ulna a feebly-developed olecranon is projected. A minute carpal bone, two metacarpals, and a single phalanx, which supports the long curved obtuse alar claw, complete this rudimental hand, which is 7 lines in length, including the claw, and that measures 3¼ lines. To the ulna and metacarpus a few short and strong quill-feathers are attached by ligament.



Skeleton of Ostrich. (Pender and D'Alton.)

Skeleton of *Apteryx*. (Owen.)

Strongly contrasted with the flattened sternum and the dwindled anterior extremities are the strongly developed pelvis and posterior limbs of the *Struthionidæ*. The pelvis of the ostrich bears some resemblance to that of the extinct quadrupedal Mylodon, of which there is a noble skeleton in the Museum of the Royal College of Surgeons. In this part of the osseous system we have ample fulcra for those powerful muscles which render the larger Struthious Birds swifter than the swiftest. The iliac bones of *Apteryx* resemble those of the rest of the tribe in size and shape, and are four inches and three lines in length. There is a slight anterior concavity on the outer surface, and this concavity passes into a convexity posteriorly, the two surfaces, not being separated by the transverse elevation which exists above the acetabulum in the four large *Struthionidæ*. Between the posterior extremity of the ilia and the first three caudal vertebræ, a distinct epiphyseal piece of bone is wedged in. The ischium extends backwards parallel with the sacrum, in the form of a thin plate of bone, which slightly expands to its free and truncated extremity. The pubic element is a slender bony style, connected by ligament to the end of the ischium, but attached by bone at its acetabular extremity only. A short pointed process extends from the anterior margin of the origin of the pubis. In comparing the pelvis of *Apteryx* with that of the large Struthious Birds, Professor Owen observes that the ischia do not meet below the sacrum, as in the *Rhea*, but are more distant from that and the iliac bones than in any of the *Struthionidæ*; the pubic bones, he remarks, are not joined together at their distal extremities, as in the Ostrich; nor are the extremities of the ischia anchylosed to the superincumbent ilia, as in the Cassowary. It is the Emeu, he adds, that comes nearest to the *Apteryx* in the structure of the pelvis, but it also differs in the complete bony boundary of the foramen, which transmits the tendon of the obturator internus, and which is completed posteriorly by ligament in *Apteryx*. The acetabulum, he observes, communicates, as usual, by a wide opening with the pelvis, and a surface covered with a cushion of thick cartilage is continued from its posterior and upper part.

The great length of leg in the *Struthionidæ* is produced, as in the true wading-birds, by the tibia and common bone of the tarsus and metatarsus; for the femur is comparatively of short dimensions.

The fibrous capsule of the hip-joint of *Apteryx* is very strong; the synovial membrane is reflected from it upon the upper margin of the trochanter and upper part of the short neck of the femur, as well as upon the ligamentous bridge, continued from the upper and extended margin of the acetabulum to its anterior part. The very large ligamentum teres is short, and consists of an infundibular process of synovial membrane, reflected from the circumference of the acetabular perforation to that of the depression on the head of the femur: this synovial sheath incloses two distinct ligaments, which are twisted about each other like the crucial ligaments of the knee-joint. One of the ligamentous bands passes from the upper margin of the acetabular perforation to the lower edge of the femoral depression.

The femur, tibia, patella, fibula, and other parts of the osseous system of the legs of these birds are not less characteristic of their habits.

The number of the toes varies in these birds. In the Ostrich the number of toes is two only; the Cassowary and Emeu have each three. The *Apteryx* has a fourth. In the *Apteryx* the number of phalanges of the three greater toes follows the ordinary law; the inner toe having three, the middle four, and the outermost five phalanges.

The crop in the *Struthionidæ* is of great size. The bulbus glandulosus or proventriculus is situated before the entrance of the œsophagus into the proper stomach, and is so large and so modified in form in some of the species, the Ostrich for example, as to give it the appearance of a second stomach; indeed Valisnieri, in his 'Anatomy of the Ostrich,' calls it the first stomach. Mr. Lawrence found the œsophagus of an ostrich which he dissected dilated into an immense bag capable of holding several pints of water, and five or six times larger than the gizzard itself, which was placed on the right and anterior part of this dilatation. The glands did not surround the tube, so that, Mr. Lawrence observes, the term 'zone' would be here inapplicable. They formed, he tells us, a long but narrow band, commencing at the termination of the œsophagus, and running along the front of the bag towards the gizzard. This band measured about twelve inches in length and not more than three inches at its greatest breadth. The size of the individual glands varied: they were largest in the middle, and decreased towards either margin of the band. Some of them equalled a large pea, and their openings were in proportion. They were arranged in close apposition to each other, and the inner surface of the pouch was covered by a continuation of the insensible lining of the gizzard, which separated very easily from the surface. The cæca in the ostrich are characterised by a remarkable spiral valve, and the villi in its small intestine are rather flat thin laminæ than villi; but they are at the same time long and numerous, presenting a very elegant structure. The large intestine of the ostrich presents a remarkable deviation from the structure usually seen in birds; for the surface of that intestine is in them generally uniform on its surface, whereas in the Ostrich the large intestines, which are very long, have numerous transverse folds, like the valvulæ conniventes of man.

In the Museum of the College of Surgeons in London is a series of preparations admirably illustrative of the internal anatomy of the *Struthionidæ*.

The tongue of the *Apteryx* is short; but short as it is, it is more developed than in other Struthious Birds. The lining membrane of the pharynx, behind the glottis, forms two elongate, square-shaped, smooth, thick, and apparently glandular folds or processes, the obtuse free margins of which project backwards like lappels into the pharynx; beyond which the lining membrane is produced into close-set, narrow, somewhat wavy, longitudinal folds; the œsophagus is continued through the thorax and diaphragm to the proventriculus without forming any partial dilatation or crop. The proventriculus is a narrow elongated cylindrical cavity in the axis of the œsophagus, of which it is an immediate continuation. The gastric glands, narrow elongated follicles, are developed around its whole circumference, and are closely packed together; they are mostly bilobed, but sometimes more subdivided at their cæcal or outer extremities. The longitudinal rugæ of the lining membrane gradually subside at the entry of the proventriculus, where they run into each other, and so form a general reticulate surface, in the meshes of which the orifices of these glands are situated. The epithelium lining the glandular part of the stomach is gradually condensed towards its lower part into a cuticle, which, as it passes into the muscular compartment, assumes a brown colour and a callous hardness, and forms a stratum about one-third of a line thick. In the Cassowary and Emeu, observes Professor Owen in continuation, the proventriculus is marked off from the stomach by a circular strip of epithelium, whiter and thinner than the rest, from one to two lines in width, as is well shown in Sir Everard Home's 'Comparative Anatomy' (pl. li., lii.) In this structure the *Apteryx*, though it resembles these species in the arrangement of the gastric glands, does not participate. Its muscular stomach does not present the characteristic sub-compressed shape of a gizzard; but in its regular oval rounded form resembles the membranous stomach of carnivorous birds. It is small for the size of the bird in its contracted state, but when distended with food Professor Owen found that it measured two inches and a half in length, and two inches across at the widest parts. The muscular fibres are not digastric and lateral, as in the true gizzard; but, instead of being arranged in well-defined masses, radiate from two tendinous oval centres, measuring about two-thirds of an inch in the longest diameter. The pyloric passage is narrow, leading from the left side of the muscular stomach into the duodenum. A transverse crescentic ridge of the lining membrane defends the pylorus, but there is no distinct sphincter. The cuticle is continued into the duodenum about three lines beyond the pylorus, but the Professor found no dilatation of this part constituting a pyloric pouch, as in the Emeu and Ostrich. In one *Apteryx* there was a very short cæcum, the remnant of the ductus vitello-intestinalis, attached to about the middle of the small intestine; and from the same relative position of the intestinal tube in a small female specimen there extended an obliterated duct three lines long, which expanded into a still persistent sub-globular vitelline sac, about an inch in diameter, but collapsed, and with wrinkled parietes. In a large male the intestinal canal measured four feet, independently of the cæca, each six inches in length: the rectum was four inches long. The lining membrane of the rectum, which is beset with minute short villi or points, together with glandulæ solitariæ, that become numerous and large at the terminal half of the rectum, is thrown, when it is contracted, into longitudinal folds; but there is no trace of the transverse or spiral valvulæ conniventes, characterising the cæca and rectum of the Ostrich and *Rhea*; and in this respect the *Apteryx* resembles the Cassowary and Emeu. The liver presented nothing extraordinary. In two of the specimens there was a gall-bladder, as in the Emeu and Cassowary; in the third it was wanting, as is usually the case in the *Rhea* and Ostrich. In the *Apteryx* without a gall-bladder there were two long ducts terminating in the same part of the duodenum. The pancreas consisted, as usual, of two elongated subtrihedral lobes; and the spleen was about the size and form of a hazel-nut.

In the preparations in the College of Surgeons the peculiarities of the circulating and respiratory systems of these birds are well displayed. The *Apteryx* possesses a complete and well-developed diaphragm.

Professor Owen, after adverting to the long recognised existence of a diaphragm in a rudimental condition in birds, and Hunter's beautiful figure of the costal portion of that of the Ostrich ('Cat. Mus. Coll. Chir.,' vol. ii., pl. xxvi., 'Physiol. Series'), observes that in this, as well as in the other large Struthious Birds, there is also a pars vertebralis, or analogue of the lesser muscle of the diaphragm, which rises by two tendinous crura from the last dorsal vertebra, and in the Emeu, by a double origin on each side. Nevertheless, he remarks, their diaphragm is incomplete; first, by reason of an arrest of its centripetal development, which leaves a permanent defect of union in the mesial plane; and, secondly, by the large perforations for the abdominal air-cells.

Professor Owen found the mechanism of respiration in the *Apteryx* essentially the same as in other birds, and he states that a more muscular diaphragm than it possesses would be unnecessary as a part of the mechanism. As in the *Mammalia*, the abdominal surface of the diaphragm is principally in contact with the liver, spleen, and stomach; but its thoracic surface does not support the heart, and it

is separated from the lungs by the interposition of a series of small but well-marked air-cells. No thoracic serous sac or pleura could be traced. "Thus," says Professor Owen, "although the respiratory organs are confined to the chest, and the *Apteryx* offers the only known instance in the feathered race of a species in which the receptacular part of the lungs is not continued into the abdomen, yet the Struthious type is strictly preserved, and the march of development has only been restricted, not changed."

The brain and nervous system appear to be, generally speaking, well developed in the Struthious Birds.

The senses of Touch, Taste, Smell, and Hearing are well developed.

The Eye is well formed, and the Sight piercing in the *Struthionidæ* generally; but, in the *Apteryx*, the eye has less development than appears in the rest of the family, the reasons for which are above assigned. It presents a remarkable deviation from the construction characteristic of birds generally, in the total absence of the pecten or marsupium, a privation compatible with the nocturnal habits and restricted locomotion of this species. "The eyeball," says Professor Owen, "is relatively much smaller than in other birds; its antero-posterior diameter is three lines; its transverse diameter four lines. The cornea transparens is very convex, and two lines in diameter. The sclerotic is thin, but the margin supporting the cornea is strengthened by a circle of small osseous plates. The choroid is a delicate membrane; its pigment is of a light brown colour. The ciliary processes commence at the ciliary ring, each process having at its origin a slight linear rising, which becomes gradually wavy and tortuous as it approaches the lens, anterior to the circumference of which it projects freely to a small extent. The iris in the specimen examined was one-third of a line in breadth. The optic nerve terminates by a small round aperture. The lens is two lines in breadth, and nearly one line at the thickest part, being thus more convex than in other birds. The external appendages of the eye presented no peculiarities, except the very great strength of the orbicularis palpebrarum; the membrana nictitans had the usual trochlear muscles: its free margin was black."

The place assigned to the Struthious Birds by zoologists generally will be found in the articles BIRDS and GRALLÆ. The position of the Dodo in this family is doubtful. [DODO.]

Mr. G. R. Gray makes the *Struthionidæ* the first family of the order *Cursores*, Temm., the sixth order in Mr. Gray's arrangement, and includes under it the following sub-families and genera:—

Sub-Family 1. *Struthionidæ.*

Genera:—*Struthio*, Linn.; *Casuarius*, Briss.; *Dromaius*, Vieill.; and *Rhea*, Briss.

Sub-Family 2. *Apteryginæ.*

Genus:—*Apteryx*, Shaw.

Sub-Family 3. *Didinæ* (?).

Genus:—*Didus*, Linn.

Sub-Family 4. *Otinæ.*

Genera:—*Otis*, Linn.; *Tetrax*, Leach; *Sypheotipes*, Less.; *Chlamydotis*, Less.; and *Eupodotis*, Less.

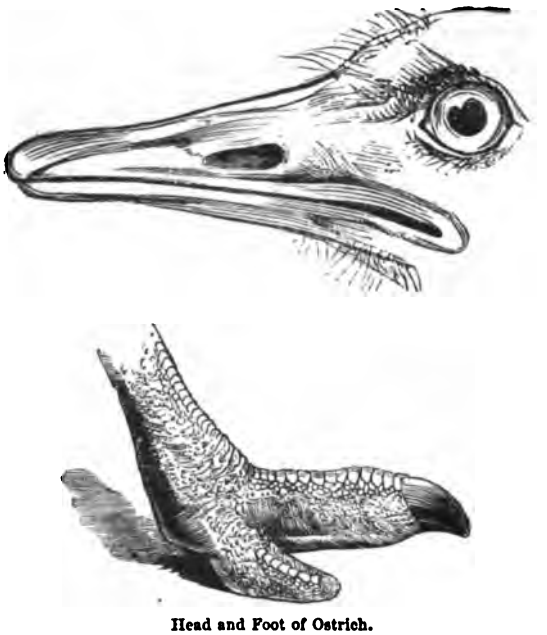
The *Struthionidæ* are placed in Mr. Gray's arrangement between the *Tinamidæ*, the last family of his *Rasores*, and the *Charadriadæ* the first family of his *Grallatores*.

Amongst the *Mammalia* the *Marsupiata* make the nearest approximation to the *Ovipara;* and amongst the birds the *Struthionidæ* approach the most closely to the Mammals and the Reptiles.

This approximation of the Struthious Birds to the *Mammalia* especially cannot fail to strike the physiologist. In the first and typical genus, *Struthio*, it is strongly manifested.

Struthio (Linn.).—Bill moderate, obtuse, straight, depressed at the point, which is rounded and unguiculate; mandibles equal and flexible; nasal fossæ longitudinal, prolonged half way down the bill, open. Feet very robust; toes two only, stout and strong, directed forwards, and connected at their base by a strong membrane, the internal toe considerably larger than the external, and furnished with a thick and hoof-like claw, external toe clawless. Wings useless for flight, furnished with long soft undulating plumes, and armed with two spurs, or rather two plumeless shafts, not unlike a porcupine's quill. Head and upper half of the neck scantily covered with a thin down, through which the colour of the skin is visible. There is but one species, the *S. Camelus.*

It would be a needless occupation of space to give a minute description of a bird which is so well known in these days of zoological societies and menageries. The Ostrich is generally understood to be the bird designated by the terms Joneh, or Jaanah, and Rinonim, in the Scriptures (Levit., xi. 19; Deut., xiv. 15; Job, xxx. 29; Isai., xiii. 21; xxxiv. 13; xliii. 20; Jer., l. 39; Lament., iv. 3; Mic., i. 8; Job, xxxix. 13). In many of these passages, Jer., l. 39, and Isai., for instance, our version reads 'Owls,' and in Levit. does not mention the Ostrich, but the general opinion seems to be in favour of the Ostrich being intended. It is the Neamah of the Arabs, Thar Edajanmel (Camel-Bird) of the Orientals, Στρουθοκάμηλος of the Greeks, *Struthiocamelus* of Pliny and the Romans, Struzzo and Struzzolo of the Italians, Strauss of the Germans, Autruche of the French.



Head and Foot of Ostrich.

The approximation in the digestive organs of the Ostrich to the structure of some of these parts in the *Ruminantia*, especially in the additional ventricle of the bird, is still further strengthened by the bisulcous foot, which may not be inaptly compared to that of the camel, and probably led in no small degree to its appellation of Camel-Bird, to which, moreover, its height, lengthened neck, habit of frequenting the desert, and patience under thirst may have contributed.

The food of the ostrich consists of vegetable substances only, but seeds and grain appear to be preferred, and it is consequently a most unwelcome neighbour to the cultivator of the soil, on whose crops the bird commits great devastation. Its iron-eating propensities have long been celebrated, and indeed it picks up and swallows any mineral substance, metallic or not, with indiscriminating voracity. Nor is this propensity confined to the devouring of minerals; for leather, hair, cordage, and wood do not seem to come amiss. In the stomach of one of these birds Valisnieri found a farrago of grass, nuts, cords, stones, glass, brass, iron, tin, copper, lead, wood, and among the stones one weighing more than a pound.

Perrault took from an ostrich's stomach 70 doubles, the greater part of which were worn down three-fourths of their substance by collision against each other or the pebbles found with them: those which were bent were worn and polished on the convex side, while they remained entire on the concave surface. These copper pieces had tinged everything in the stomach with green. This eagerness for picking up everything, whether or not it can be assimilated or can assist in the grinding down of the food by the action of the stomach, to which no doubt the polishing and wasting of the pieces of money mentioned by Perrault were due, is often fatal to the Ostrich. Too great a quantity of copper or iron thus taken into the stomach has caused the death of the bird. Valisnieri saw one killed by swallowing a quantity of quick-lime; and one kept in the gardens of the Zoological Society of London was first deformed and afterwards died from swallowing part of a parasol. Some of the heterogeneous contents found in the stomachs of these birds are preserved in the Museum of the Royal College of Surgeons.

Their speed is great. The swiftest grayhound cannot overtake them; and even the Arabian and his horse are obliged to have recourse to cunning as well as speed to close the chase, by throwing a stick dexterously between its legs, or otherwise to disable it. In its flight it spurns the pebbles behind it like shot against the pursuer. Nor is this its only mode of annoyance. Dr. Shaw, who gives a pretty account of the airs which the Ostrich plays off in a domesticated state, fanning itself with its expanded wings, and seeming to admire its own shadow, states, that though tame and tractable to those familiar with them, these birds were often very fierce to strangers, especially those of the poorer sort, whom they would try to run down and attack with their feet. They are capable of striking with great force, and the same author gives a melancholy account of a person whose belly was ripped up by a stroke from the pointed and angular claw. The European sportsman, after riding so that the bird shall pass within shot, dismounts and brings it down with the rifle.

The strength of the Ostrich is great. Adanson mentions the rapidity with which a large tame one ran, first under the weight of two little blacks, and afterwards under two full-grown negroes, while a smaller bird carried with equal facility one full-grown negro.

The general opinion is that the Ostrich is not polygamous. The number of eggs does not seem to be correctly ascertained. From 20 to 30, and 38 with 13 others scattered around the inartificial nest—a mere pit in the sand, which is thrown up so as to form an elevated edge round it, about three feet in diameter—have been found together. Some have made the number 80; others reduce it to 10. This is the number that Le Vaillant would assign to a single female, although he disturbed one from the nest containing the 38 eggs surrounded by the 13 others. This nest he watched, and saw during the day the four females successively sit upon them; and towards the close of the evening a male took his turn of incubation. This then was probably a common nest in which several females had laid their eggs.

The passage in Job (xxxix. 14) will occur to every one, and there is no doubt that within the torrid zone the heat of the sun's rays renders the incubation of the female unnecessary, excepting perhaps at night; but in cooler latitudes she performs the maternal office with assiduity, and even in the warmer climates, where an officious determination to sit would in all probability endanger the vitality of the eggs, she watches over them; and indeed the hunters have learned from her actions, and doubling back in her flight to one particular spot, where to seek for the nest. If, as has been asserted, the outlying eggs are intended to serve for the nourishment of the young, it is a proof of provident care for her offspring on the part of the mother.

The flesh of the Ostrich when young is good and palatable, and the eggs are considered a great delicacy. Both Europeans and natives agree in this last opinion. The Hottentot, who abstracts the egg from the nest with a long stick, that the hen may not take alarm at the human touch, and not abandon the nest, but go on laying, as the common hen will do to a great extent when her nest is robbed, buries them in hot ashes. They are said to be excellent when eaten with a sufficient quantity of butter. The brains of hundreds of these birds not unfrequently made a dish at the insane Roman suppers; and Firmus is said to have eaten a whole ostrich at a meal. The flesh of the bird was prohibited by the Mosaical law as unclean, and the Arabs regard it in the same light; but many of the barbarous tribes of the interior of Africa feed on it without scruple. The well-known plumes form a material article of commerce for the head-dress of European ladies, &c.

There is in the noble and admirably arranged zoological gallery of the British Museum a fine and well-preserved series of young ostriches. Not the slightest trace of a nail is observable on the external toe of any of them, any more than on that of the adult bird. The usual height of the ostrich is from 7 to 8 feet, but it has reached 11 feet.

The ostrich is a native of Africa, and is scarcely known beyond the limits of the Arabian deserts.

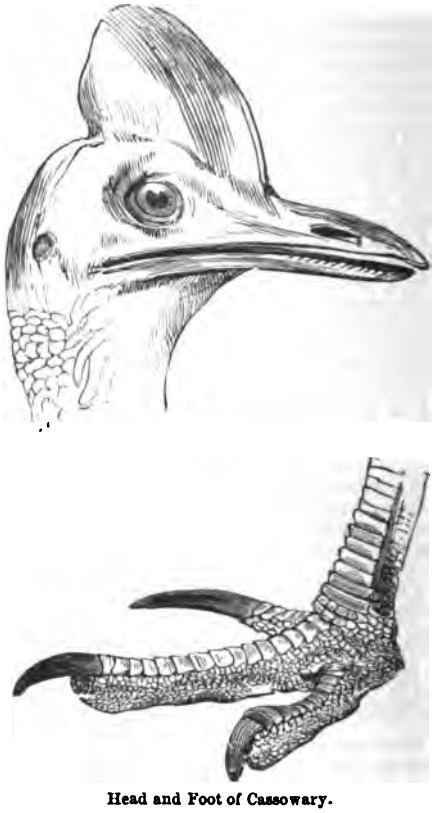
Casuarius (Briss.)—Bill straight, carinated above, rounded and bent at the point; upper mandible slightly vaulted; the edges depressed, and notched or jagged towards the extremity; the lower mandible rather angular below towards the point; nasal fossæ nearly as long as the bill. Head helmeted. Front of the neck naked, and furnished with two wattles. Toes three. Wings entirely unfit for flight, furnished with five rounded naked pointed quills.

C. Emeu has the bill compressed laterally, the head surmounted with a bony prominence covered with a horny substance; skin of the head and the upper part of the neck naked, tinged with cærulean blue and flame colour, with pendent wattles like those of a turkey-cock; wings furnished with some stiff featherless quills; nail of the internal toe much the strongest. "It is," says Cuvier in continuation, "the largest of the birds after the ostrich, from which it differs sufficiently in its anatomy, for it has short intestines and small cæca, wants the intermediate stomach between the crop and the gizzard, and its cloaca does not exceed that of other birds in proportion.

This well-known bird was named Emeu by the early Portuguese navigators. It is the *Emeu* vulgo *Casoaris* (the latter appearing to be the Malayan appellation) of Bontius, the *Struthia Casuarius* of Linnæus, *Casuarius galeatus* of Vieillot, and Cassowary of the British naturalists, who now apply the term Emeu to the Australian Cassowary (*Dromaius*, Vieill.). Its height when erect is about 5 feet.

It is a native of the peninsula of Malacca and the great chain of islands to the south and east. Bontius notes it from Ceram and the other neighbouring Molucca Islands. M. Lesson observes that it is very common in the islands of the Asiatic Archipelago, and especially at New Guinea. It is frequently seen alive in our menageries, and is common in museums.

This species, which is characterised by M. Lesson as "stupid and massive," feeds on seeds and herbage according to him; but Cuvier says that it eats fruits and eggs, but no grain. Bontius states that he does not think it should be placed among the birds: "Alæ enim ad currendum pro velo, non ad volandum inserviunt." He adds, that when irritated, it does not rush forward to the attack, but turns itself obliquely, kicking backwards at the enemy. Cuvier observes that the featherless quills serve the bird for offensive weapons. Bontius remarks that the eggs are very different from those of the Ostrich, by reason of their thinness and colour, for their shell is greenish, ornamented with numerous tubercles of a deeper green (saturè viridibus): he adds that they are eaten by the natives. Cuvier relates that the bird lays a small number of green eggs, which it abandons, like the Ostrich, to the heat of the climate.



Head and Foot of Cassowary.

Rhea (Briss.).—Bill straight, short, rather soft, furnished at its base with an obliterated membrane, slightly depressed, moderate, the point rounded, bent, and unguiculated: upper mandible with its back elevated, notched towards the end; lower mandible flat below; nostrils large, longitudinal. Wings improper for flight, the phalanges furnished with plumes and terminated by a spur. Head completely feathered. Feet three-toed, all the toes furnished with claws.

Foot of *Rhea*.

In this genus the wing is better developed than in any of the Struthious Birds, but it is still useless as an organ of flight.

Till lately the only species known was *Rhea Americana*, the Nhandu-Guaçu of the Brasilians. (Marcgrave; Piso.) It is described as haunting the banks of rivers and having the same propensity for swallowing iron and stones as the African Ostrich, running so swiftly and cunningly, aided by its wings, as not only to evade the pursuit of dogs, but the weapons of the barbarians. The females are said to lay eggs like other ostriches, but smaller, in the sand; and it is added that the males sedulously perform the function of incubation. "Salaces sunt admodum, mentulamque aliquantum aduncam vibrant sæpe, donec reperta femella eam rigidissimè ineant, suppressamque diu immobilem teneant." (Piso.) The same author states that these American Ostriches are fond of flesh, the best fruits, and the little fishes washed to the bank; nor do they spare the gray amber, if they can gain possession of it on the shore. He adds that their flesh is approved of and solid, equalling that of our swans and geese.

This American Ostrich is the *Struthio Rhea* of Linnæus, the Tuiju of Laoépède; but we owe the perfect knowledge of a second species to Mr. Darwin, who has given a figure and ample descriptions of the bird and its habits in the 'Zoology of the Beagle,' and in his 'Researches in Zoology and Natural History;' but before we proceed to notice

Rhea Darwinii, we must give his valuable account of the habits of *Rhea Americana*.

"This bird," says Mr. Darwin, "is well known to abound on the plains of La Plata. To the north it is found, according to Azara, in Paraguay, where however it is not common; to the south its limit appears to be from 42° to 43°. It has not crossed the Cordillera; but I have seen it within the first range of mountains on the Uspallata plain, elevated between six and seven thousand feet. The ordinary habits of the Ostrich are well known. They feed on vegetable matter, such as roots and grass; but at Bahia Blanca I have repeatedly seen three or four come down at low-water to the extensive mud-banks, which are then dry, for the sake, as the Gauchos say, of catching small fish. Although the Ostrich in its habits is so shy, wary, and solitary, and although so fleet in its pace, it falls a prey, without much difficulty, to the Indian or Gaucho armed with the bolas. When several horsemen appear in a semicircle, it becomes confounded, and does not know which way to escape. They generally prefer running against the wind; yet at the first start they expand their wings, and like a vessel make all sail. On one fine hot day I saw several ostriches enter a bed of tall rushes, where they squatted concealed till quite closely approached. It is not generally known that ostriches readily take to the water. Mr. King informs me that in Patagonia, at the bay of San Blas and at Port Valdes, he saw these birds swimming several times from island to island. They ran into the water, both when driven to a point, and likewise of their own accord, when not frightened: the distance crossed was about two hundred yards. When swimming very little of their bodies appear above water, and their necks are extended a little forward: their progress is slow. On two occasions I saw some ostriches swimming across the Santa Cruz River, where it was about four hundred yards wide, and the stream rapid.

"The inhabitants who live in the country readily distinguish, even at a distance, the male bird from the female. The former is larger and darker coloured, and has a longer head. The Ostrich, I believe the cock, emits a singular deep-toned hissing note. When first I heard it, standing in the midst of some sand-hillocks, I thought it was made by some wild beast, for it is a sound that one cannot tell whence it comes or from how far distant. When we were at Bahia Blanca in the months of September and October the eggs were found, in extraordinary numbers, all over the country. They either lie scattered single, in which case they are never hatched, and are called by the Spaniards 'huachos,' or they are collected together into a shallow excavation which forms the nest. Out of the four nests which I saw, three contained twenty-two eggs each, and the fourth twenty-seven. In one day's hunting on horseback sixty-four eggs were found; forty-four of these were in two nests, and the remaining twenty scattered huachos. The Gauchos unanimously affirm, and there is no reason to doubt their statement, that the male bird alone hatches the eggs, and for some time afterwards accompanies the young. The cock when on the nest lies very close; I have myself almost ridden over one. It is asserted that at such times they are occasionally fierce, and even dangerous, and that they have been known to attack a man on horseback, trying to kick and leap on him. My informer pointed out to me an old man, whom he had seen much terrified by one chasing him."

Rhea Darwinii, Gould, is smaller, and the general tinge of the plumage is light brown in place of gray; each feather being conspicuously tipped with white. The bill is considerably smaller, and especially less broad at its base; the culmen is less than half as wide, and becomes slightly broader towards the apex, whereas in the *R. Americana* it becomes slightly narrower: the extremity of both the upper and the lower mandible is more tumid in the latter than in *R. Darwinii*, and there are other differences.

R. Americana has been exhibited alive in the Gardens of the Zoological Society of London, and specimens of both species are to be seen in the museum of that Society and in the British Museum.

Dromaius (Vieill.).—Bill straight, with the edges very much depressed, rounded at the extremity, slightly carinated above; nostrils large, protected by a membrane, and opening above about the middle of the bill; head feathered; throat nearly naked; feet three-toed.

This is also the genus *Dromiceius* of Vieillot, *Tachea*, Flem., and the form is placed by Latham under the genus *Casuarius*, and by Temminck under *Rhea*.

The Emeu, Emu, or Australian Cassowary, *Dromaius Novæ Hollandiæ* of authors, *D. ater* of Vieillot, and *Dromiceius Australis* of Swainson, Parembang of the natives, has become quite familiar to us from the frequency of its exhibition in menageries, and its breeding so readily in a state of domestication.

The food of the Emeu consists of vegetables and seeds, but chiefly of fruits, roots, and herbage. In a state of nature it is very fleet, and affords excellent sport in coursing with dogs, which are however rather shy of their game, in consequence of the powerful kicks that the bird can inflict, so powerful that the settlers say it can break the bone of a man's leg by striking out with its feet. Well-trained dogs therefore, to avoid this infliction, run up a-breast and make a sudden spring at the neck of the bird. Though the Emeu has bred so frequently in captivity, the mode of making the nest in the wild state does not appear to be well known, though it is generally supposed to be a mere hollow excavated in the earth. The dark green eggs are six or seven in number. The birds appear to be tolerably constant in pairing, and the male bird sits and hatches the young, whilst the female watches and guards the nest. The Emeu can produce a hollow drumming sort of note, well known to those who have attended to its manners in captivity. These birds will, like the *Rhea*, take water. Captain Sturt, when descending the Murrumbidgee, in Australia, saw two of them in the act of swimming. They appear to be gregarious, and not very shy in some localities, for Major Mitchell in his excursion towards Port Phillip found them very numerous on the open downs, and their curiosity brought them to stare at the horses of the party, apparently unconscious of the presence of the riders. In one flock he counted thirty-nine, and they came so near him that the gallant traveller, having no rifle with him, was tempted to discharge a pistol at them, but without effect.

Rhea Darwinii.

Foot of Emeu.

This bird is widely diffused over the southern part of Australia and the neighbouring islands; but gradually disappearing before the encroachment of civilised man. They have also been observed on the west coast (Swan River). Captain Flinders found them in abundance at Port Phillip and King George's Sound, and D'Entrecasteaux at the latter place. Flinders and Péron saw them in numbers at Kangaroo Island.

The flesh of the Emeu, particularly the hind quarters, is generally described to be good and sweet eating.

Apteryx (Shaw).—In 1812 Captain Barclay, of the ship Providence, brought a specimen from New Zealand, and presented it to Dr. Shaw. When Dr. Shaw died, this specimen came into the possession of the late Earl of Derby. M. Temminck placed it with the Dodo among the *Inertes*, but still hardly anything was generally known of the bird till Mr. Yarrell, in 1833, described and figured the Earl of Derby's original specimen, collecting in his paper, in the first volume of the

'Transactions of the Zoological Society,' all that had been previously made known on the subject.

Mr. Gould, who has given beautiful and accurate figures of the bird in his grand work 'The Birds of Australia,' states that since Mr. Yarrell wrote he had become acquainted with five additional specimens, and had obtained further information respecting the history of the species. Two of these, from which his figures are taken, were presented to the Zoological Society by the New Zealand Company; and that society possesses a third but imperfect specimen, presented by Alexander M'Leay, Esq., of Sydney. Two others were afterwards added to the collection of the Earl of Derby, one of which his lordship liberally presented to Mr. Gould. A specimen is now (1855) alive in the gardens of the Zoological Society, Regent's Park.

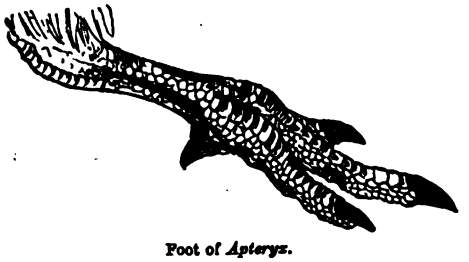
The following is Mr. Gould's description:—Face and throat greenish-brown; all the remainder of the plumage consisting of long lanceolate hair-like feathers of a chestnut-brown, margined on each side with blackish-brown; on the lower part of the breast and belly the feathers are lighter than those of the upper surface, and become of a gray tint; bill yellowish horn-colour, its base beset with numerous long hairs; feet yellowish-brown.

This is the *Apteryx Australis* of Shaw; *Apteryx* of Temminck; Apterous Penguin of Latham; and Kivi-Kivi, or Kiwi-Kiwi, of the aborigines of New Zealand.

The length from the point of the bill to the end of the tailless body is about thirty-two inches; but the bill is much longer in some individuals than in others, and it is not satisfactorily made out whether this difference of length is to be attributed to difference of age or sex; but it has been supposed that the female has the longest bill.

Bill of *Apteryx*. (Owen.)

The toes are four in number; the three anterior ones are unconnected. The hind toe is placed on the inner flattened surface of the tarsus, is directed backwards, and almost perpendicularly downwards;



Foot of *Apteryx*.

it measures only one inch and one-eighth, and of this the claw or spur measures three-quarters of an inch. In the size and position of this toe the *Apteryx* corresponds with the Dodo.

Worms, insects, especially the larvæ of *Lepidoptera*, and probably snails, appear to be the food of this species. Mr. Gould states that the favourite localities of the bird are those covered with extensive and dense beds of fern, among which it conceals itself, and when hard pressed by dogs, the usual mode of chasing it, it takes refuge in crevices of the rocks, hollow trees, and in the deep holes which it excavates in the ground in the form of a chamber. In these latter situations, Mr. Gould tells us, it is said to construct its nest of dried fern and grasses, and there deposits its eggs, the number and colour of which have not been clearly ascertained.

Its habits are exclusively nocturnal, and the natives usually hunt it by torchlight, seeking for it with the utmost avidity, the skins being so highly prized for the dresses of the chiefs, and indeed the natives can be rarely induced to part with them. The feathers are also used for artificial flies in angling, after the European manner. When attacked it vigorously defends itself, striking rapidly and dangerously with its powerful feet and sharp spur, with which it is also said to beat the ground, in order to disturb the worms, on which it feeds, seizing them with its bill the instant they make their appearance.

The *Apteryx* inhabits all the islands of New Zealand, particularly the southern end of the middle island. ('Birds of Australia.') A second species, *A. Oweni*, has been described.

Apteryx Australis. (Gould.)

STRUVITE, a Mineral consisting of a Phosphate of Ammonia and Magnesia, with water.

STRYCHNOS (from *στρύχνος*), a name applied by Theophrastus and Dioscorides to a kind of Nightshade, and adopted by Linnæus for a genus of Plants belonging to the natural order *Apocynaceæ*. This genus has been made the type of a distinct order by Blume, who has been followed by Link, D. Don, and others. The principal difference that it presents from the order *Apocynaceæ*, to which it is referred by Von Martius, Brown, and Lindley, is in its peltate seeds and simple succulent fruit. This genus is composed of trees or shrubs, which do not yield a milky juice, and have opposite usually nerved leaves and corymbose flowers. Some of the species are possessed of tendrils, and are climbing plants. The calyx is 5-parted; corolla tubular, funnel-shaped, with a 5-parted spreading limb, which is valvate in æstivation; the stamens are 5, inserted into the throat of the corolla; ovary 2-celled, with a single style and capitate stigma; fruit a berry, pulpy inside, with a hard rind; seeds peltate, numerous, attached to a central placenta, with copious albumen, and foliaceous embryo. The species are not numerous, and are found principally in the tropical parts of Asia and America. One has been described by Mr. Brown a native of Australia.

S. Nux-vomica, Poison-Nut or Ratsbane, is characterised by its oval shining leaves 3-5-nerved, and its round smooth berries containing many seeds. The flowers are small, of a greenish-white colour, and are arranged in terminal corymbs. The fruit, when ripe, is of the size and colour of an orange. Although the seeds of this plant yield an alkaloid, which is a deadly poison, the pulp of the fruit is greedily eaten by many kinds of birds. The wood of this plant is very hard and durable, and on that account is applied to many purposes by the natives on the coast of Coromandel and other places where it grows.

S. potatorum, Clearing-Nut, has ovate or oval glabrous pointed leaves; a deeply-fissured bark; and berries containing only one seed. It is an abundant plant in the woods and mountains of the East Indies. It has shining fruit, which is black when ripe. When full grown it attains a height of from 15 to 20 feet, and, like the last species, has a very hard wood, which is used for various economical purposes. The English name is derived from the use which is made of the seeds, which, when dried, are sold by the natives for the purposes of clearing muddy water.

S. St. Ignatii, St. Ignatius's Bean, has ovate acute glabrous leaves; pyriform fruit with many seeds, and 4-flowered axillary peduncles. It is a climbing shrub, without tendrils, bearing long drooping white flowers, which have the scent of jasmine. This species is the *Ignatia amara* of Linnæus, but has been referred to the present genus by later botanists. It is a native of Cochin-China, the Philippine Islands, and other parts of Asia. This plant is called Papesta in India, and is used by the native doctors as a remedy in cholera, but is administered in conjunction with Jehiree (*Cocos Maldivica*). When given in overdoses the symptoms are those of poisoning by strychnia, as vertigo, convulsions, &c., and the remedy used for these effects is lemonade in large quantities, which is said to afford relief speedily.

S. colubrina, Snake-Wood, or Snake-Poison-Nut, is a climbing plant with simple tendrils; leaves oblong or oval, obtuse, 3-nerved, shining; ovaries many-seeded. It is a native of the coast of Coromandel and of Silhet. It has small greenish-yellow flowers, and fruit as large as an orange, of a yellowish colour. It is called by the Telingas Naga Musadi, and is considered by the Indian doctors as an effectual remedy for the bite of the Nagra, or Cobra di Capella, a well-known poisonous snake; for this purpose it is used both externally and internally. It should however be stated as the result of the observation of the most intelligent travellers, that these vegetable remedies are not to be depended on in cases of bites of serpents, and that where danger is apprehended the only effectual remedy is excising the wound. The wood of this and other species of the genus is brought to this country, and is known under the name *Lignum colubrinum*.

S. Tieute, Tjettek, or Upas Tieute, has elliptical, acuminate, 3-nerved, glabrous leaves, and simple tendrils which are thickened opposite the solitary leaves. This plant is a climbing shrub, and is a native of Java, and is said to be the true Upas-Tree of that country. It is undoubtedly the most poisonous species of the genus, and yields the greatest quantity of strychnia. There are several other plants which are called by the name of Upas in various parts of Asia. The natives of Java prepare from this species one of the most deadly of the various poisons that are used by barbarous nations for producing death by the wounds occasioned by their arrows.

S. toxifera, Wooraly, Urari, or Poison-Plant of Guyana, has a climbing stem, thickly covered with long spreading reddish hairs; coarse, rough, 5-nerved, ovate, or oblong, shortly acuminate leaves; large round fruit. This plant is a native of Guyana, and was brought to this country by Sir Robert Schomburgk. It had long been suspected that the poison used by the American Indians for their arrows was a species of Strychnos, but such is the secrecy with which they gather the plant and prepare the poison, that all inquiries had been frustrated. Sir Robert's long stay in Guyana has enabled him to decide this point: by bribing some of the natives, he induced them to guide him to a spot where their famous Urari flourished, and on arriving at the place, found it to be the species of Strychnos above described. In the preparation of the poison, the Urari is not the only ingredient, but forms about half of the bulk of the ingredients used. For a full account of the discovery of this plant, and the mode of making the poison, with its effects on the animal economy, the reader is referred to Sir Robert Schomburgk's account of the Indian arrow-poison. ('Annals of Natural History,' vol. vii. p. 407.) It is remarkable that the poison prepared from this plant, though destroying life so rapidly when applied to a wound, may be taken into the stomach in doses of several grains without producing any ill effects, and it has even been proposed as a remedy in many diseases. It must be admitted however that it is a dangerous remedy to administer, as by coming in contact with the slightest abrasion of surface or ulceration, it might immediately destroy life.

S. pseudo-quina, Quina do Campo, has short-stalked, ovate, quintupled-nerved leaves, which are callous at the edge, and smooth or nearly so above. It is a native of Brazil, and forms a scrubby plant about 12 feet high, with a corky bark. Its fruit is a smooth shining berry of a yellow colour, containing only four seeds. This plant is not poisonous, and is remarkable for its bitterness, which gives it a resemblance to the Gentians and Cinchonas. The fruit of this species is eaten by the native children. The fruit also of another species, *S. brachiata*, is eaten by deer in Peru, and that of *S. spinosa*, a Malagash plant, is greedily devoured by swine.

STRYGOCE'PHALUS. [BRACHIOPODA.]

STURGEON. [STURIONIDÆ.]

STURIO'NIDÆ, a family of Fishes belonging to the section *Chondropterygii*, the species of which are distinguished from others of the section by the gills being free, as in ordinary fishes, thus differing from the second great division of the fishes having a cartilaginous skeleton, such as the Sharks and Rays, in which the gills are fixed, and have their outer margin attached to the skin. The *Sturionidæ*, or Sturgeon Tribe, have moreover but one opening to the gills, and this is protected by an operculum.

Four genera are contained in this family, *Accipenser*, *Spatularia*, *Chimæra*, and *Callorhynchus*. To the first of these genera belongs the Common Sturgeon (*Accipenser Sturio*, Linn.), which is not unfrequently met with in mouths of English rivers. It is of an elongated form, and has the body protected by numerous indurated plates, which are arranged in longitudinal series; the head is entirely covered by bony plates; the muzzle is elongated, and more or less pointed; and the mouth, which is placed on the under side of the head, is tubular, and destitute of teeth: on the back is a single dorsal fin, which is placed on the hinder third of the fish; the tail is forked, and the upper lobe is the largest, as in the Sharks.

"In the northern part of Europe," observes Mr. Yarrell, "this fish is much more numerous than with us, and extensive fisheries are established for its destruction. Caviar is made of the roe of the female; isinglass is obtained from the dense membrane forming the air-bladder; and the flesh, besides being preserved by salting and pickling, is in request for the table while fresh, being generally stewed with rich gravy, and the flavour considered to be like that of veal. The flesh, like that of most of the cartilaginous fishes, is more firm and compact than is usual among those of the osseous families."

Two species of Sturgeon have long been distinguished by the fishermen of the Solway Frith, the one with a blunt nose, and the other with a sharp nose: the latter is the more common of the two; the former has been described by Dr. Parnell, in the 'Transactions of the Royal Society of Edinburgh' (vol. xiv. pl. 4), and is introduced by Mr. Yarrell, in the Supplement to his 'History of British Fishes.'

Several very distinct species frequent the rivers of Russia, and will be found described and figured by M. A. Loretsky, in the third volume of the 'Transactions of the Imperial Society of Naturalists at Moscow.' Three species are found in the rivers which flow into the Black Sea, and moreover North America possesses species which are peculiar.

The genus *Spatularia* is distinguished by the enormous prolongation of the muzzle, the sides of which are dilated. The general form of the body nearly resembles that of the Sturgeons; but the gills are more open, and the operculum is prolonged into a membranous point behind; the mouth is deeply cleft, and well provided with small teeth; the lobes of the tail are very nearly equal. But one species of this curious genus is known (*Squalus Spatula*, Mauduit), and that is an inhabitant of the Mississippi.

Chimæra, Linn.—Although placed in the present section, the *Chimæræ* differ considerably from the Sturgeons, and are in fact very nearly allied to the Sharks. "Though in these fishes there is but one apparent gill-opening," observes Sir John Richardson, in his 'Fauna Boreali-Americana,' "the gills in reality adhere by a large part of their borders, and there are consequently five holes communicating with the external gill-opening." They have a rudimentary operculum concealed by the skin; and their jaws, still more reduced than those of the sharks, are furnished with hard plates, four above and two below, in place of teeth. The males are distinguished by trifid bony appendages to the ventral fins. The eggs are large and of a coriaceous texture, and have flattened and hairy margins. The snout, supported like that of the sharks, projects forwards, and is pierced with pores arranged in tolerably regular lines; the anterior dorsal fin is armed with a strong bony spine, and is placed over the pectorals.

In the genus *Chimæra*, as at present restricted, the snout is conical; the second dorsal fin commences immediately behind the first, and extends to the tip of the tail, which is elongated and pointed, and terminates in a long filament: on the under side the tail is also furnished with a long but narrow fin. Only one species is known, the Northern Chimæra (*C. monstrosa*, Linn.). This fish inhabits the European seas, and is said to be frequently caught following the shoals of herrings, on which it preys. It is usually two or three feet in length, and the general colouring of the body is silvery-white, but the upper parts are mottled with brown.

The next genus differs from *Chimæra* chiefly in having the snout terminated by a largish fleshy appendage. The second dorsal fin is placed over the ventrals, and terminates opposite the commencement of the lower tail-fin. The only species known until very recently was the Antarctic Chimæra (*C. Callorhynchus*, Linn.), an inhabitant of the South Seas. A second species of *Callorhynchus* is described by Mr. Bennett under the name of *C. Smythi*, in the zoological appendix to Beechy's 'Voyage;' and more recently Sir John Richardson describes a species of the present genus (*C. Tasmanius*), which he regards as distinct. It is from Port Arthur, Van Diemen's Land.

STURMIA, a genus of Plants belonging to the natural order *Orchidaceæ* and the tribe *Malaxideæ*. It has a patent perianth; lip anterior, erect or oblique, entire, dilated, much larger than the sepals; stigma roundish; rostellum obsolete, but with an appendage consisting of two tubercles; anthers terminal, deciduous, moveable like a lid, with two distinct cells; column elongated; germen on a twisted stalk.

S. Loeselii has the leaves oblong-lanceolate; stem triangular; lip obovate, longer than the petals; flowers from 6 to 12, in a lax spike, yellowish in colour; the sepals lanceolate; petals linear; the hybernaculum is large, ovate, inclosed in the whitish sheaths of the decayed leaves. It is the *Liparis* of some authors. It is found in spongy bogs in Norfolk, Suffolk, and Cambridgeshire, but is very rare.

(Babington, *Manual of British Botany.*)

STU'RNIDÆ, Mr. Vigors' name for the Starling Family, belonging to his order *Insessores*.

Linnæus placed his genus *Sturnus*, consisting of only five species, among which the Water-Ouzel appears as *Sturnus Cinclus*, between *Alauda* and *Turdus*, in his order *Passeres*. Cuvier arranges the Starlings between the Cassiques (*Cassicus*) and the Crows (*Corvus*).

Mr. Vigors, who assigns to the *Sturnidæ* a place between the *Fringillidæ* and the *Corvidæ*, in his *Conirostres*, observes that this family embraces a considerable number of groups, approaching each other in their gregarious and migratory habits. They are, he remarks, found in every part of the globe united in large flocks, carrying destruction among the cultivated fields, and following herds of cattle for the sake of the insects or grains which they may pick up from their bodies or in their neighbourhood. "In addition to the American genus *Icterus*," continues Mr. Vigors, "and the contiguous genera *Cassicus* and *Xanthornus* of M. Brisson, together with *Pendulinus*, Vieillot, and several corresponding groups, we may observe the genus *Amblyramphus*, Leach, united to the family, as also the *Buphaga*, Linnæus, and *Pastor* and *Lamprotornis*, which M. Temminck has separated from the Thrushes. The whole of the family, united by their manners and the straight and conical form of the beak, the ridge of which passes back to some extent over the forehead, may be observed, by those who cast even a casual glance over the three adjoining groups, to hold an intermediate rank between the weaker conformation of the *Fringillidæ* and the more powerful structure of the *Corvidæ*." And he passes into the family of *Corvidæ* by the genus *Nucifraga*. [NUCIFRAGA.]

Mr. Swainson divides the family into five groups or sub-families.

Sturnidæ. Starlings.

Size smaller than that of the *Corvidæ*. Stature less robust. Bill angulated at the base; the upper mandible entire. Lateral toes equal. (Sw.)

Sub-Family *Sturninæ*.

Bill in the form of a lengthened cone, longer than the head; the commissure with an acute angle at the base.

Sturnus, Linn.—Bill depressed from the base as far as the tip, which is slightly inflexed, and obsoletely notched; culmen convex and rounded. Wings lengthened, pointed; the first quill minute and spurious; the second and third longest. Tail short, divaricated. Feet moderate, terrestrial; the lateral toes equal; the middle toe as long as the tarsus; hinder toe shorter. The Conirostral type. (Sw.)

S. vulgaris, the Common Starling, the Stare. This bird is too well known in Great Britain to need description. It is one of the handsomest of our birds, and is a general favourite. It is intelligent, sprightly, has a retentive memory, and when kept in confinement the males learn to whistle tunes and imitate some of the sounds of the human voice. They are social, living in flocks throughout the greater portion of the year. The Starling builds in church steeples, under eaves, and in holes of houses, towers, or ruins. The nest is made of slender twigs. The eggs are four or five in number, of a delicate pale blue, 1 inch 2 lines in length by 10 lines in breadth. Their food consists of worms, insects, and snails. They are frequently seen in meadows searching for food amongst cattle and sheep. They sometimes eat berries and grain. They occasionally congregate together in prodigious numbers in shrubberies and plantations.

The Starling is common in almost every part of the United Kingdom. It is found in the north of Europe, and as far east as Nepaul, the Himalaya Mountains, Calcutta, China, and Japan. It has been seen in Africa as far south as the Cape of Good Hope.

Head and Foot of Starling (*Sturnus vulgaris*).

Pastor, Temm.—Bill depressed only at the base, compressed beyond; culmen slightly bent; tip of the upper mandible deeply notched; commissure distinctly angulated at the base; nostrils large, feathered. Wings moderate in length, ample in breadth; first quill very minute, the second nearly equal to the third. Tail short, broad, rounded. Feet very large and strong: middle toe as long as the tarsus; hinder shorter; lateral toes equal; claws somewhat slender, acute, but not much curved.

P. roseus, the Rose-Coloured Ouzel. This bird is an accidental visitor in the British Islands. Like the Common Starling, it has a wide geographical range. It is very numerous in various parts of Hindustan. It inhabits Syria, Egypt, and Africa. It flies in flocks, and has many of the habits of the Common Starling.

The adult male has a beak of a yellowish rose-colour; the head, neck, wings, and tail black, glossed with violet-blue; the feathers on the head elongated so as to form a flowing crest; the back, scapulars, and rump of a delicate rose-colour; the chin, throat, and front of the neck, black; breast, sides, and abdomen, like the back, of rose-colour; thighs and under tail-coverts black; legs and toes yellowish-brown; claws darker brown. (Yarrell.)

Gracula, Auct. [CORACIAS.]

Acridotheres, Vieill.—General structure of *Pastor*; but the whole of the head entirely naked, and furnished with fleshy crests and wattles; nostrils large, naked. Feet moderate. Tail even. Bill very wide at the base. The Tenuirostral type. (Swainson.) Ex. *A. cæruculatus*.

Oxystomus, Sw.—Bill much lengthened, longer than the head; the sides are compressed; culmen flattened, nearly straight, and angulated on each side, the base advancing very far upon the head and dividing the frontal feathers; nostrils placed in a large depression towards the base of the bill. Wings very short and considerably rounded. Tail moderate, rounded; all the feathers, and the secondary quills, ending in setaceous points. Legs long and robust; tarsus much longer than the middle toe; lateral toes unequal, the inner shortest. It is a native of the Pacific Islands. The Scansorial type. (Sw.) Ex. *O. cæruculatus*.

Sub-Family *Lamprotorninæ*. Grakles.

Bill thrush-like, compressed; the culmen curved from the base. Lateral toes unequal.

Ptilonorhynchus.—Size large. Bill short, very thick, convex above; both mandibles distinctly notched; nostrils placed half-way between the gape and the tip, partly concealed by the short thick-set feathers of the front, which lie on the basal half of the bill. Wings rather short, rounded; the first and second quills graduated; the third shorter than the fourth and fifth, which are the longest. Tail moderate; the feathers broad, their tips truncated. Feet ambulating, large, and very strong; middle toe and tarsus of equal length; hinder toe very strong, but much shorter; lateral toes unequal, the outer longest, and united to the middle as far as the first joint. It is a native of Australia. (Sw.) Ex. *P. holosericeus*.

Lamprotornis, Temm. (Grakle).—Bill thrush-like, compressed its whole length; culmen curved from the base to the tip; upper mandible notched; commissure slightly curved; nostrils midway between the tip and the gape, naked, but with the frontal feathers reaching to their base. Wings long, ample; the first quill spurious; the third, fourth, and fifth of equal length, and longest. Tail short, even, rounded, or (as in the Rasorial type) considerably lengthened and cuneated. Feet very large and strong; middle toe and tarsus equal; hinder strong, but much shorter; lateral toes unequal. (Sw.) Ex. *L. ptilonorhynchus*. ('Birds of West Africa,' i. 140.)

Sub-Family *Scaphidurinæ*. Boat-Tails.

Bill of a very lengthened conic shape, entire, and compressed; the culmen slightly curved. Tail graduated, the sides reflected upwards, or boat-shaped. Feet strong. (Sw.)

Astrapia. [CORVIDÆ.]

Scaphidura, Sw.—Bill longer than the head, conic; both mandibles equally thick; the base of the culmen broad, flattened, and advancing very far on the front of the head; commissure angulated at the base, and sinuated on the sides; nostrils basal, placed in a small triangular hollow on the sides, the membrane obsolete. Wings lengthened, pointed; the first quill longest. Tail moderate, graduated, boat-shaped. Feet strong; middle toe and tarsus of equal length; hinder toe much shorter; inner toe hardly shorter than the outer. It is a native of South America. (Sw.) Ex. *S. Barita*.

Quiscalus, Vieill.—Bill longer than the head, compressed. Both mandibles equally thick. Culmen slightly curved, and compressed from the base, where it simply divides the frontal feathers, without being dilated. Commissure considerably sinuated. Nostrils broad, naked; the aperture round. Wings moderate, somewhat pointed; the first two quills slightly shorter than the third and fourth, which are the longest. Tail rather lengthened, much graduated, boat-shaped; tips of the lateral feathers truncated. Feet large, strong. Middle toe and tarsus equal; hinder toe shorter; inner toe scarcely shorter than the outer. America. (Sw.) Ex. *Q. versicolor*.

Scolecophagus, Sw.—Bill shorter than the head, straight, slender; the margin inflexed, but not sinuated. Wings moderate, pointed; the first quill rather shorter than the second. Tail divaricated, flat, and slightly rounded. Legs lengthened, slender, formed for walking. Middle toe and tarsus of equal length; hinder toe shorter; lateral toes of equal length. Claws slender, acute, slightly curved. (Sw.) Ex. *S. ferrugineus*.

Sub-Family *Icterinæ*. Hang-Nests.

Bill completely conic, entire, rather shorter than the head, either straight or with both mandibles slightly bent. Feet formed for grasping. The claws thick, broad, and much curved. (Sw.)

Cassicus, Daudin (Cassicans).—Bill rather longer than the head; the base thick, very convex, and enlarged into a broad oval plate,

which advances very far on the front, and divides the frontal feathers. Nostrils oval, naked, basal, pierced in the solid substance of the bill, and close to the margin of the upper mandible. Commissure straight, but angulated at the base. Wings rather long; the first and second quills graduated. Tail graduated. Feet short, very strong. Hind toe and claw nearly as long as the tarsus. It is a native of Tropical America. (Sw.)

Zanthornis (*Xanthornus*), Cuv.—Bill not longer than the head, generally shorter, perfectly straight; the culmen not dilated at the base, but simply dividing the frontal feathers. Wings moderate, pointed; the first three or four quills generally or nearly equal. Tail moderate, rounded. Feet moderate, but with the hinder toe manifestly longer than the tarsus; lateral toes unequal. It inhabits America. (Sw.) Ex. *X. Baltimorii.*

Icterus, Cuv.—Bill somewhat lengthened, as long as the head, or longer; both mandibles slightly curved, and considerably attenuated. Nostrils basal, rather large, covered above by a membrane; the aperture lateral and oval. Wings moderate; the first and second quills rather shorter than the third. Tail somewhat lengthened, graduated. Feet moderate; inner toe shorter than the outer; hinder toe shorter than the tarsus. Ex. *I. castaneus.*

Chrysomus, Sw.—Bill resembling *Zanthornis* (*Xanthornus* must be meant); but the margin of both mandibles inflexed. Wings moderate; the first quill rather shorter than the second, Tail rounded. Feet formed for walking. Toes large, very long and slender; middle toe longer than the tarsus; lateral toes equal; hinder toe shorter than the tarsus. Claws long, very slender, and but slightly curved. (Sw.) Ex. *C. icterocephalus.*

Sub-Family *Aglainæ* (*Agelainæ ?*). Maizers.

Bill short, thick, entire, completely conic, sometimes depressed, and rounded at the tip. Culmen rather broad, and flattened at the base. Legs long, slender, formed for walking.

Dolichonyx, Sw.—Bill very short, finch-like, conic, entire, shorter than the head; the commissure sinuated. Wings pointed; the first and second quills longest and nearly equal. Tail slightly graduated, subscansorial; the tips acuminated, and somewhat rigid. Legs long, slender; middle toe longer than the tarsus; lateral toes unequal, the inner longest; hind toe of equal length with the tarsus. Claws long, very slender, and slightly curved. (Sw.) Ex. *D. oryzivorus.* [Bobo-Link.]

Agelaius, Vieill.—Bill short, very conic, entire; the tips compressed; the culmen flattened towards the base; sides of the mandibles inflexed. Wings lengthened; the first two quills longest. Tail slightly rounded. Legs long, slender; middle toe nearly as long as the tarsus. Claws long, very slender, and but slightly curved. It is a native of America. (Sw.)

A. phœniceus, the Red-Winged Starling. It is the *Sturnus prædatorius*, *Icterus phœniceus*, Red-Winged Maize-Bird and Red-Winged Blackbird of authors. This bird is a native of America, but a few specimens have been taken in Great Britain. In America it is called Marsh Blackbird, where they are very destructive to the corn crops. They are social like the starling, and not unfrequently vast numbers of them assemble together.

Leistes, Vigors.—Bill lengthened, conic, very straight; the culmen depressed from the base to the tip, which is flattened. Wings moderate; the first quill rather shorter than the three next, which are the longest. Tail rounded. Legs large, strong; middle toe longer than the tarsus; hinder toe shorter; lateral toes unequal, the outer one smaller than the inner; the hinder claw much stronger and more curved than the middle one. (Sw.) Ex. *L. erythrocephalus.*

Molothrus, Sw., Cowpen. Ex. *M. pecoris.* [Molothrus.]

Sturnella, Vieillot.—Bill long, equal to the length of the head, conic, much depressed towards the tip, where it is broader than high; culmen dividing the frontal feathers, where it is depressed and flattened. Wings moderate; first quill rather shorter than the second. Tail short, rounded; the feathers rather narrow. Feet large, but slender; tarsus longer than the middle toe; lateral toes unequal, the inner shortest; hind toe not much shorter than the middle. Anterior claw small, and of equal size; hinder claw (typically) twice as long as the others. (Sw.) Ex. *S. collaris.* ('Classification of Birds.')

The family is immediately succeeded in Mr. Swainson's arrangement by the *Fringillidæ*, to which some of the species placed by him among the *Sturnidæ*, but by others among the Finches (*Dolichonyx*, for example), would seem rather to belong.

Prince Bonaparte, in his 'Birds of Europe and North America,' places the *Sturninæ* in his family *Corvidæ*, next to *Corvinæ*, and arranges under the *Sturninæ* the genera *Acridotheres*, *Quiscalus*, *Scolecophagus*, *Sturnella*, *Icterus*, *Agelaius*, *Molothrus*, and *Dolichonyx*.

Mr. G. R. Gray ('Genera of Birds') makes the *Sturnidæ*, which are immediately succeeded by the *Fringillidæ*, as they are in Bonaparte's method, follow the *Corvidæ*.

Mr. Gray divides the *Sturnidæ* into the following sub-families:—

1. *Lamprotorninæ.*

Genera:—*Ptilonorhynchus*, Kuhl (*Pyrrhocorax*, Vieill.; *Kitta*, Kuhl); *Chlamydera*, Gould (*Ptilonorhynchus*, Jard.; *Calodera*, Gould); *Lamprotornis*, Temm. (*Turdus*, Lath.; *Lamprotornis*, Temm.); *Jaida*, Less. (*Lamprocolius*, Sundev.; *Lamprotornis*, Temm.); *Megalopterus*, Smith; *Spreo*, Less. (*Turdus*, Gm.; *Lamprotornis*, Sw.); *Aplonis*, Gould (*Turdus*, Lath.); *Cochoa*, Hodgs.

2. *Buphaginæ.*

Genus, *Buphaga*, L.

3. *Sturninæ.*

Genera:—*Pastor*, Temm. (*Psaroides*, Vieill.; *Boscis*, Brehm; *Turdus*, L.); *Acridotheres*, Vieill. (*Cossyphus*, Dum.; *Gracula*, Gm.); *Psarolophus*, Jard. and Selby (*Pastor*, Gould; *Oriolus*, Hodgs.); *Cutia*, Hodgs.; *Dilophus*, Vieill. (*Sturnus*, Lath.; *Pastor*, Temm.; *Acridotheres* (Vieill.), Swains.; *Gracula*, Gm., Cuv.); *Creadion*, Vieill. (*Sturnus*, Lath.; *Oxystomus*, Swains.; *Philesturnus*, J. Geoff.; *Philedon*, Cuv.; *Icterus*, Less.); *Sturnus*, L.; *Sturnella*, Vieill. (*Cassicus*, Daud.; *Alauda* and *Sturnus*, L.); *Amblyrhynchus*, Leach (*Oriolus*, Gm.; *Sturnella*, Vieill.; *Leistes*, Sw.).

4. *Quiscalinæ.*

Genera:—*Astrapia*, Vieill. (*Paradisea*, L.; *Lamprotornis*, Temm.); *Scolecophagus*, Sw. (*Gracula*, Wils.; *Quiscalus*, Bonap.; *Chalcophanes*, Wagl.); *Quiscalus*, Vieill. (*Icterus*, Temm.; *Quiscala*, Licht.; *Chalcophanes*, Wagl.; *Scaphidura*, Sw.); *Cassidix*, Less. (*Oriolus*, Gm.); *Scaphidura*, Sw. (*Gracula*, Gm.; *Quiscala*, Licht.; *Icterus*, Temm.; *Chalcophanes*, Wagl.).

5. *Icterinæ.*

Genera:—*Cassicus*, Briss. (*Icterus*, Temm.; *Xanthornus*, Pallas; *Psarocolius*, Wagl.; *Oriolus*, L.); *Cassiculus*, Swains. (*Icterus*, Bonap.; *Xanthornus*, Jard. and Selby); *Xanthornus*, Briss. (*Psaracolius*, Wagl.; *Yphantes* and *Pendulinus*, Vieill.; *Oriolus*, L.); *Icterus*, Briss. (*Oriolus*, L.; *Pendulinus*, Vieill.; *Psarocolius*, Wagl.); *Chrysomus*, Sw. (*Pendulinus*, Vieill.; *Oriolus*, L.).

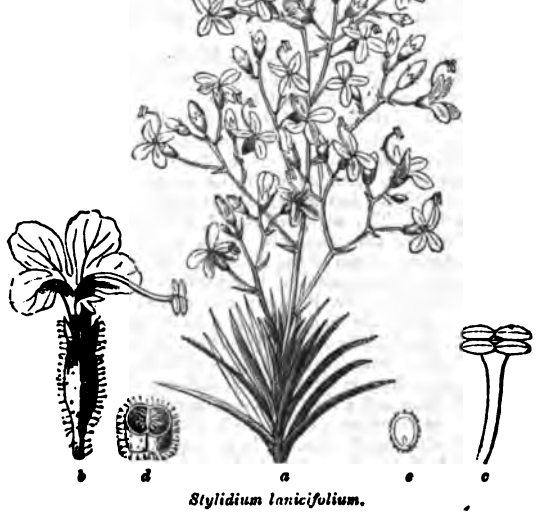
6. *Aglainæ.*

Genera:—*Molothrus*, Swains. (*Emberiza*, Gm.; *Passerina*, Vieill.; *Psarocolius*, Wagl.; *Agelaius*, Swains.); *Leistes*, Vigors (*Agelaius*, Vieill.; *Psarocolius*, Wagl.; *Xanthornus*, Quoy and Gaim.; *Icterus*, Licht.); *Agelaius*, Vieill. (*Oriolus*, L.; *Sturnus*, Wils.; *Icterus*, Briss.; *Psarocolius*, Wagl.); *Dolichonyx*, Swains. (*Emberiza*, L.; *Passerina*, Vieill.; *Icterus* and *Emberizoides*, Bonap.; *Psarocolius*, Wagl.).

STYLA'RIA, a genus of *Annelida.*

STYLE. [Pistil.]

STYLIDIA'CEÆ, *Styleworts*, a natural order of Plants belonging to the epigynous group of Monopetalous Exogens. They are herbaceous plants, or under-shrubs, with aqueous juices, sometimes having hairs, which are simple, acute, or capitate; the stem and branches are round, or sometimes they have a scape; the leaves are entire, without stipules, mostly scattered, sometimes whorled, the radical ones clustered in the



Stylidium lanicifolium.

a, cutting showing corymbose flowers and leaves; *b*, flower showing irregular corolla, tubular calyx, and capitate hairs; *c*, filaments and style, forming a single column, with anthers covering stigma; *d*, 2-celled ovary; *e*, section of seed with minute embryo.

species which possess a scape; the flowers are solitary, or arranged in spikes, racemes, or corymbs, mostly terminal; the pedicels have three bracts; the tube of the calyx is attached to the ovary; the limb is 2-6-parted, bilabiate, or regular and persistent; the corolla is monopetalous, irregular, 5- or 6-cleft, imbricated in æstivation, and late in falling off; there are two stamens, the filaments of which are united

with the style, the whole forming a single elongated column; the anthers are 1- or 2-celled; when the latter, they lie over the stigma; the pollen is globose, simple, sometimes angular; the ovary is 2-celled, or sometimes 1-celled from a contraction of the dissepiment, many-seeded, with a single gland in front, or two opposite ones; the style is one with the filaments, and the stigma, which is simple or bifid, is inclosed and hidden by the anthers. The fruit is a capsule, with two valves and two cells; the seeds are indefinite, small, erect, sometimes stalked; the embryo is minute, and inclosed within a fleshy somewhat oily albumen. This curious order of plants is allied to *Campanulaceæ* and *Goodeniaceæ*, but the peculiar union of its filaments and style into a single column distinguishes it at once. This column possesses a considerable degree of irritability. [STYLIDIUM.] There are only two genera of this order known besides *Stylidium*. They are chiefly found in Australia, but species have been discovered on the Himalayas, Ceylon, and the South Sea Islands. Their properties are unknown.

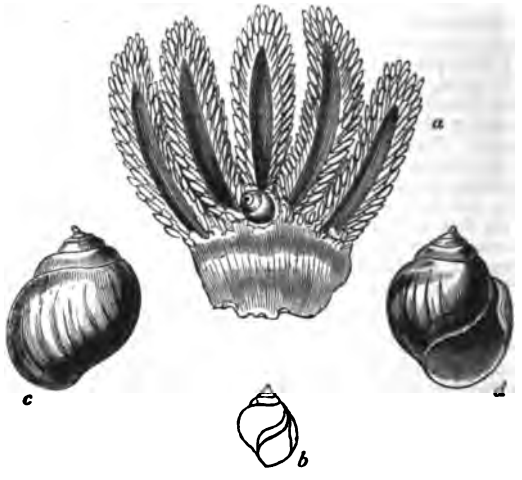
STYLI'DIUM (a diminution of 'stylus,' a column), the name of a genus of Plants, the type of the natural order *Stylidiaceæ*. The essential characters of this genus are: Calyx 2-lipped; corolla irregular, 5-parted, form of the segments equal, the fifth smaller, forming a labellum, which is deflected; column consisting of filaments and style, reflexed, with a double curve; anthers with two lobes widely separated; stigma obtuse, undivided; capsule bilocular, with the dissepiment sometimes superiorly incomplete. This is chiefly an Australian genus of plants, and is remarkable for its gynandrous structure, and for the irritability of the column formed by the union of filaments and style. Irritability is seen in many genera allied to this, as in the indusium of *Goodenia*. The part which exhibits movement on being excited is the curved column, and the irritability is confined to a small portion only of the column near its base. In the natural state the column projects from beyond the flower, and hangs down over the smaller petal or labellum, and the irritable part of it is in contact with the labellum. The movement of the column consists in raising itself from this deflected position to that of perfect uprightness. In the bud, the column does not possess this power, but as the anthers develop, this property of the column increases, and is at its greatest intensity at the time of the dehiscence of the anthers, and entirely ceases when the impregnation of the ovules has taken place. During this process the anthers also undergo a change; previous to dehiscence, they entirely cover the stigma, but after this process has taken place, the stigma is fully exposed, and remains so. The irritability is then developed with the anther: it is at its greatest height whilst the anther is performing its function, and ceases with the function of that organ. The movement of the column is produced by external stimulants or the application of a solid body. Exposure to heat will erect the column, and its withdrawal will cause it to return to its natural position. After returning to this state, it requires ten or fifteen minutes' rest before it will again exhibit irritability. When elevated, the column cannot be made to return by force to its bent position. When the movement takes place naturally, it is slow and regular, and when under the influence of artificial excitants, it occurs suddenly and by jerks. The final cause of these movements is evidently connected with impregnation, and it seems that the pollen is conveyed to the stigma whilst the column is upright, which could not be the case whilst it was dependent.

The species of this genus described by Mr. Brown, in his 'Prodromus Floræ Novæ Hollandiæ,' are forty-five in number; besides these there are two or three natives of the East Indies.

STY'LIFER, or STILIFER (Broderip), a family of Pectinibranchiate *Mollusca*. The shell is hyaline, turbinated, the apex of the spire mucronate. The aperture subovate, acuminated above. The external lip acute and sinuated. Animal with the mantle thick, fleshy, and cup-shaped, covering the last whorls of the shell. The proboscis very long and retractile. The tentacles round, thick, subacuminate, and situate at the base of the proboscis. Eyes very small, sessile at the base of the tentacles. Stem of the branchia solitary. Animal marine, penetrating into the integument of the star-fish.

S. Astericola (Brod.).—Mr. Broderip states that the arrival of this species with the soft parts had afforded data for a generic character, indicating a distinct family among the *Pectinibranchiata*, the form of whose mantle differs from any other genus of that order. This mantle, which is of a green hue, is thick, fleshy, and cup-shaped, with a small aperture at its base, and a free posterior margin, enveloping the soft parts and the last volutions of the shell, which has thus somewhat the appearance of a small acorn set in its cup. On the ventral aspect of the mantle is the rudiment of a foot, and from the small basal aperture a retractile proboscis (which, when exserted, is as long as the whole animal) is protruded. At the base of the proboscis are two thick, round, somewhat pointed tentacula; and at the base of them are the eyes, or rather, ocular specks without pedicles. The branchia is placed on a single stem. At the base of the proboscis is a spherical muscular stomach, and the intestine ascends into the spire of the shell, where it becomes attached to the liver, which in *S. Astericola* is of an orange colour.

Mr. Cuming found this elegant parasite burrowed in different parts of the rays of the oral disc of *Asterias solaris*. It was almost hidden from sight, so deeply does the animal penetrate into the substance of the star-fish, in which it makes a comfortable cyst for itself, and wherein it most probably turns by the aid of its rudimentary foot. All the specimens infested with these testaceous molluscs appeared to be in the best health, though there is reason to believe that they feed upon the juices of the star-fish. Mr. Broderip observes that *Stylifer* (with that instinct of self-preservation which is imparted to all parasites whose existence depends upon that of their nidus) appears, like the larvæ of the ichneumon tribes among insects, to avoid the vital parts; for in no instance did Mr. Cuming find it imbedded anywhere save in the rays, though some of the individuals had penetrated at their base, and very near the disc. When extracted, the older shells have the appearance of a milky-clouded glass-bubble: the younger shells Mr. Broderip found of an unclouded transparency.



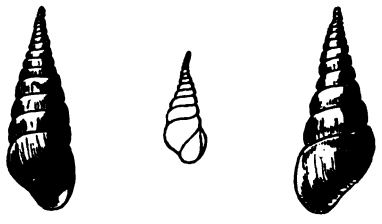
Stylifer Astericola. (Sowerby's 'Genera.')

a, a portion of *Asterias solaris*, showing *S. astericola* in its cyst; *b*, a fine specimen of the shell; *c*, *d*, views of the upper and under side of the same, magnified.

Mr. Broderip remarks that Dr. Turton, in the second volume of the 'Zoological Journal,' p. 367, pl. 13, describes and figures a shell under the name of *Phasianella stylifera*, adding that he found a dozen attached to the species of *Echinus esculentus* dredged up in Torbay. Mr. Broderip observes that it is clear that Dr. Turton's shell is not a *Phasianella*, for it is described as having no operculum, and the similarity of the shell leaves no doubt, when joined to the parasitic habits of the animals, that it is one of the congeners of *Stylifer Astericola*. Mr. Broderip therefore names Dr. Turton's specimen *S. Turtoni*.

Stylifer Turtoni, natural size and magnified. ('Zool. Journ.')

Mr. G. B. Sowerby furnished Mr. Broderip with a third species, which, though its habits were unknown to the latter, he considers to be referrible to this genus, and he names it *S. subulatus*; it is so beau



Stylifer subulatus, natural size and magnified. (Sowerby's 'Genera.')

tifully transparent, that in fine specimens the columella can be as distinctly seen as if there were no intervening medium; and its long apex, which consists of many close-set whorls, is generally out of the perpendicular.

(Broderip, in Sowerby's *Genera of Recent and Fossil Shells*, Number xxxviii.)

STYLINA. [MADREPHYLLIGEA.]
STYLOCERUS. [CERVIDÆ.]
STYLOPORA. [MADREPORÆA.]
STYLOPS. [STREPSIPTERA.]

STYRA'CEÆ, *Storaxworts*, a small natural order of Plants, placed by Lindley in his Polycarpous group of Monopetalous Exogens. The

species are trees or shrubs, with alternate leaves without stipules, usually turning yellow in drying. The flowers are axillary, and are either solitary or clustered with membranaceous bracts. The calyx is persistent, and has five divisions; corolla with divisions, frequently differing from the calyx, and with imbricated æstivation; stamens varying in number, arising from the tube of the corolla, with 2-celled anthers; ovary 3-5-celled, with few ovules, a simple style, and capitate stigma; fruit a drupe; seeds solitary, with the embryo lying in the midst of albumen. This order is nearly allied to *Ericaceæ*, from which it differs in habit, its definite seeds, and its frequently inferior ovary. It differs from *Ebenaceæ* in its stamens being perigynous, in the insertion of the ovules, and its simple style. It is however an order on which there are many different opinions, some referring all its genera to *Ebenaceæ*, whilst others separate from it the genera *Symplocos* and *Halesia* as types of distinct orders.

The species are found in the temperate and tropical parts of North and South America, and also in Nepaul and China. This order is chiefly remarkable, in an economical point of view, for furnishing the Storax and Benzoin of commerce, which contain a peculiar acid called the Benzoic Acid. Some of the species are used for dyeing yellow, and a species of *Alstonia* is employed as a substitute for tea. The various species of *Halesia* are the Snow-Drop Trees of the Carolinas. [HALESIA.]

Styrax officinalis.

a, branch showing leaves and clustered flowers; *b*, corolla opened with perigynous stamens and pistil; *c*, fruit covered with tomentum; *d*, transverse section of ovary, showing three cells; *e*, section of seed, showing embryo in the midst of albumen.

STYRAX (from στύραξ), a genus of Plants forming the type of the natural order *Styraceæ*. It has a persistent campanulate 5-toothed calyx; monopetalous deeply 3-7-cleft corolla; 10 stamens monadelphous at the base, with linear 2-celled anthers; superior ovary with indefinite ovules, with simple style and 3-lobed stigma; fruit a dry drupe; seed with a double testa, inverted embryo, and fleshy albumen. The species are elegant trees and shrubs, mostly covered with hairs having a stellate form, with entire leaves, and white or cream-coloured racemose flowers. They are principally natives of America and Asia; one is found in Europe and one in Africa.

S. officinalis, Officinal Storax. Leaves ovate, downy beneath, shining above; racemes 5-6-flowered, simple, shorter than the leaves. It is a native of Syria, Italy, and most parts of the Levant. It is common all over Greece and the Peloponnesus, where Dr. Sibthorp found it retaining almost the same designation as that given it by Theophrastus and Dioscorides, the modern name being Στυράκι. It was first cultivated in England by Gerarde, but is still a rare plant in this country. One of the finest specimens is in the Botanic Garden at Chelsea, and is annually covered in May and June with a profusion of rich blossoms. This species yields the Storax admitted into the Materia Medica of the London Pharmacopœia. [STYRAX, Arts & Sci. Div.] There is however another Storax known in commerce, with which this must not be confounded, and which is the produce of the *Liquidambar styraciflua*, a plant belonging to the natural order *Balsamaceæ*.

S. Benzoin, Benjamin Storax, or Gum-Benjamin Tree. Leaves ovate-oblong, pointed, glabrous above, downy beneath; racemes compound, almost the length of the leaves. It is a native of Sumatra and Java. It is the plant which produces the Benzoin, or Gum Benjamin, of commerce; and which, as well as Storax, is used in medicine. [BENZOIN, Arts & Sci. Div.] The great consumption however of these resins is principally as incense in the worship of the Roman Catholics and Mohammedans. Though older botanists, as Garcias, Grim, and others, were acquainted with the tree that yielded Benzoin, Ray confounded it with the genus *Laurus*, and Linnæus with the genera *Croton* and *Terminalia*. Dryander gave a correct account of the plant in 1787, and referred it to its present position.

S. grandifolius, Large-Leaved Styrax. Leaves broad, obovate, pointed, slightly serrated, green above, downy beneath; lower peduncles 1-flowered, solitary, axillary. It is a native of North America, in woods and on the banks of rivers from Virginia to Georgia. It is a handsome shrub, bearing white flowers, opening them in June and August.

S. lævigatus and *S. pulverulentus* are North American species, and are natives of the woods of the Carolinas and Virginia.

Several other species are described from South America, mostly from Brasil.

SUBAPLYSIA'CEA, M. De Blainville's name for the first family of his *Monopleurobranchiata*.

SUBER. [QUERCUS.]

SUBMARINE FORESTS. Under this term geologists class very numerous accumulations of vegetable matter, involving roots, stems, branches, leaves, and fruits of trees, rarely in the attitude of growth, sometimes in the condition of having fallen, and locally with the appearance of having been drifted from some distance, but all occurring on the margin of the sea, below the level of high-water, and extending not unfrequently much beyond the low-water line.

Subterranean Forests is another term for similar phenomena, not limited however to any particular level, nor to a close proximity with the sea. The circumstances as to level, and physical condition of the neighbouring regions, when these buried forests either grew on or were drifted to their present repositories, and the changes in these respects which may have since occurred, are extremely worthy of consideration.

If we take, as a mode of classifying these phenomena, the relative levels of the buried forests and the surface of the sea, we find a series of instances, beginning on high ground, and ending below the sea. On parts of the very high ground at the head of Glencoe, we see yet rooted in peaty soil the bases of enormous trunks of trees, while far around, and even in much lower levels, and warmer and more sheltered situations, large trees are altogether wanting. On the moderate elevations between Kirby Lonsdale and Kendal are small dried basins of ancient lakes, in which portions of fir-trees abound; on the course of many rivers, in flat parts of valleys, and especially when they approach the sea, as at Ferrybridge on the Aire, and at Stockton on the Tees, vegetable accumulations, peaty plants, and lacustrine shells, hazel-wood, nuts, and large trees abound. In situations where the tides cease to have power, along the sides of rivers, the accumulations of this nature are locally enormous, as over the large area of Hatfield Chase and Thorn Waste in Yorkshire, Sedgemoor in Somersetshire, and the fens of Huntingdon and Cambridge. Finally, on reaching the actual sea-shore, whether along the course of a great river, as the Humber or the Mersey, or on the bare coast, as in Lincolnshire, Yorkshire, Norfolk, and many parts of the coast of Great Britain, we find narrow or extensive deposits of like nature, both above high-water and below low-water mark. Generally in all these situations, the trees, even though not now growing in the neighbourhood, are of sorts that belong to the same latitude and the same region. What might be the circumstances which encouraged their growth in ancient times is not easy to be determined. Instead of supposing any elevation of land since the growth of trees in the high valleys about Glencoe, which, by raising the surface to a temperature too low, prevented their continued existence, it appears better to suppose that the duration of forests under some constant conditions is limited. It is only by mutual protection in some cases that trees rise to perfection. Arriving from this cause nearly at once to maturity, and passing by equal stages to decay, it may easily happen, in a limited area, that a whole forest of trees should perish and be followed by no successors. Such an occurrence might be accidently caused by the alteration of the supply of water, the growth of peat, addition of sediments, and other causes of injury. Violent tempests might prostrate a forest, and affect the drainage of the country, and thus convert the area where the forest grew into a marsh, a peat-bog, a buried forest.

Suppositions of this nature have commonly been suggested by the phenomena observed in various parts of Europe. De Luc adopts such views regarding the buried pine-forest of Bornholm, which is covered by peat and surrounded by sand-hills. The trees lie prostrated from the circumference toward the centre, not by the force of inundations, but by the violence of winds. ('Hist. de la Terre,' v. 222.) A similar opinion has been entertained concerning some part of the extensive levels of Hatfield Chase in Yorkshire, where in places the trees appear as if prostrated in a particular direction. Moreover, in examining the deposits of this nature on the shores of the Frith of Tay, Dr. Fleming found the clay below the peat penetrated by numerous roots, which are either carbonised or pyritised.

But there are other cases in which the accumulations of buried timber and peat may better be supposed to have been drifted. This

appears to be the fact in the eastward prolongation of the great levels of Hatfield Chase along the estuary of the Humber, and much below its level. De Luc supposes the same thing in regard to the peaty deposit of Rotterdam, which rests on silt, as that reposes on sand. He regards the whole as drifted by the river currents, and as accumulated below the river waters.

There are many examples of the occurrence in one deposit of sand, clay, peat, timber, lacustrine shells, and bones of quadrupeds. It is rather characteristic of such combinations that there is only one layer of peat with trees, that it lies upon the clay, and that in this clay are the lacustrine shells and the bones of quadrupeds. This general rule applies to numerous small deposits on the coasts of Yorkshire and Lincolnshire, including bones of deer, and to the larger area of the Irish peat, which yields the bones of the gigantic elk; and is exemplified in the American deposits which contain the mastodon. Beneath the whole of these deposits frequently lie the gravelly clays and sands, with boulders of distant rocks, commonly called Diluvium. The shells are usually of existing species, the trees of existing kinds, but the quadrupeds (Beaver and Irish Elk for instance) often of races locally or universally extinct.

It has been thought necessary in some cases to appeal to a local change of the relative level of land and sea for an explanation of the submerged forests of the English and European coasts: sometimes this may be avoided by assuming in ancient times a different condition of the tides; and sometimes it is unnecessary, because the trees may be supposed to have been transported. It should seldom be granted, because, in the very same district, the diluvium with its marine shells may be thought to be a 'raised beach,' and the submarine forests to mark a real subsidence of the land. This is the case in Holderness.

The antiquity of these buried forests is often beyond the reach of inference, but in many inland districts the condition of the trees is such as to have led observers to believe they were cut down or burned down. In Hatfield Chace ('Phil. Trans.,' 1701) many of the trees were thus destroyed; some were evidently worked by the woodman's tools of stone or wood. Roman coins were gathered from among the roots; and in one situation the ground below seemed to have been ploughed in ridge and furrow.

Examples of accumulations such as have here been generalised, are abundant round all the shores of Britain, and are common in the interior of the island.

(De la Beche, *Geological Manual;* Lyell, *Principles of Geology;* Phillips, *Treatise on Geology*, vol. ii.; De Luc, *Histoire de la Terre;* De la Pryme, in the *Philosophical Transactions*, abridged by Hutton; *Transactions of the Cornish Geological Society, &c.*, may be consulted for details of phenomena and reasoning on the causes and dates of their occurence.)

SUBMYTILA'CEA, M. De Blainville's name for his sixth family of *Lamellibranchiata.*

The following is a definition of the *Submytilacea*:—Mantle nearly as in the *Mytilacea*, that is to say, adherent, and slit throughout its lower part, with a distinct orifice for the anus and a commencement of a tube for respiration by means of a particular disposition of its posterior extremity, which is furnished with tentacular papillæ; a large fleshy abdominal mass for locomotion, without byssus at its base; two distinct muscular impressions.

Shell free, subnacreous, regular, equivalve; dorsal hinge lamellar, ligament external; two muscular impressions with the pallial impression which unites them not excavated backwards.

M. De Blainville remarks that this family are more or less inhabitants of mud, and are locomotive by means of their foot.

He divides them into two sections:—

1. The Limnoconchs (*Limnoderma*, Poli).

All these have an epidermis, are nacreous, and are inhabitants of fresh waters. [NAIADÆ.]

2. Species without any evident epidermis, not nacreous, and more or less pectinated.

These are marine.

Under this section M. De Blainville arranges but one genus, *Cardita.* Animal resembling that of the Fresh-Water Muscles. [NAIADÆ.]

Shell very thick, solid, equivalve, often very inequilateral; umbones recurved forwards; hinge with two unequal oblique teeth, one short and cardinal, the other long, lamellar, bent, and placed much more backwards; ligament elongated, subexternal, and sunk into the shell; muscular impressions rather large and very distinct; pallial impression narrow.

M. De Blainville divides the genus into the following sections:—

A. Elongated species, a little notched or gaping at the inferior border; umbo nearly cephalic; ligament hidden. (The *Mytilicardia.*)

Examples, *Cardita crassicosta*, Adans., 'Seneg.,' pl. 15, f. 8; *Cardita calyculata*, 'Malacol.,' pl. 69, fig. 1.

B. Oval species, with the inferior border nearly straight or a little convex, crenulated and completely closed. (The *Cardiocardita.*)

Ex. *Cardita Ajar*, Adans., 'Seneg.,' pl. 16, f. 2.

C. Species nearly round or suborbicular, with the inferior border rounded, denticulated, and more and more equilateral; the two teeth shorter and more oblique. (Genus *Venericardia*, Lam.)

Ex. *Venericardia imbricata*, 'Malacol.,' pl. 68, f. 3.

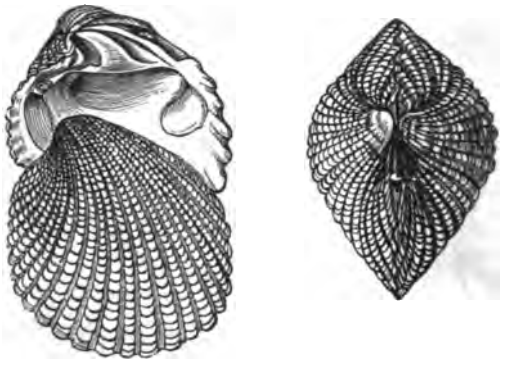
D. Elongated and very inequilateral species; the umbo nearly cephalic and recurved forwards; two short cardinal diverging teeth besides the lamellar tooth; ligament very long, little or not at all projecting; abdominal impression sometimes a little directed backwards. (Genus *Cypricardia*, Lam.)

Cardita calyculata has the shell oblong, white, painted with lunate brown spots; the ribs imbricato-squamous; the scales arched and incumbent.

Cardita calyculata.

a, with the umbones turned towards the spectator, showing the lunule.

Species of *Cypricardia*, *Venericardia*, and *Cardita* occur fossil from the Lower Silurian upwards. [VENERIDÆ.]



Venericardia (*Cardita*) *imbricata.*

Fossil from Grignon. A variety found at Courtagnon.

SUBOSTRA'CEA, M. De Blainville's name for his second family of *Lamellibranchiata.* [PECTINIDÆ.]

SUBULA. [ENTOMOSTOMATA.]

SUBULA'RIA (from 'subula,' an awl, from the form of the leaves), a genus of Plants belonging to the natural order *Cruciferæ*, and the tribe *Subulariæ*. It has an oval-oblong laterally compressed pouch, with boat-shaped valves.

S. aquatica, Awl-Wort, is a little aquatic stemless herb, with fascicular simple white fibrous roots. The radical leaves are linear and awl-shaped, the scapes naked and few-flowered, the pedicels filiform and bractless. It is a native of the colder parts of Europe, in ditches, lakes, and rivulets with a sandy or gravelly bottom. It is also found plentifully in the north of England, Scotland, and Ireland. Sir W. Hooker and Sir J. E. Smith agree in stating that the flowers always remain several feet under water, even during the time they are expanded, so that, contrary to the general rule, fertilisation must take place in that element.

(Babington, *Manual of British Botany;* Burnett, *Outlines of Botany.*)

SUBULICORNES. [NEUROPTERA.]

SUCCI'NEA, a genus of Pulmoniferous Gasteropodous *Mollusca*, belonging to the *Colimacea* of Lamarck and the *Limacinea* of De Blainville. It is the sub-genus *Cochlohydra* of Férussac.

The shell is ovate, rather elongated, with a large entire longitudinal aperture, and a short spire; the outer lip is thin, and continuous with the delicate sharp-edged columella; the inner lip is spread over a part of the body-whorl.

Cuvier, who places the genus between *Chondrus* and *Clausilia*, remarks that the animal cannot withdraw itself into the shell entirely, and that it may be regarded almost as a *Testacella*, with a large shell. It has, he remarks, the lower tentacula very small, and lives on the herbage and plants on the brinks of streams, whence it has been considered as amphibious. [HELICIDÆ.]

The most familiar species is *Succinea putris*, *Helix putris* of Linnæus, which is common in moist places, on the banks of fresh waters.

SUCCINITE. [GARNET.]

SUCCORY. [CICHORIUM.]

SUCCULA'TÆ, the name of a natural order of Plants in the 'Fragments of a Natural System' of Linnæus, adopted by Bartling

It includes those families which are remarkable for the succulent character of their leaves, as *Saxifragaceæ, Crassulaceæ, Ficoidaceæ, &c.*

SUCHOSA'URUS, a genus of Fossil Saurians of the Wealden Formation of Tilgate.

SUCKING-FISH. [Discoboli; Echineis.]

SUCTORIA. [Pulex.]

SUCTORIA. [Annelida.]

SUCTORIAL CRUSTACEANS. [Siphonostomata.]

SUGAR is a sweet soluble crystallisable substance found very generally in plants. It differs from the other assimilable secretions of plants in its solubility, its sweet taste, and the readiness with which it enters into fermentation. Chemists have detected different kinds of this substance. Thus there is Cane-Sugar, Grape-Sugar, Eucalyptus-Sugar, Milk-Sugar, &c. There are other sweet secretions of plants as Mannite and Glycyrrhizin, which seem to be modifications of some common form.

The physiological action of Sugar seems to be indicated by its ready solubility, a property which renders it easily conveyable from one part of the plant to another.

Sugar is found under all circumstances in some plants, but in the great mass of the vegetable kingdom it presents itself at particular seasons. It is found very generally in the seed during germination. It appears that the starch of the albumen of the seed is converted first into dextrine and then into sugar, whilst the embryo is growing. Here it seems a provision for assisting the growth of the tender tissue of the germ. In this stage it is obtained for the purposes of fermentation, as in the brewing of beer, where germinating barley is converted into malt for the sake of the sugar.

Sugar is frequently found in considerable quantities in the sap of trees previous to their budding. It is found in sufficient quantities in the sap of *Acer saccharinum*, to be separated for dietetical purposes in North America. The Common Birch (*Betula alba*) contains so large a quantity of sugar in its sap that it is employed in the north of England and Scotland for making an effervescing wine in considerable repute. Many other trees yield sugar in their sap.

The roots of many plants contain sugar. The Beet-Root is extensively cultivated in Germany and France for the purpose of yielding sugar. The Turnip, the Carrot, and the Parsnip, are familiar instances of roots which contain sugar, and which owe their principal dietetical value to this circumstance. The roots of many plants eaten by animals contain sugar, and are probably sought after on this account. Most of the plants belonging to the natural family of Grasses contain sugar. The *Saccharum officinarum* is the principal source of the sugar that is used dietetically in Great Britain. It is contained in its tissues at almost all seasons of its growth, but it is present in especially large quantities previous to flowering; it is at this stage that the sap is employed for the manufacture of sugar. The Indian Corn (*Zea Mays*) yields a sufficient quantity of sugar to render it a profitable source of manufacture in the United States of America. Barley, oats, wheat, rye, and rice, all contain sugar in their stems, and might be cultivated for this purpose were they not more valuable as producers of grain. The dietetical value of grasses on which cattle and horses are fed depends in a great measure on the quantity of sugar they contain.

Many of the Palm Tribe yield sugar in their sap. The *Caryota urens, Cocos nucifera*, and species of *Sagus*, are used in tropical countries for obtaining sugar.

Another source of sugar in the vegetable kingdom is the Fruit. Nearly all the fruits of plants eaten by man contain sugar. Such are the grape, the orange, the pine-apple, pear, and numerous others.

The different species of sugar have the following composition:—

1. Milk-Sugar	$C_{24} H_{19} O_{19} + 5 H O$
2. Cane-Sugar	$C_{12} H_9 O_9 + 2 H O$
3. Grape-Sugar	$C_{12} H_{12} O_{12} + 2 H O$
4. Eucalyptus-Sugar	$C_{24} H_{19} O_{19} + 9 H O$

Milk-Sugar is an integral constituent of the milk of the *Mammalia*, and has very rarely been met with anywhere else. It has been said to have been detected in eggs during the process of incubation; but this observation requires to be confirmed. Cane-Sugar is the most closely related to starch and dextrine, differing from them merely by one equivalent of water. It is not by any means so widely distributed as Grape-Sugar, being found in very few plants besides the sugar-cane, beet, and maple. Grape-Sugar is identical with the sugar in honey and in diabetic urine, and with the Glucose or fruit-sugar of the French chemists. The uncrystallisable sugar which is obtained during the decomposition of many plants, and which is yielded by starch acted on by diastase or sulphuric acid, has the same composition as Grape-Sugar. Cane-Sugar is not fermentable. The only fermentable form of sugar is Grape-Sugar; and in all cases where alcohol is formed, the substances employed must pass into the form of Grape-Sugar.

Eucalyptus-Sugar is a species of manna produced in Van Diemen's Land by various species of *Eucalyptus*. Whether it is the natural sap spontaneously escaping, or whether it is the sap extracted by the locust and afterwards excreted, is uncertain. Its properties have been carefully examined by Professor Johnstone.

There is obviously an intimate connection between these different kinds of sugar, as well as between cellulose, starch, dextrine, and gum. They all contain carbon, in combination with the elements of water. As they all contain C_{12} or a multiple of it, they are produced from each other by a simple change depending on catalytic force.

If sulphuric acid is allowed to act on gelatin, a species of sugar containing nitrogen, and termed Glycocol or gelatin sugar, is formed. Its formula is $C_4 H_9 N_2 O_7$; and it is worthy of remark, that if from two of its equivalents we deduct one equivalent of cane-sugar we obtain the elements of two equivalents of urea, or—

$$2 (C_4 H_9 N_2 O_7) - C_{12} H_{10} O_{10} = 3 (C_2 H_4 N_2 O_2).$$

This relation leads to the belief that sugar is a component part of the gelatinous tissues, and when separated from them it may be presumed to discharge the same functions as when either cane- or grape-sugar is supplied with the food. In other words, there exists in the substances yielding gelatin a primary matter which exists also in cane-sugar. If then substances or tissues containing gelatin are employed in effecting the metamorphosis continually occurring in the animal body, this primary matter may serve the same purpose as cane-sugar when supplied to feed the body. On these grounds Mulder considers that gelatin-sugar should be classed amongst the nourishing substances. If gelatin be formed in the animal body, then sugar, either derived directly from the food or produced from starch in the alimentary canal, may be used for this purpose.

It is not known in what part of the plant sugar is formed. Mr. Knight states that birch sap contains more sugar the farther from the root it is collected; this seems to prove that the sap, which probably contains much dextrine, is changed into sugar as it passes through the cell-walls. When sugar accumulates in certain parts of a plant, it almost always remains in solution; it is however found crystallised in some few instances, as in the nectary of *Fritillaria imperialis*.

Closely allied in its chemical composition to sugar is a peculiar substance to which the term Mucilage is given. Although insoluble in water, it assumes the appearace of a mucilaginous mass when immersed in that fluid. It sometimes accumulates largely in certain parts of plants, as in the perisperm of quince-seed, lint-seed, &c.; it is the chief constituent of the gums tragacanth and Bassora, and is abundant in various roots, as for instance the mallows. According to Mulder's analysis it must be represented by the formula $C_{24} H_{19} O_{19}$. It has been shown by Schmidt that mucilage when digested with dilute sulphuric acid is converted into sugar. Hence it supplies a link to the following series of analogous substances:—

Grape-Sugar and Fruit-Sugar	$C_{24} H_{24} O_{24}$
Cellulose and Soluble Inulin	$C_{24} H_{21} O_{21}$
Starch, Dextrin, Gum, Insoluble Inulin, and Lichen-Starch	$C_{24} H_{20} O_{20}$
Mucilage, Milk-Sugar, and Eucalyptus Sugar	$C_{24} H_{19} O_{19}$
Cane-Sugar	$C_{24} H_{18} O_{18}$

In its physical characters, the product of the mucous membrane of the animal body resembles vegetable mucilage. Owing to their insolubility in water, both these substances serve to cover denuded parts of animals, and thus they are both suited to lessen or prevent the influence of acrid matters on the tender parts of the animal frame. It is for this reason that the mucilage of salep, tragacanth, &c., may be made, in certain diseased conditions, to supply temporarily the want of animal mucus. In chemical composition they are perfectly distinct, as animal mucus contains nitrogen. The mucus of the animal body seems however to differ according to the organs by which it is produced. (Day's edition of Simon's 'Animal Chemistry,' vol. ii. p. 78, note.)

SUGAR-CANE. [Saccharum.]

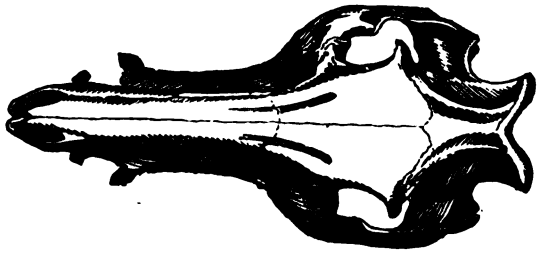
SUGAR-SQUIRREL. [Marsupiata.]

SU'IDÆ, a family of Pachydermatous Animals, including the various forms of Swine.

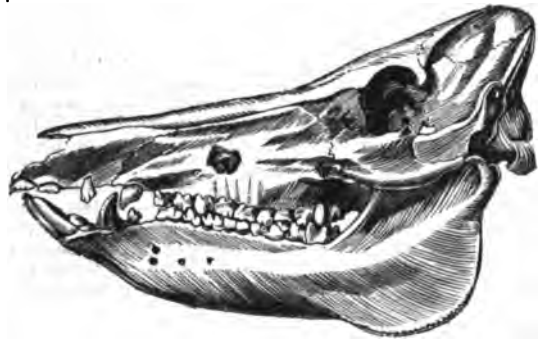
The Swine have on each foot two large principal toes shod with stout hoofs, and two lateral toes which are much shorter and hardly touch the earth. The incisor teeth are variable in number, but the lower incisors are all levelled forwards. The canines are projected from the mouth and recurved upwards. The muzzle is terminated by a truncated snout fitted for turning up the ground, and the stomach is but little divided.

Cuvier remarks that the skull of a hog is nearly a quadrangular pyramid, the palatine surface of which is almost perpendicular to the base, represented by the occiput. The nasal bones occupy the upper part of the muzzle; their base is slightly widened; the other extremity advances a little pointedly above the nasal aperture. The intermaxillaries ascend rather obliquely to one-third of the length of the nasal bones, and carry at their extremity the peculiar bone which supports the snout. The orbit is round, and well defined (cerné) by an advance of the frontal and the two post-orbital apophyses; the portion formed by the frontal especially is well marked. Between the two it is nearly the sixth of a circle, not closed. The frontals descend in front of the orbit more than a fourth of the length of the muzzle before they encounter the nasal bones. The lachrymal bone occupies a rather large rhomboidal space upon the cheek. The two lachrymal holes are pierced, the upper one on the border itself, the other a little in front of the border of the orbit. In the orbit, the lachrymal descends to the upper border of the vault of the sub-orbital canal. The jugal bone is articulated to the whole width of the lachrymal bone. It is elevated, and the suture with the temporal bone behind the post-orbital

apophysis descends at first, and afterwards becomes horizontal. The zygomatic apophysis of the temporal bone ascends a little, and rises to a point backwards above the auditory meatus. The temple is well marked by a parietal crest, which goes to the occipital without touching its congener; so that the occiput is truncated squarely above, where it widens a little. The palate is prolonged a little behind the origin of the zygomatic arches. The palatine bone advances no farther than just before the last molar tooth. It is prolonged a little on each side, where it terminates in form of a tubercle between the two pterygoid wings. It ascends into the orbit, showing nothing there but a process (languette) by no means large, which pushes forward into the internal walls of the suborbicular canal. The internal pterygoid apophyses are distinct from the body of the bone, high and narrow, and terminated in a hook. The external apophyses at least equal them, make one with the body of the bone, and also terminate in a hook. In the temple the posterior sphenoid is nearly reduced to the anterior surface of the external pterygoid apophyses. It articulates itself with the temporal bone, does not touch the frontal except with its point, and does not reach the parietal. The anterior part occupies most space there, and it permits nevertheless the frontal bone to descend in front of it till it reaches the palatine, and even to bend itself back to enter into the vault of the suborbital canal between the maxillary and the palatine bones. The temporal bone raises itself rather high in the temple, where its parietal suture curves downwards. It occupies a part of the occiput on each side, and its suture comes in front of the base of the mastoid apophysis, which is very long, very pointed, and entirely belonging to the occipital bone. The tympanic cavity (caisse) is a very projecting tubercle, not to say pointed, in front of this apophysis.



Skull of Hog, seen from above. (Cuvier.)



Skull of Hog, seen in profile. (Cuvier.)

It receives a very long and very narrow auditory meatus, which commences very high behind the posterior base of the arcade. Its cavity is very small, and the whole of its apparent volume consists only of cellular osseous substance. The glenoid facet is projecting, and much wider than it is long, between the arcade and the tympanic cavity, which last is early ossified in its convex portion, and seemed to Cuvier to belong to the temporal bone, from which it is not separated even in the fœtus, but the petrous bone (rocher) is long distinguishable: this last does not appear externally. The two frontal bones unite together early, and the two parietals still earlier: there is no interparietal in those subjects which have seen the light. The suborbital hole is rather large, above the fourth molar, nearly in the middle of the maxillary bone. Its canal opens widely in the orbit, at the ordinary place. The lachrymal holes have been already noticed. There is below the orbital surface of the orbital bone a deep hollow without issue, the use of which was unknown to Cuvier. At the upper vault of the orbit is a suborbital hole, which conducts to an aperture pierced on the front. The orbital hole is near the suture with the anterior sphenoid. The analogous holes to the spheno- and pterygo-palatine bones are in the suborbital canal. The last enters the palate opposite the penultimate molar. The optic and spheno-orbital holes are approximated as ordinarily, and rather large. The oval aperture is separated by the whole external pterygoid apophysis, the direction of which is transversal. It is common to the sphenoid and temporal bones, and is only separated by a small bony ridge from a large carotidian hole, which answers in part to the internal side of the tympanic cavity. Under the junction of the anterior sphenoid to the posterior is a double canal, which goes into the thickness of the vomer. The posterior foramen lacerum, the stylo-mastoidian, and the condyloidian, are very much approximated near the mastoid apophysis. At the interior one may see that the frontal and sphenoidal sinuses are very much extended, and narrow the cerebral cavity a good deal. The first-named sinuses extend to the occiput. The sella ascends nearly vertically to sustain the optic nerves. The bony tentorium only exists on the sides; it does no more than pass upon the petrous bone. The ethmoidal fossæt is very much sunk, of moderate size, divided by a very salient crest, and riddled with numerous holes. The area of the cerebral cavity is only half that of the cranium, as it appears externally, so much is it augmented by the great sinuses which exist even to the occiput.

Different *Suidæ* offer more or less variations in the length of the head.

The Wild Boar (*Sus Scrofa*, Linn.) has the face longer and the skull less elevated; the domestic pig of Europe has the cranium slightly more elevated, and the face still sufficiently long; the Siamese Pig has the face shorter, the cranium more convex in the frontal region, and larger in proportion.

The Masked Boar of Africa differs from the European boar in having its zygomata extending more outwards and taking a more horizontal direction, and especially by a great elevated apophysis, above the alveolus of the canine tooth, and ascending obliquely so as to leave a canal between it and the maxillary bone. It terminates by a great rugged tubercle, and the nasal bone opposite to a similar tubercle. It is to these two prominences that the great warts or mamillæ, which give this animal so hideous an aspect, adhere.

The Babyrussa, or Babirousa, when compared with a Siamese Hog of the same size, has the cranium longer in proportion to the muzzle, the orbit more advanced, the temporal fossæ more approximated on the cranium, the zygomatic arch longer and ascending less suddenly backwards, and the tympanic cavities much longer.

Skull of Babyrussa.

The peculiar character of the Ethiopian Boar (*Phacochœrus*) consists in the retreat of the eyes and the relative smallness of the temporal fossæ, the necessary consequence of that retreat; in the enormous development of the base of the zygomatic arches; and in the width of that part, as well as in the interval between the orbits. The alveoli of its enormous canines form a projection on each side of the muzzle, which is terminated by two small peculiar bones that unite the extremities of the nasal to those of the intermaxillary bones, and which correspond to the single bone carried on the extremity of the intermaxillaries in the Common Hog. The tympanic cavities are small, terminated in a point. The basilary part has between them a hook projecting on each side, and in front are two very deep and very remarkable fossæ prolonging the vault of the back nostrils, and hollowed principally in the sphenoid bone.

The Peccary approximates more to the Babyrussa than to the Siamese Hog, but its muzzle is still shorter; the tympanic cavities are rounded and cellular; its mastoid apophyses are very short and directed backwards; its palate is prolonged, narrowing as it retires, more backward than its molars. Its glenoid facet is very different from that of the hog, and fenced (cernée) in front and behind as in some of the *Carnivora*.

Cuvier remarks that the relationship of the *Suidæ* with the *Carnivora* is very close, indeed that there is no difference in the anterior part of the cranium. Take, says he, the head of an Opossum (Sarigue) for example; shorten the cranium; widen the orbits and parietal crests; raise the occiput, shortening at the same time the basilary part and the back nostrils, and you will only require the differences of projection of some parts, the presence of an external pterygoid apophysis, the direction downwards of the curvature of the zygomatic arch, &c., to arrive at the head of a Hog. In the pterygoidian and neighbouring parts, the Kangaroo approaches it still nearer.

The dentition of the Hog has its characters and laws, like that of all other animals. The normal number of its teeth is six incisors

two canines, and fourteen molar teeth in each jaw. ('Ossemens Fossiles.')

Teeth of Hog. (F. Cuvier.)

The extremities of the hog have much relationship to those of the Ruminants [RUMINANTIA], especially of the Sheep and the Stag.

The Spine of the Shoulder-Blade, as in the Horse, is nearly at an equal distance from the anterior and posterior border; whilst in the Ox and Stag it is much nearer to the anterior edge. This spine, as in the Horse again, is lowered before, and more projecting at its upper third, where it forms a hook bent backwards. In other respects, it is wider in the upper part than that of the Horse, its coracoid tubercle is less projecting, and its articular surface higher than it is wide. The great tuberosity of the Humerus is very high, as in the Ruminants; but it is notched by a large re-entering arch; the bicipital groove is, on the internal side, narrower and deeper; the whole upper part of the head of the bone is narrower in proportion. The Ulna is wide and depressed, with a ridge on its anterior surface, forming with the internal edge a long hollow surface, by which in advancing age it is soldered to the radius. In the Ruminants it is more compressed and much more slender. In the Peccary it is soldered sooner and more completely than in the Hog. The Carpus much resembles that of Ruminants, with this difference, that the trapezoidal remains a longer time distinct from the great bone. Nevertheless, no bone has a perfect resemblance, and on comparison the difference will de detected, although it cannot be expressed in words.

The differences of the Femora are also very difficult to be expressed verbally. The head is more elevated and more convex towards the upper part than that of any Ruminant. The great trochanter is wider and a little notched; the projecting ridge which goes from one to the other trochanter is more rounded; the internal edge of the rotular pulley ascends less than the other, which is the contrary of the structure in the Ruminants; the notch between the condyles is narrower and pointed forwards, &c. The Tibia is easily recognised, because it is shorter, has its lower head squared and not narrowed from behind forwards, and has no articulation with the fibula. The principal difference of the Tarsus rests on the small wedge-shaped bone, on the vestige of the fifth toe, and in the scaphoid remaining distinct from the cuboid bone. The astragalus tends to that of the Ruminants by the form of the pulley of the lower head. The metacarpal bones, metatarsals, and toes, cannot be confounded with those of any other animal, and their characters, partly visible externally, are known to all naturalists, or will be easily defined by them. It need only be remarked, that in the Peccary the two middle bones of the metacarpus and metatarsus are soldered into a Cannon, as in the Ruminants, and that the only vestige in this animal of the external toe on the hind foot is a small flattened stylet, applied against the base of the cannon bone.

The Cervical Vertebræ of the Hog are not easily confounded with those of any Ruminant of its proportions, by reason of the brevity of their bodies, and the width of their transverse apophyses, especially of those of the penultimate one. The body of the vertebra is not so convex in front as in the Ruminants. ('Ossemens Fossiles.')

The number of the vertebræ appears to be liable to considerable variation. (Eyton, 'Proc. of Zool. Society,' 1837.)

The other parts of the internal organisation of the *Suidæ* need no detailed description. In the Museum of the College of Surgeons in London is a preparation of the stomach of *Dicotyles torquatus*, which is remarkable for having three compartments.

Linnæus placed the genus *Sus* between *Hippopotamus* and *Rhinoceros*, in his order *Belluæ*, which order stands between those of *Pecora* and *Cete*, in his last edition of the 'Systema Naturæ.'

Cuvier arranges the Cochons (*Sus*, Linn.) under his ordinary *Pachydermata*. This genus comprises the sub-genera *Sus*, *Phacochærus*, and *Dicotyles*, and stands between *Hippopotamus* and *Anoplotherium*, which last is followed by *Rhinoceros*.

Illiger arranges *Sus* as the only genus of his *Setigera*, his last family of his fifth order *Multungula*, which order is immediately preceded by the *Nasuta*, consisting of the genus *Tapirus*. The *Solidungula* immediately follow the *Multungula*.

Dr. J. E. Gray makes the *Suina* a sub-family of the *Elephantidæ*. He includes in it the following species, of which specimens exist in the British Museum :—

Sus fasciatus, the Striped Boar.
S. Scrofa, the Boar.
S. Papuensis, the Bêne.
S. Indicus, the Indian Wild Boar.
Babirussa Alfurus, the Babirussa.
Choiropotamus Africanus, the Bosch-Vark.
Phacochærus Æthiopicus, the Valke-Vark, or Emgallo.
P. Æliani, the Haruja, or Hallup.
Dicotyles Tajacu, the Peccary, or Tajaçu.
D. labiatus, the Tagnicate.

We now proceed to give some account of the more remarkable forms in this list.

Sus Scrofa, Linn., *S. Aper*, Briss., the Wild Boar, Le Sanglier of the French, is still an inhabitant of many of the temperate parts of Europe and Asia, but no longer exists in a natural state in the British Islands.

Dental Formula :—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{7-7}{7-7} = 44$.

The Wild Boar, which is too well known to need description, and of which living individuals are to be seen in the gardens of the Zoological Society, Regent's Park, harbours in the most solitary places in retired forests. His lair is generally in some wild and remote spot, not far from water, and commanding by some devious path access to the open country. The young, or Marcassins, as they are termed by the French, are striped with longitudinal bands.

Throughout Europe the boar was held in high estimation as a beast of chace. Nobles, princes, and even kings, delighted to take the field with the boar-spear, and peril their persons in hunting this fierce animal. In our own country, where it formerly rioted in the dense forests which have now vanished before the inroads of an increasing population, the loss of his eyes was the punishment inflicted by William the Conqueror on him who was convicted of killing a wild boar. In the vast forest which so late as Henry II.'s time stood on the north side of London, were stags, fallow-deer, wild boars, and bulls. In the 'Leges Wallicæ' it appears that Howel-dda gave permission to his grand huntsman to chace the boar from the middle of November to the beginning of December. In Europe the boar-spear has given way to the rifle; but in India, where the field is taken on horseback, the spear is still used, and hog-hunting appears to be one of the most exciting of the wild sports of that land of the sun.

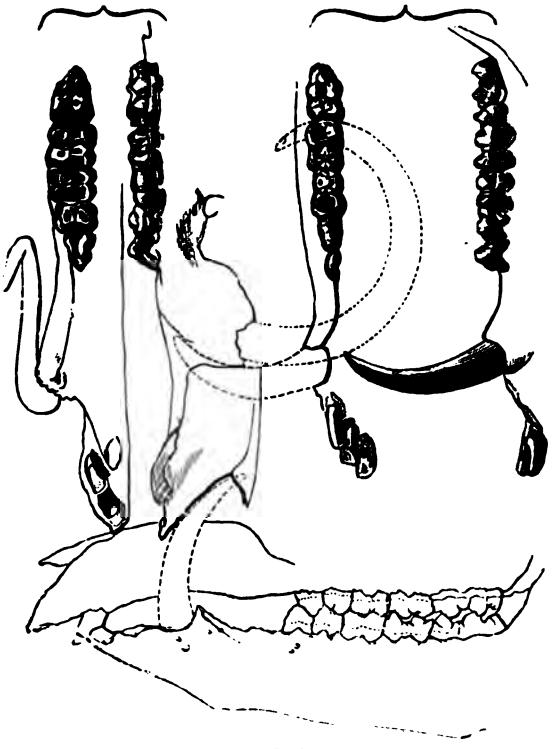
An attempt was made by Charles I. to restore this noble game to England, and he turned out several wild boars in the New Forest; but the civil wars were no friendly times for the experiment, and they were all destroyed. More recently General Howe procured some wild boars and sows from Germany, and turned them into the forests of Walmer and Alice Holt, or Ayles Holt, "to the great terror of the neighbourhood," as White says, in his 'History of Selborne;' "and, at one time, a wild bull or buffalo: but the country rose upon them, and destroyed them."

The senses of the Hog are acute, especially that of smelling. The broad snout ploughs up the herbage; and not a root, an insect, or a worm, escapes the olfactory sense. If fairly treated, it is by no means a dirty animal; but it is too often styed up in its own filth. There are few more pleasing scenes in the farm-yard than a well laid-out piggery properly kept. The animal itself is anything but stupid, and is capable of strong attachment where kindness is shown to it. That it is docile the number of learned pigs proves; and still more the famous sporting sow, that went regularly out with the gun, and stood her game as staunch as any pointer. It is said that the Hog is trained on the Continent to hunt for truffles. [HOG, in ARTS AND SC. DIV.]

Babirussa, F. Cuv.—F. Cuvier has separated this form from *Sus*, relying upon characters, one of the principal of which is the upward

direction of the alveolus of the upper canine tooth, which is enormously developed, ascending upwards, and curving back upon itself; the first upper grinding-tooth is a false molar, and the first two below have the same character. The canines of the lower jaw form long, and, as compared with the other tusked *Suidæ*, slender tusks, as the animal advances in age.

Dental Formula:—Incisors, $\frac{4}{4}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5} = 32$.



Teeth of *Babirussa*.

B. Alfurus, the Babirussa; *Sus Babirussa* of Linnæus; Le Babyroussa of Buffon; Le Sanglier des Indes Orientales of Brisson; and Le Cochon Cerf of Lesson and other French authors.

The Babirussa stands high upon its rather slender legs. The skin, which is of a grayish tint, inclining to fawn-colour on the belly, is very thinly furnished with hair. The upper tusks come through the skin of the muzzle, and form nearly a circle directed backwards, often touching the skin again on their downward curvature. The females are smaller than the males, and are without these tusks.

Babirussa, male. (From an individual in the Gardens of the Zoological Society of London.)

Piso, in his edition of the 'Natural and Medical History of East India,' by Bontius, remarks, that sedulous as Bontius was, he had made no mention of this animal. Piso however supplies the deficiency, and gives in the page no very bad figures of the animal and of its skull. In the frontispiece however, where the Babirussa occupies a conspicuous place in the foreground, the painter has evidently had the Hog-Deer in his mind, and has taken a few liberties with the animal's muzzle, aspect, and bearing, though the tusks are tolerably correct, lengthening its neck not a little. The Indians, Piso tells us, ascribe these animals to a union of the Hog and the Deer. He says that they are only found in the island of Bourou, 30 miles distant from Amboyna. He adds, that the Babirussa is swift and fierce, and that its flesh is highly prized (inter delicias expetita) by both natives and foreigners.

It still inhabits the marshy forests of the island of Bourou, and is said to be abundant in the Moluccas, and a few other islands of the Indian Archipelago.

F. Cuvier has given very good figures, and a lively description of two males and females brought to France in the Astrolabe, and kept in the Paris Menagerie. The female was much younger and more active than the male, which was aged and very fat, and spent his short life in eating, drinking, and sleeping. The female bred once after her arrival in Europe. When the male retired to rest she would cover him completely over with litter, and then creep in under the straw to him, so that both were concealed from sight. They died of diseased lungs about three years after their arrival.

The lower tusks must be formidable weapons, though not so destructive as those of some of the other *Suidæ*. In old individuals the upper tusks can hardly inflict a wound: they may perhaps ward off the bushes from the eyes of the animal as it rushes through the thick cover of its retreats.

Head of *Babirussa*, seen in profile. *a*, male; *b*, female.

Sus Papuensis, the Bêne of the natives of New Guinea, is described as being remarkable for its small stature and its agreeable and slender form. The canines of the upper jaw are very small, and nearly of the same form as the incisors; the bristles are rather thick, short, yellow, and brownish below, white above and annulated with black; the tail is very short. The young (Marcassins) are of a brown colour, more or less deep, with five rather bright fulvous stripes upon the back.

The length of the Papuan Hog is three feet. It is common in the forests of New Guinea, and the Papuans highly esteem its flesh, which the French found excellent. The natives catch the young in the woods in order to rear them in a kind of domestication.

M. Lesson remarks that the *S. Papuensis* has many points of analogy with the Peccaries, and seems to be intermediate between them and the True Hogs.

Phacochœrus (*Phascochœrus*, F. Cuvier).—Feet formed like those of the True Hogs; two triquetrous incisors above, six small ones below; tusks lateral and directed upwards, very large; molars composed of enamelled cylinders inclosing the osseous substance and joined together by a cortical substance; very large fleshy warts or wens on the cheeks; tail short.

Incisors, $\frac{2 \text{ or } 0}{6 \text{ or } 0}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{3-3}{3-3} = 16 \text{ or } 24$.

F. Cuvier remarks that we have here arrived at a system of dentition entirely different from that of the True Hogs (Sangliers), and which announces animals endowed with a particular nature, and much more herbivorous than omnivorous. Nevertheless, in the locomotive organs the True Hogs and the Phacochœres bear the greatest resemblance to each other, and have accordingly been united in the same genus, as far as these organs served for the principal basis of the formation of generic groups. At present, he observes, but two Phacochœres are known, and one has incisors, whilst the other appears to be deprived of them. We have seen, he remarks, that in the Pachyderms there is but little regularity in the number of the teeth; and he inquires whether this may belong to the nature of these animals, or to lacunæ which it has not been given to us to fill up; a question which he will not decide. Therefore he does not separate these animals.

F. Cuvier's plate is taken, as far as regards the upper jaw, from a Phacochœre without incisors, and, as relates to the lower jaw, from a Phacochœre furnished with those teeth; and he remarks that the discs of the last molars of the first are smaller and less numerous than those of the last molar of the second; he concludes by inquiring whether this may be a specific character.

P. Æliani, Ælian's Wart-Hog, is a native of the North of Africa. It is at all ages provided with incisors in the upper and lower jaw, and therefore is in the most marked manner distinguished from the Wart-Hog of the Cape. Another distinction is, that the Cape Wart-Hog has, according to F. Cuvier, only three molars in the upper and lower jaws; whereas, *P. Æliani* always presents four in the upper jaw. But there ought to be hesitation in admitting this last mark of distinction to be of much weight, because the anterior molars are disposed to decay.

Further, if a line be drawn from the hind part of the head, as far as the most prominent part of the nasal-bone, there will be found in *P. Æliani* a sinus, the depression of which falls in the middle of the line. This very place, in the case of the Wart-Hog of the Cape, rises to an arched prominence; and there are other differences.

The skin is of an earthy colour, scantily bristled. A mane which extends along the neck and the back arises between the ears; the single hairs of it are frequently 10 inches long. All the bristles, those of the mane included, are light-brown. They have not each a

Teeth of *Phacochærus*.
a, last molar tooth, side view. (F. Cuvier.)

separate root, but three or six bristles form one tuft, and have one common root. The whole body, with the exception of the back, appears rather bare. The head is broad along the brow, which is rather depressed; the eyes are small, and situated very high up; there is a depression below the eyes, and near the cheek is a wart, which, as compared with a smaller one alongside the cheek, may be called the larger wart. These warts are formed of thickened skinny tissue, and they are smaller than in the species from the Cape. A whisker of white hair curling upwards runs along the lower edge of the lower jaw. The eyes are small, eye-lashes blackish, eye-brow bristles long and black, and under the eyes is a tuft of bristles. Ears cut obliquely at the lower part of the external edge, and the whole margin bordered with white bristly hair. Tail nearly bare, thin, and with a tuft of hair. On the fore feet a piece of thick hard protuberant skin.

Wart-Hog (*Phacochærus Æliani*). (Rüppell.)

This species was found by M. Rüppell, first in Kordofan, and more frequently afterwards on the eastern slope of Abyssinia. It haunts low bushes and forests. It creeps on its bent fore feet in quest of food, and in this posture digs up the roots of plants (of which its food is supposed to consist) with its enormous canine teeth. The hind legs push the body forward as it moves in this posture.

P. Æthiopicus, the Black Bark, or African Wart-Hog, differs from the last in the larger size of its warts, and the more singular form of its head. Some fine specimens are now living (1855) in the Gardens of the Zoological Society, Regent's Park.

Dicotyles, Cuv.—Intermediate toes larger than in *Sus*, and touching the ground. Canines of the ordinary form, not protruding from the mouth. Incisors and molars resembling those of *Sus*. A glandular opening on the loins, secreting a fetid humour. No tail. The two great bones of the metacarpus and those of the metatarsus united together.

Dental Formula :—Incisors, $\frac{4}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6}$ = 38.

Teeth of *Dicotyles*. (F. Cuvier.)

Of this form, now so well known by means of our zoological societies and publications, there are two species, *D. torquatus* and *D. labiatus*.

D. torquatus, The Collared Peccary. In Hernandes we find a figure and two descriptions of this species under the names of Quauhtla Coymatl, Quapizotl, *Aper Mexicanus*, by which 'Jo. Fabri Lyncei Descriptio' is headed; and of Coyametl, or Quauhcoyametl, 'quoniam est montanus,' by Fernandes. Both notice the gland on the loins; and the latter, who repeats the Mexican names first above stated, remarks that it is fierce and truculent when first taken, but mild when tamed, "et amicus domesticis, habeturque in deliciis." The flesh he describes as similar to ordinary pork, but harder and not so sweet, and the food of the animal as consisting of acorns, roots, "and other mountain fruits," as well as of worms, earthworms, and other creatures of the same sort that are bred in lacustrine, moist, and marshy places. These Mexican Hogs, he adds, lay waste the cultivated fields, if they are not driven from them, go in droves, and when domesticated are fed on the same esculents as the Common Hogs.

The Collared Peccary has been bred in a state of domestication in South America and in some of the West Indian Islands; but, notwithstanding the favourable accounts given of its flesh by the author whom we have last quoted, it is out of all comparison inferior to that of the Common Hog, both in flavour and fatness. The comparative infertility, too, of the Peccary, which only produces two young at a birth, is at once a bar to its superseding the domestic pig, which is equally fertile in all climates where it has been introduced. The gland, too, is highly objectionable, making the animal, neat and trim as it

generally is, a nuisance in life, and flavouring the flesh, unless removed immediately after death. D'Azara however seems to have revelled in its scent as a perfume; and Tyson and others appear to have considered it agreeable enough. Those which we have seen in captivity have been positively offensive; and the Peccaries seem to have affected the olfactory organs of Buffon, Sonnini, and indeed all other modern authors, in the same disagreeable way. This species is the Patira of Sonnini, and the Taytétou of D'Azara, according to Mr. Bennett.

It is found in Mexico and nearly the whole of South America, where they haunt the thickest and greatest forests, dwelling in hollows of trees or earths made by other animals. Not common in the vicinity of villages, to which they are bad neighbours, devastating the crops of maize, potatoes, sugar-canes, and manihot.

D. labiatus, the White-Lipped Peccary. D'Azara appears to be the first who distinguished the two species of Peccaries, which are both confounded by Linnæus under the common name of *Sus Tajacu*. Indeed the old writers above quoted seem to have fallen into the same error; for it is very improbable that the Collared Peccary only was known when they wrote. Cuvier, who first gave the scientific specific names now used, states that *Dicotyles labiatus* is the Taytétou, Tajassou, &c., as well as the Tagnicati of Azara. It is larger than the Collared Peccary, which is seldom more than three feet long, and rarely weighs more than 50 lbs.; whereas the White-Lipped Peccary often measures three feet and a half in length, and sometimes weighs 100 lbs. The last-named species is thicker and stouter, the legs are shorter, and the snout, which is longer, has its termination more expanded. Its prevailing hue is brown, and the lips are white.

The secretion from the gland in this species has been said to be inodorous. This could not be said of the White-Lipped Peccaries exhibited in the Gardens of the Zoological Society of London, though they were perhaps somewhat less offensive than the Collared Peccaries.

Mr. Bennett says, "unlike the former species, the White-Lipped Peccaries congregate in numerous bands, sometimes amounting, it is said, to more than a thousand individuals of all ages. Thus united they frequently traverse extensive districts, the whole troop occupying an extent of a league in length, and directed in their march, if the accounts of the natives are to be credited, by a leader, who takes his station at the head of the foremost rank. Should they be impeded in their progress by a river, the chief stops for a moment, and then plunges boldly into the stream, and is followed by all the rest of the troop. The breadth of the river or the rapidity of the current appears to be but trifling obstacles in their way, and to be overcome with the greatest facility. On reaching the opposite bank, they proceed directly on their course, and continue their march even through the plantations which, unfortunately for the owners, may happen to lie in their way; and which they sometimes completely devastate by rooting in the ground for their favourite food, or devouring such fruit as they find there. If they meet with anything unusual on their way, they make a terrific clattering with their teeth, and stop and examine the object of their alarm. When they have ascertained that there is no danger, they continue their route without further delay; but if a huntsman should venture to attack them when they are thus assembled in large numbers, he is sure to be surrounded by multitudes, and torn to pieces by their tusks, if he is so unwise as to neglect his only chance of escape, which consists in climbing a tree, and thus getting fairly out of their reach. The smaller bands are by no means equally courageous, and always take to flight at the first attack."

M. Lesson remarks that this species have been nowhere more particularly observed than in Paraguay.

In Guyana, Sonnini was surrounded by a herd of Peccaries, exasperated at the havoc made among them by the fusils of himself and his companions. Betaking himself to a tree, he beheld at his ease how they encouraged, by their grunts and rubbing snouts together, those which were wounded from the shots above, still maintaining their ground with bristles erect and eyes fiery with rage. They sometimes stood an incessant fusillade of two or three hours before they quitted the battle-field and left their dead to the conquerors. After such encounters comes the festival of the travellers. A great gridiron, so to speak, of sticks fixed in the ground, and some three feet in height, with numerous small branches laid on it in a transverse direction, is got ready. On this sylvan cooking-apparatus the pieces of Peccary pork are broiled over a slow fire kept up during the night. Sonnini dwells enthusiastically on these forest feasts, to which he looks back with regret.

Specimens of the *Choiropotamus Africanus* are now living (1855) in the Gardens of the Zoological Society, Regent's Park.

Fossil remains of this family have been found in the second division (Miocene of Lyell) and the third and fourth divisions (Pliocene of Lyell) of the tertiary deposits. In the first of these divisions are to be noticed the three species of *Sus* found in the Epplesheim sand. Bones of swine occur frequently in the bone-caverns and bone-breccia.

SULA, a genus of Natatorial Birds belonging to the family *Pelecanidæ*. [Pelecanidæ.] It has the following characters:—Bill strong, long, forming an elongated cone very large at its base, compressed towards the point, which is slightly curved; edges of the mandibles serrated; the angle of the gape behind the line of the eyes. Face and throat naked; nostrils basal, linear, hidden. Legs short, strong, placed rather backward; three toes in front, one behind articulated to the inner surface of the tarsus, all four toes united by membrane; claw of the middle toe pectinated. Wings long, first quill-feather the longest. Tail cuneiform.

S. alba, the Gannet, or Solan Goose, Fou de Bassan of the French. It is the *S. Bassan* of many authors. This bird is a constant resident on the British coast. It breeds in large numbers at Lundy Island, off the coast of Devon, the west of Ireland, the Isle of Ailsa, and the Bass Rock in the Frith of Forth.

They form their nests in a mass of weeds and grass. They lay one egg. Gannets feed exclusively on fish.

The Gannet is found in the Baltic, on the west coast of Norway, at the Faroe Islands, and Iceland. On the coasts of America they are found from Labrador to Carolina. It is also included in the birds of Madeira and South Africa.

In the adult bird the bill is of a horny grayish-white; the edges serrated, the naked skin of the face blue; iris of a pale straw-colour; the head and neck buff-colour; all the rest of the plumage white, except the wing primaries, which are black; the line of the bones of the legs and toes in front green, the other portions of the bones and the connecting membranes almost black. The whole length of the bird is about 34 inches, from the breast to the end of the first quill-feather, which is the longest, 19 inches. The young have the appearance of the young of the Red-Throated Diver, but the structure of the foot will prevent them from being taken for each other.

(Yarrell, *History of British Birds.*)

SULCULEOLARIA. [Acalephæ.]

SULPHUR, an elementary substance, occurring abundantly in an uncombined form on the surface of the earth. It occurs also in combination with various metals, forming sulphurets and sulphates (iron, copper, lead, mercury).

Native Sulphur is found in acute octahedrons, and, secondary to this form, with imperfect octahedral cleavage. It also occurs massive. The colour and streak of sulphur is yellow, sometimes orange-yellow; lustre vitreous. Transparent to translucent. Hardness 1·5 to 2·5. Specific gravity 2·07. It is easily distinguished by burning blue, and emitting a sulphur odour.

The great repositories of sulphur are either beds of gypsum and the associated rocks, or the regions of active or extinct volcanoes. In the valley of Noto and Mazzaro in Sicily, at Conil near Cadiz in Spain, Bex in Switzerland, and Cracow in Poland, it occurs in the former situation. Sicily and the neighbouring volcanic islands, Vesuvius and the Solfatara in its vicinity, Iceland, Teneriffe, Java, Hawaii, New Zealand, Deception Island, and most active volcanic regions, afford more or less sulphur. The native sulphur of commerce is brought mostly from Sicily, where it occurs in beds along the central part of the south coast and to some distance inland. It is often associated with fine crystals of sulphate of strontian. It undergoes rough purification by fusion before exportation, which separates the earth and clay with which it occurs. Sixteen or seventeen thousand tons are annually imported from Sicily into England alone. Sulphur is also exported from the crater of Vulcano, one of the Lipari Islands, and from the Solfatara near Naples.

It is also found in the United States of America, on the Potomac, and in districts where sulphuretted hydrogen is evolved from mineral-springs.

Sulphuric Acid is said to occur in the waters of the Rio Vinagro in South America, also in Java, and at Lake de Taal or Luzon in the East Indies. Sulphuric acid has been detected in the fumes of volcanoes.

(Dana *Manual of Mineralogy.*)

SULPHUR-WORT. [Peucedanum.]

SUMACH. [Rhus.]

SUN-BIRDS. [Cinnyridæ.]

SUN-DEW. [Drosera.]

SUN-FISH. [Orthagoriscus.]

SUN-FLOWER, the English name of a genus of Plants called *Helianthus*, from ἥλιος, the sun, and ἄνθος, a flower. Two reasons have been assigned for giving the plants of this genus this name: first, the resemblance of the large disc and ray of their flowers to the sun; and second, the tendency of these flowers, in a stronger degree than in other plants, to present their face to the sun. From this circumstance, the French Tournesol, Italian Girasole, and English Turnsol have been given. This is a genus consisting of very stately herbaceous plants, and containing upwards of 40 species, all of which are indigenous to America. It belongs to the natural order *Compositæ*, and has the following characters:—Head composed of many flowers, the flowers of the ray being ligulate and neuter, the flowers of the disc tubular and hermaphrodite; involucre irregularly imbricated, the outer scales foliaceous, the inner ones scaly; receptacle plane or convex, covered with oblong acute scales; tube of the corolla of discoid flowers short, 5-toothed; style appendiculated. Fruit an achenium compressed laterally; pappus in the form of two lanceolate acute deciduous scales. The leaves are opposite, sometimes superiorly alternate, and either entire or toothed. The whole plant is scabrous or villous. The flowers are solitary, and of a yellow or orange colour.

H. annuus, Annual Sun-Flower, is an herbaceous annual plant with thick rough stems from 6 to 20 feet in height; leaves alternate, petiolate, nearly heart-shaped, crenulated or dentated, rough. The

heads are large, from one to two feet in diameter, and composed of a multitude of flowers of a beautiful yellow colour, terminal, solitary, inclined, the disc vertical and oftenest facing the south. This species is the largest of the genus. It is indigenous in Mexico and Peru; it was early introduced into Europe after the discovery of America, and has since been very generally cultivated in gardens, on account of its very large and handsome yellow flowers. The plant however in Europe never attains the height nor the flowers the size they do in their native soil and climate. The albumen of the seeds of this plant contains a large quantity of oil; and it has been proposed to cultivate it for the sake of obtaining this oil, which is very palateable, and might be used for the table. Cows and oxen, horses, sheep, pigs, rabbits, and poultry are all fond of it. When torrified in the same manner as the seeds of coffee they make an agreeable drink, which may be used as a substitute for that article.

H. multiflorus, Many-Flowered Sun-Flower, is not so high a plant as the last, nor are its flowers so large. It has vivacious roots, which produce numerous herbaceous stems, which are branched and rough; its leaves are alternate, petiolate, dentated, the inferior ones are heart-shaped, the superior oval and acuminate; the heads of flowers are numerous and not inclined. It is a native of Virginia.

H. tuberosus, Tuberous Sun-Flower, or Jerusalem Artichoke. This latter name is a barbarous corruption of the Italian Girasole, this species having been introduced into Europe at the Farnese Garden at Rome, whence it was originally distributed. The roots are composed of a number of oblong tubercles, very large and fleshy, reddish outside and white within, resembling a potato; the stems are herbaceous and upright; the leaves are alternate and opposite, petiolate, oval, rough; the heads of flowers are yellow, and small compared with the two preceding species. It is a native of Brazil. In France it is also known by the name of Topinambour and Poire de Terre. According to Braconnot and Payen, the tubers do not contain fecula, but a vegetable principle called Inulin or Dahlin. These tubers, when cooked, form a good substitute for potatoes, and by some are even preferred.

Some of the species secrete a resinous juice, which is found to exude from the various organs of the plant. This is most observable in the *H. thurifer*, in which the resinous matter runs down the stem. This is sometimes observed to occur in the flowers of *H. annuus*. The *H. Indicus* of Linnæus and our gardens is probably only a variety of *H. annuus*, and is not a native of India, as its name would imply. This last species, according to Dr. Royle, is cultivated by the natives of India for the purpose of obtaining oil from its seeds.

SUN-ROSE. [HELIANTHEMUM.]

SUN-STONE. [FELSPAR.]

SURF-DUCK. [DUCKS.]

SURIANACEÆ, the name given to a supposed order of Plants represented by a solitary species, *Suriana maritima*, found on the coast of all tropical countries. It is a woody plant, with alternate leaves without stipules; hairs capitate, pointed. Flowers racemose; calyx 5-parted, slightly imbricated; petals the like number, equal, shortly clawed; stamens indefinite, hypogynous, placed in a single row; filaments subulate, anthers roundish, incumbent, bursting internally by two longitudinal fissures; carpels 5, distinct, attached to a very short gynobase, 1-celled, with two ascending collateral ovules; styles rising from near the base of the carpels; stigmas simple; pericarp woody. Seed solitary, erect, compressed. In some respects it may be compared with *Coriariaceæ* and Cranesbills, but its annular embryo is so peculiar as to indicate a somewhat different relationship; and this indeed has led Dr. Wight to suggest an affinity to Phytolaccads.

(Lindley, *Vegetable Kingdom.*)

SURIRELLA. [DIATOMACEÆ.]

SU'RNIA. [STRIGIDÆ.]

SUZANNITE, *Sulphato-Tricarbonate of Lead*, a Mineral occurring crystallised in two forms, namely, an acute rhomboid and a right rhombic prism. Cleavage of both forms perpendicular to the axis, and very distinct. Colour white, gray, pale-yellow, or green. Streak white. Hardness 2·5. Transparent, translucent. Specific gravity 6·2 to 6·4. It is found at Lead-Hills, in Scotland. Its analysis by Brooke gives—

Carbonate of Lead	72·5
Sulphate of Lead	27·5
	——100

SWALLOW-HAWK. [FALCONIDÆ.]

SWALLOW TRIBE, *Hirundinidæ*, a family of Insectivorous Birds, in which the powers of flight are very highly developed, but which have the feet comparatively weak.

Belon placed the Swallows at the end of his birds, immediately following his Petit Mouchet, or Moineau de Haye, which is engraven with a fly in its mouth. Brisson arranges the Swallow, together with the Goat-sucker [GOAT-SUCKERS] in his eighth order, consisting of birds which have the bill very small, compressed horizontally at its base, and hooked at its end, its aperture being larger than the head. This order stands between that containing *Upupa* and *Promerops* and that containing *Tanagra* and the Finches.

The genus *Hirundo* is placed, in the twelfth edition of the 'Systema Naturæ,' between *Caprimulgus* and *Pipra*, in the second division of the *Passeres*, namely, *Curvirostres*, 'mandibul. superior, apice incurvata.' In Latham's method it also appears in the second section of the *Passeres*, which is characterised much in the same way. In Lacépède's arrangement, *Hirundo* and *Caprimulgus* form his third order of birds (first sub-class and first sub-division) with 'Bec très court,' standing between the antecedent order, consisting of those with the 'Bec droit et menu' (the last genus of which is *Motacilla*) and the succeeding one, comprising birds with 'Bec arqué,' the first genus of which is *Glaucopis*, M. Duméril arranges the Swallows in his sixth family (*Planirostres* or *Omaloramphes*) of the *Passeres*. Meyer's *Chelidones* (his sixth order) consist of *Hirundo*, *Cypselus*, and *Caprimulgus*. The same genera appear in Illiger's method as his family *Hiantes*, the last of his order *Ambulatores*. In Cuvier's system the Swallows and Goatsuckers, including *Podargus*, form his family *Fissirostres*, which stands between the *Dentirostres* and *Conirostres*. M. Vieillot's Chelidons are placed between his Baccivores and his Myothères, in his second tribe (*Anisodactyli*). M. Temminck's eighth order, embracing the Swallows and Goatsuckers, stands between the orders consisting of the Kingfishers and the Pigeons. In M. Latreille's method the first genus of the first family (*Latirostres*) of his second order (Passereaux) contains the Goatsuckers and Swallows.

Mr. Vigors states that the families which compose the first tribe (*Fissirostres*) of his second order (*Insessores*) are distinguished from those of all the other, except the *Tenuirostres*, by their habit of feeding on the wing. From the latter, or the Suctorial Birds, which meet them at one of the extremes of the tribe, and of which the typical families feed also on the wing, they are distinguished, he observes, by their animal food, which they take by their bills or in the gape of their mouths; while the *Tenuirostres* live chiefly upon vegetable juices, which they extract with their tongue. "The *Fissirostres*," says Mr. Vigors in continuation, "depending so much on the powers of their wings, exhibit a proportional deficiency in the strength of their legs. These members are not only shorter and weaker than in the other Perchers (the typical families of the *Tenuirostres* here again being excepted, which correspond with them in this particular also), but they have their external toes in general to such a degree united with the internal, for the most part as far as to the second phalanx, that they are deprived of the free play of the joint; and the bird is thus rendered nearly incapable of using its legs in walking, or for any purpose besides that of mere perching. But even in this particular a group of the typical family appears deficient; for the toes of the genus *Cypselus*, being all placed in front, seem to assist the bird only in suspending itself, where other birds would perch. All the families of the tribe are again united by a striking conformity in their mode of nidification. They deviate from the manners of the Perchers in general in forming their nests on the ground; or if, like some of the *Hirundinidæ*, they choose elevated situations for that purpose, they build up the exterior of their nests with earth cemented into a solid substance, and thus preserve a similarity in their construction to those nests which are actually formed on the ground. The two typical groups of this tribe may be observed to be separated from the other three by the shortness of their bills and the wider gape of the mouth. Their mode of seizing their prey is conformable to these characters: they receive it in full flight into the cavity of their mouths, which remain open for that purpose, and where a viscous exudation within, and a strong reticulated fence of vibrissæ on the exterior, assist in securing the victim: while, on the other hand, the longer-billed families catch their food by their bills. The series of succession in the tribe may be stated as follows, the typical families being placed in the centre:—

"*Meropidæ.*
Hirundinidæ.
Caprimulgidæ.
Todidæ.
Halcyonidæ."

After alluding to the approximation between the *Meropidæ* and *Hirundinidæ*, Mr. Vigors notices the union between the latter and the *Caprimulgidæ*. [GOAT-SUCKERS.]

Prince Bonaparte arranges the *Hirundinidæ* as the second family of the *Passeres*; and in the first section of that family (*Ambulatores*). The following are the Prince's sub-families and genera:—

a. Cypselinæ.

Genera:—*Cypselus*, Ill.; *Chætura*, Sw.

b. Hirundininæ.

Genera:—*Pronge*, Boie; *Chelidon*, Boie; *Cotyle*, Boie; and *Hirundo*, Linn. (*Cecropis*, Boie). The family stands between the *Caprimulgidæ* and the *Ampelidæ*.

Mr. G. R. Gray divides the *Fissirostres*, into two sub-tribes:—1. *Fissirostres Nocturnæ*, consisting of the family *Caprimulgidæ*, with its sub-families; and, 2. *Fissirostres Diurnæ*, the first family of which last sub-tribe is *Hirundinidæ*, with the following sub-families:—

1. *Cypselinæ.*

Genera:—*Cypselus*, Ill. (*Apus*, Scop.; *Micropus*, W. and Mey.; *Hirundo*, L.); *Macropteryx*, Sw. (*Macropterus*, Sw.), *Hemiprocnes* Nitzch., *Acanthylis*, Boie (*Chætura*, Steph.; *Hirundo*, L.), *Collocalia*, G. R. Gray (*Hirundo*, L.).

2. *Hirundininæ.*

Genera :—*Hirundo*, L. (*Cecropis*, Boie), *Progne*, Boie (*Hirundo*, Gm.) *Cotyle*, Boie (*Hirundo*, L.), *Chelidon*, Boie (*Hirundo*, Vieill.)

The European species of this family are the Swift (*Cypselus Apus*, *C. murarius*, Temm.); the White-Bellied or Great Gibraltar Swift (*Cypselus Melba*, *C. Alpinus*, Temm.); the Rock-Martin (*Hirundo rupestris*); the Rufous Swallow (*Hirundo rufula*, Temm.); the Chimney Swallow (*Hirundo rustica*, Linn.); the Martin (*Hirundo urbica*, Linn.); and the Sand-Martin (*Hirundo riparia*, Linn.). Of these the first and the three last are British (summer visitors); and of the second, three specimens have been killed, and one found dead in Britain. (Yarrell.) [HIRUNDINIDÆ.]

Cypselus.—Tarsus thickly feathered; all the four toes directed forwards; the two middle equal; the hallux, or inner toe, shorter than the exterior; tail forked or even. (Sw.)

Head and Foot of Common Swift. (Swainson.)

C. Apus, the Common Swift, which usually comes to this country from Africa early in May, and leaves us generally by the middle of August, is the Moutardier, Martelet, Martinet noir ou Grand Martinet of the French; Rondone, Dini, and Dardano of the Italians; Ring-Swala of the Swedes; Thurm Schwalbe of the Germans; Gier Zwaluw of the Netherlanders; Screech, Screech Martin, Deviling, Screamer, and Black Martin of the country-people in various parts of Britain; and Martin Dû of the Welsh.

Belon considers this to be the Ἄωος and Κυψέλλος, or Κυψελος of Aristotle ('Hist. Anim.,' ix. 30); and indeed Aristotle states that it would be difficult to distinguish these ἄκροδες or κυψέλλοι from Swallows (Χελίδονες), if it were not that the former had the leg covered with feathers (δασεῖαν). M. Camus however thinks that those zoologists who are of opinion that Aristotle had here the Swifts in view are wrong; for the latter says (loc. cit.) that the birds thus designated by him made long nests of mud, with only just room enough to enter, which, M. Camus remarks, Swifts do not, but House-Martins do; and therefore he thinks the birds last named are meant.

In White's 'History of Selbourne' will be found many highly interesting particulars relating to the habits of the Swift, especially with regard to the structure of the nest, its constant use (by the same birds, as has been proved in some instances) for years in succession, and the treatment of the young by the parents under certain circumstances. Mr. Salmon has verified the fact of their producing three, and sometimes even four eggs, though two appear to be the ordinary number.

The old quatrain, in the 'Portraits d'Oyseaux,' sums up the qualities of the Swift thus :—

"Le Moutardier, ou bien grand Martinet,
Est à voler tres-leger et fort viste :
Mais sur la terre il ne pose, ny giste;
Car y estant, sur pieds mobile n'est."

The bird appears to spread over Europe in the summer and breeding season. They visit Lapland, Norway, Denmark, and Sweden; in which last country Professor Nillson states that it makes its nest in hollows of trees in the woods. Its eastward range appears to be as far as the mountain-lake Baïkal. At Erzerum it has been observed in numbers from May till September. Mr. Yarrell states that he has never seen this species in any collection brought from India. It has been noted at Madeira. Montagu extends its southward range in Africa as far as the Cape: Temminck limits it to the tropics. In our own country it has been remarked that Swifts are less plentiful with us than they formerly were.

The genus *Hirundo* is represented in Britain by three species. [HIRUNDINIDÆ.] The following is a summary of the characters of the Martin, or House-Martin (*H. urbica*) :—

"Ce Martinet fait en forme spherique
Son nid si fort, qu' impossible est de mieux,
En l'attachant aux bastiments fort vieux;
Duquel l'entrée est estroicte et oblique."

H. esculenta, is the Swallow which makes the edible nests that form a considerable article of Chinese commerce. The species, which is the Lawet of the Javanese, is small. It is brown above, and whitish beneath and at the end of the tail, which last is forked. The nests are made of a particular species of *Fucus* [ALGÆ] which the bird macerates and bruises before it employs the material in layers so as to form the whitish gelatinous cup-shaped nests so highly prized as delicacies and restoratives by the Chinese when dissolved in their soups. Bontius, who seems to have thought that the nest was formed of no vegetable material, says of these birds, "ex spuma maris basin scopulorum alluentis, tenacem quandam materiam colligunt, sive ea Balænarum seu aliorum piscium sit semen, ex qua nidos suos ædificant, in lisque ova ponunt, et pullos excludunt." The nests are affixed to the rocks, and the finest are semi-transparent. Coarse or dirty nests are used for glue, but the good ones are eagerly sought after. "Chinenses hos nidos e scopulis avulsos, ingenti quantitate per Indiam venales ferunt, gulosis in summas delicias, qui eos gallinæ, seu vervecis decocto dissolutos, avidè devorant, et ostreis, fungis, et cæteris gulæ irritamentis, longè anteponunt." This recipe for making the famous birds'-nest soup ends a chapter which begins poetically and pathetically with the following lines :—

"Quid scopulos, Progne, quid inhospita littora nidis
Optas, per medias hos gula quæret aquas?"

There is another species, *H. fuciphaga*, the Linchi of the Javanese, about five inches long, nearly an inch shorter than *H. esculenta*, which has a white abdomen and longer wings in proportion to its size. This species constructs its nests of mosses and lichens connected by the same glutinous substance which composes the edible nest of *H. esculenta*. Dr. Horsfield, who states this in his 'Systematic Arrangement and Description of Birds from the Island of Java' ('Linn. Trans.,' vol. xiii.), there remarks that the specimens of *H. esculenta* examined by him in Java and those which he brought home differ from Latham's description in being uniformly of a blackish-colour without a white extremity to the rectrices. Bontius, who gives a rude cut of the nests adhering to the rock, with the birds sitting and approaching, describes his birds, in the chapter 'De nidis hirundinum edulibus,' above referred to, as 'Aviculæ parvæ discolores, hirundinum specie.' Specimens of *H. esculenta* and *H. fuciphaga* are preserved in the Museum of the East India Company.

H. Senegalensis. It is the Senegal Swallow of authors; Le Grande Hirondelle à Ventre Roux de Senegal. Large. Tail forked. Plumage above glossy-black; sides of the nape and neck, and lower part of the back, rufous; beneath ferruginous, verging to white on the throat and breast; under wing-coverts and thighs pure white. (Sw.)

Mr. Swainson, who has given a most characteristic figure of this species in his 'Birds of Western Africa,' observes that this is the largest of the true swallows that he has yet seen, for it measures full eight inches in its total length. "Its structure," says that observing author, "is precisely similar to our common *H. rustica*, excepting that the hind toe and claw, which in that bird is of equal length with the shank, is in this a slight degree longer. In the general cast of its colouring it has such a close resemblance to the *H. Capensis* figured by Le Vaillant as an inhabitant of the Cape of Good Hope ('Ois. d'Afr.,' 5, pl., 245, fig. 1), that we were at first tempted to believe it was the same, particularly as Le Vaillant forgets to give us the size of his bird, an omission which all the compilers since his days have perpetuated. It appears however that the Cape species has a small white spot on the inner web of all the lateral tail-feathers, excepting that which is elongated, and that the feathers of the vent have a black stripe down the middle of each." In the same volume will be found a description of the small but very beautiful White-Bodied Swallow, *H. leucosoma*, Sw.

The species of *Hirundines* enumerated by Nuttall, in his interesting 'Manual of the Ornithology of the United States and Canada,' are, the Purple Martin (*Progne purpurea*, Boie; *H. purpurea*, Linn.), the Barn-Swallow (*H. rufa*, Gm.; *H. Americana*, Wils.), the Fulvous or Cliff-Swallow (*H. fulva*, Vieill.; *H. lunifrons*, Say), the White-Bellied Swallow (*Chelidon bicolor*, Bonap.; *H. bicolor*, Vieill.; *H. viridis*, Wils.), the Bank-Swallow or Sand-Martin (*Cotyle riparia* (?), Boie; *H. riparia*, Wils.), and the Chimney Swift or Swallow (*Chætura Pelasgia*, Steph.; *Cypselus Pelasgius*, Temm.; *H. Pelasgia*, Linn., Wils.).

H. purpurea, the Purple Martin. The male is dark bluish glossy purple; the wings and forked tail are brownish-black. The female and young are bluish-brown, and have the belly whitish. Tail considerably forked. Length about 8 inches. Alar extent 16 inches.

"This beautiful species," says Nuttall, "like many others of the family, seeks out the dwellings of man, associating himself equally with the master and the slave, the colonist and the aboriginal. To him it is indifferent whether his mansion be carved and painted, or humbled into the hospitable shed of the calabash or gourd. Secure of an asylum for his mate and young, while under the protection of man, he twitters forth his gratitude, and is everywhere welcomed to a home. So eager is he to claim this kind of protection, that sometimes he ventures hostilities with the blue birds and domestic pigeons, whom he often forces to abandon their hereditary claims. Satisfied with their reception and success, like so many contented and faithful domestics, they return year after year to the same station."

The Chimney-Swift, or Swallow, is sooty-brown, and has the chin and line over the eye of a dull whitish. It is about 4½ inches in length, but 12 in alar extent. The wings extend far beyond the tail, which is even, and, like that of the rest of the genus, mucronate.

H. fasciata, Latham, is L'Hirondelle à Ceinture Blanche of Buffon, the White-Bellied Swallow of Latham. It is of a glossy blue-black; thighs and band on the abdomen snowy.

Mr. Swainson speaks of this as a very rare bird; and, according to Buffon, it is sometimes seen perched on floating trees in the rivers of Guyana. Length to the end of the deeply-forked tail about 6 inches. The first quill is longest.

White-Bellied Swallow (*Hirundo fasciata*). (Swainson, 'Zool. Ill.,' 2nd series.)

Macropteryx.—Tarsus remarkably short, naked. Anterior toes long; the outer scarcely shorter than the middle; the inner shortest; hinder toe very short. Tail long, forked. It is a native of India. (Swainson).

M. longipennis.—Above obscure glossy-green; throat, breast, and lower part of the back, light-gray; belly, spot on the scapulars, and line over the eye, white; ears rufous; front with an incumbent crest.

Mr. Swainson considers *Macropteryx* intermediate between the typical Swifts and the Swallows. To the first, he remarks, it is allied by its strong scansorial feet; to the latter by the length and fixed position of the hind toe, and the depression of the bill.

Head and Foot of *Macropteryx longipennis*.

Chætura, Steph.—Feet as in *Macropteryx*, but the tarsus longer than the middle toe. Tail short, even; the shafts prolonged into acute points. (Sw.)

Long-Winged Swift (*Chætura macroptera*). (Swainson, 'Zool. Ill.,' 2nd series.)

C. macroptera is brown, with the wings and tail glossed with greenish-blue, the back being of a gray-white, the chin and under tail-coverts snowy, and the tail even. Mr. Swainson says that *Hirundo albicollis* and it are two of the largest species yet discovered of a very singular group of swifts; wherein the tail-feathers are spined,

Tail of *Chætura*. (Swainson.)

and even more rigid than those of the woodpeckers: by this structure, he remarks, the birds can remain for a considerable time in the most perpendicular situations. The expanded tail, he adds, thus acts as a powerful support, which is further increased by the size and strength of the claws, these last being much larger than those of ordinary swallows. Most of the species are natives of America, but Mr. Swainson does not say whether this is a native of that country.

The Wood-Swallows of Australia and India are closely related to the *Hirundinidæ*, but differ in the structure of their bills and feet. Mr. G. R. Gray arranges them under his sub-family *Dicrurinæ* amongst the *Ampelidæ*. They belong to the genus *Artamus*, which is often placed in the *Laniadæ*, and is thus defined:—Bill gradually arched from the base, where it is very broad. Culmen thick and convex, without any ridge; the base dividing the frontal feathers, and somewhat dilated. Rictus bristled. Nostrils wide apart, naked, small, without a membrane, and pierced in the bill. Feet short, strong. Wings very long and pointed; the first quill longest. Tail short. (Swainson.)

A. leucorhynchos is the *Lanius leucorhynchos* of Gmelin, Pigreische Dominiquaine des Philippines of Sonnerat, and White-Bellied Shrike of Latham. Size rather larger than a sparrow, and in shape much more elongated. Head, neck, breast, back, wings, and tail black. Belly and upper part of the rump white. Under part of the wings (which are very long, and reach at least an inch beyond the tail) gray. Bill grayish, conical, and very strong, slightly curved at its extremity, and its base surrounded with stiff bristles directed forwards. Legs black.

Sonnerat states that this bird flies with rapidity, poising itself in the air like the swallows. It is, he adds, an enemy to the crow; and although much smaller, the wood-swallow not only dares to oppose but to provoke him. The combat is long and stubborn, sometimes continuing for half and hour, and concludes with the retreat of the crow. Perhaps, says Sonnerat, the crow despises this too feeble enemy, which only harasses him, and avoids his strokes by his activity, darting away and returning as he sees his opportunity.

A. sordidus, Sordid Thrush, is the *Turdus sordidus* of Latham; *Ocypterus albovittatus* of Cuvier, Valenciennes, and Gould's 'Synopsis;' *Artamus lineatus* of Vieillot; *A. albovittatus* of Vigors and Horsfield; *Leptopteryx albovittata* of Wagler; Be-wö-wen of the aborigines of the lowland and mountain districts of Western Australia; and Worle of the aborigines of King George's Sound.

The head, neck, and the whole of the body, is fuliginous gray; wings dark bluish-black, the external edges of the second, third, and fourth primaries white; tail bluish-black, all the feathers, except the two middle ones, largely tipped with white; irides dark brown; bill blue, with a black tip; feet nearly lead colour. Sexes alike in colour, but the female rather the smallest.

The young have a dirty-white irregular stripe down the centre of each feather on the upper parts, and are mottled with the same on the under parts.

This species is a native of Australia, and breeds from September to December, and the situation of the nest is very much varied. Mr. Gould saw one placed in a thickly-leaved bough near the ground, while others were in a naked fork, on the side of the bole of a tree, in a niche formed by a portion of the bark having been separated from the trunk. He describes the nest as rather shallow, of a rounded form, about five inches in diameter, and composed of fine twigs neatly lined with fibrous roots. He observed that the nests found in Van Diemen's Land were larger, more compact, and more neatly formed than those on the continent of Australia. The eggs, which are generally four in number, differ in the disposition of their markings. The dull white of the ground-colour is spotted and dashed with dark umber-brown; in some Mr. Gould found a second series of grayish spots appearing as if from beneath the surface of the shell. Medium length 11 lines, and breadth 8 lines.

Mr. Gould states that an extraordinary habit of this bird is that of clustering like bees on the dead branch of a tree. "This feature was not seen by me, but by my assistant, Mr. Gilbert, during his residence at Swan River; and I have here given his account in his own words:—'The greatest peculiarity in the habits of this bird is its manner of suspending itself in perfect clusters, like a swarm of bees; a few birds

suspending themselves on the under side of a dead branch, while others of the flock attach themselves one to the other, in such numbers that they have been observed nearly of the size of a bushel measure.' It was very numerous in the town of Perth until about the middle of April, when I missed it suddenly; nor did I observe it again until near the end of May, when I saw it in countless numbers flying in company with the common swallows and martens over a lake about ten miles north of the town; so numerous in fact were they that they darkened the water as they flew over it."

Sordid Thrush (*Artamus sordidus*). (Gould.)

Mr. Gould gives a representation on the plate which accompanies his description of this extraordinary clustering habit. The birds in the representation at once remind one of a swarm of bees.

Swarm of *Artamus sordidus*. (Gould.)

A. cinereus, the largest of the Australian Wood-Swallows, is the *Ocypterus cinereus* of Valenciennes; and also the Be-wō-wen of the aborigines of the lowland and mountain districts of Western Australia, and the Wood-Swallows of the colonists of the same.

The crown of the head, neck, throat, and chest is gray, passing into sooty gray on the abdomen; space between the bill and the eye, fore part of the cheek, chin, upper and under tail-coverts, jet black; two middle tail-feathers black; the remainder black largely tipped with white, with the exception of the outer feather on each side, in which the black extends on the outer web nearly to the tip; wings deep gray, primaries bluish-gray; under surface of the shoulder white, passing into gray on the under side of the primaries; irides dark blackish-brown; bill light grayish-blue at the base, black at the tip; legs and feet greenish-gray. Sexes alike in colour, and only to be distinguished by dissection. (Gould.)

It is found in Timor and Australia. The range in the last-named country extensive. Found by Mr. Robert Brown at Broad Sound in the east, and by Mr. Gilbert on the west coast.

Wood-Swallow (*Artamus cinereus*). (Gould.)

Mr. Gould states that in Western Australia, although a very local, it is by no means an uncommon species, particularly at Swan River, where it inhabits the limestone hills near the coast, and the Clear Hills of the interior, assembling in small families, and feeding upon the seeds of the *Xanthorhœa*, so that insects do not form the sole diet of this species. Mr. Gould indeed observes that with such avidity does it devour the ripe seeds of this grass-tree, that several may be seen crowded together on the perpendicular seed-stalks of the plant busily engaged in extracting them; but he adds that at other times, particularly among the limestone hills, where the trees are few, it descends to the broken rocky ground in search of insects and their larvæ.

The round nest is compactly formed in October and November, sometimes of fibrous roots lined with fine hair-like grasses, sometimes with grass-stems and small plants, and placed either in a scrubby bush or among the leaves of *Xanthorhœa*. Mr. Gould remarks that it is deeper and more cup-shaped than those of the other members of this group The eggs vary much in colour and the character of their

markings. Bluish-white is the usual colour, spotted and blotched with lively reddish-brown, intermixed with obscure spots and purplish-gray dashes, the markings most numerous towards the larger end. ('Birds of Australia.')

Nest of Wood-Swallow (*Artamus sinereus*). (Gould.)

SWALLOW-WORTS. [ASCLEPIAS.]

SWANS. [CYGNINÆ.]

SWA'RTZIA, the name of a genus of Plants, given by Willdenow in honour of Olof Swartz, a Swedish botanist, belongs to the natural order *Leguminosæ*. This order was divided by De Candolle into two groups, *Curvembriæ* and *Rectembriæ*: the former with the radicle of the embryo bent back upon the cotyledons; the latter with the radicle straight. The curvembryose group contains two sub-orders, of one of which, *Swartzia*, the present genus, is the type. The sub-order *Swartzia* is known by possessing a bladdery calyx with indistinct lobes, and hypogynous stamens, and by being either destitute of corolla or having only one or two petals. The other genera in this order are *Baphia* and *Zollernia*. [CAMWOOD.] The species are natives of South America and the West India Islands.

The genus *Swartzia* is known by its calyx being divided into 3 or 4 pieces or teeth, which are at first united, but afterwards break up and separate. It has sometimes one petal, which is flat and lateral; sometimes this is entirely wanting. The stamens are 10, 15, or 25 in number, with frequently 2 or 4 of them much larger than the others, and the rest are often connected a little way at the base. The seeds have an arillus, and do not possess albumen. The species are trees, with simple or unequally pinnated leaves, having racemose flowers, which grow from the axils of the leaves.

S. tomentosa, Tomentose Swartzia. Leaves with 5-7 leaflets; petioles terete, which, as well as the branchlets, are velvety; leaflets oval-oblong, pointed, velvety beneath; stipules nearly orbicular. This species forms a high thick tree, with strong angular branches, and grows on the borders of rivers in Guyana, where it is called Anacoco and Bois Pagaie Blanc. It has a fine reddish-coloured wood, which becomes black by age, and is considered very indestructible, and is used for the making of rudders for ships. The bark is very bitter, and is used as a medicine in its native country. There are about 16 other species of *Swartzia*.

SWEAT. [SKIN.]

SWEET BRIAR. [ROSA.]

SWEET CALAMUS. This aromatic, which was of equal celebrity with Spikenard, mentioned by the same authors, and procured from the same country, is described by Dioscorides under the name of Κάλαμος ἀρωματικός. It is supposed by Sprengel and some authors that the *Acorus Calamus* of botanists is intended, which is possessed of slight aromatic properties, is common in European ditches, and is likewise found in India in mountainous situations. This is known to the Arabs by the name Wuj, which appears to be a corruption of the Hindoo Buch, Sanscrit Vacha, and has in the Arabian works the name Akoron assigned as its Greek synonyme, no doubt intended for the Ακορον of Dioscorides. Therefore there is no foundation for the opinion of Sprengel that this Acoron is the *Iris pseudacorus* of botanists.

Calamus aromaticus is described by Dioscorides immediately after Σχοῖνος, or Σχῖνος, which is usually translated *Juncus odoratus*, and is acknowledged to be the *Andropogon Schœnanthus* of botanists, commonly known by the name of Lemon-Grass. This has also had the names of Camel's Hay, Palea de Mecha, &c., applied to it. *Schœnanthus* is evidently compounded of 'schœnus' and 'anthos' (ἄνθος, 'a flower'). Theophrastus treats of Calamos and Schœnos together, and states that they were found among the mountains of Libanus, on the shores of an extensive lake; but Burckhardt in such situations could only find rushes and reeds. It is possible therefore that a Syrian locality may have been assigned to drugs obtained from more distant countries by the route of the Euphrates, for Dioscorides says they are produced in India. By Hippocrates they are called Κάλαμος εὐώδης and Σχοῖνος εὔοσμος, also Κάλαμος σχοῖνος (Hipp., *f.* 5 p. 138, l. 17), evidently showing that if they agreed in properties, they had also some resemblance in nature. If we desire to find something similar to *Schœnanthus*, and possessed of still more aromatic properties, we have only to search in the genus to which this belongs, and we shall find several plants famous for their agreeable odour. The roots of *Andropogon muricatum*, commonly known in the shops of this country by the Tamul name Vitivayr, and made into small bundles for brushing velvet, are remarkable for their fragrance: hence several essences are now prepared from them in Paris. The roots are also well known to Indians by the name of Khuskhus, being used throughout the Bengal Presidency for making tattees; these thatched screens being fitted to doors and windows, have water constantly sprinkled over them; the hot air in passing through becomes much cooled by the great evaporation, and enters the room both cool and refreshing, diffusing a delightful fragrance. The aroma here depends on the presence of a principle analogous to myrrh. But other species are still more fragrant, and secrete odorous volatile oil in sufficiently large quantities to be profitably distilled. Of these, Lemon-Grass, or *Andropogon Schœnanthus*, is the best known. The infusion of its leaves is often employed in India as a pleasant stomachic, and Lemon-Grass Oil is probably distilled from them. *A. Nardus* (?) is another species, called Ginger- or Spice-Grass, by Ainslie, which is said by him to be common in the Courtallum Hills and the Indian Peninsula, where the natives occasionally prepare with it an essential oil useful in rheumatism, and use the infusion of its leaves as a stomachic. *A. Iwarancusha* is a species which comes near *A. Schœnanthus* in habit and taste. It skirts the bases of the mountains of north-west India, and was found by Dr. Blane and by Dr. Boyd about Hurdwar: it was considered by the former to be the Spikenard of the ancients. Dr. Royle also found it near Hurdwar, and in the upper parts of the Doab of the Ganges and Jumna rivers, and he states ('Illustr. Himal. Bot.,' p. 425) that it is there called Mirchiagund, with Iskhir given as its Arabic, and Iskhinos as its Greek synonym; and infers that it may have been the Σχῖνος of the Greeks as well as *A. Schœnanthus*. But another species is still more extensively diffused, and still more remarkable for its very powerful and delightful fragrance. This is the species which yields the Grass-Oil of central India, commonly called Oil of Spikenard. It extends southward to between the Godavery and Nagpore, and northward to the Delhi territory, but probably still farther north, as it delights in a dry and barren soil. In central India, especially at Namur, Ellichpore, &c., a very delightful fragrant oil is distilled from this plant, which is highly valued in the East as a scent, being added to the finer expressed oils employed for anointing the hair or the bodies of the natives. It is also much esteemed as an external application in rheumatism, and has been introduced into practice in this country, and is highly valued by some, though unknown to the generality of practitioners. It has the advantage of diffusing an agreeable odour at the same time that it is efficacious as a stimulant remedy. This or the preceding species extends into Afghanistan.

Sweet Cane, or Calamus, being described by Dioscorides immediately after Σχῖνος, which is generally acknowledged to be *A. Schœnanthus*, appears to Dr. Royle to belong to the same genus, and indeed to be the above far-famed species, as *Calamus aromaticus* is thought also to be the Sweet-Cane and the rich aromatic reed from 'a far country' of Scripture. He states that there is no plant which more closely coincides in description with everything that is required than the tall grass which yields the fragrant Grass-Oil of central India, and which he has named *A. C. aromaticus*. ('Illust. Himal. Botany,' p. 425.)

SWEET GUM-TREE. [LIQUIDAMBAR.]

SWEET-SOP. [ANONACEÆ.]

SWEET-WILLIAM. [DIANTHUS.]

SWIETE'NIA, a small genus of Plants of the natural family *Cedrelaceæ*, named by Jacquin in honour of G. van Swieten. The genus *Swietenia* is characterised by having a small 4-5-cleft calyx; petals 4 to 5, deciduous; stamens 8 to 10, the filaments united together into a toothed tube, bearing the anthers on the inside; stigma peltate; ovary 5-celled, seated on a stipes; seeds winged. The species, though few in number, are found in hot parts of the world, form large trees, and yield valuable timber.

S. febrifuga of Roxburgh has been formed into a new genus, *Soymida*. [SOYMIDA.]

S. Senegalensis has also been formed into a new genus, *Khaya*, and is the tree yielding African mahogany, which is brought to us from Sierra-Leone. The timber, though hard, is liable to warp, but it is employed where a hard and cheap wood of large size is required, as for mangles. The negroes employ an infusion of the bark, which is very bitter, as a febrifuge.

S. chloroxylon is a third species, which has been formed into a new genus, and is now *Chloroxylon Swietenia*, a native of the mountainous

parts of the Circars in the East Indies. It is the tree yielding the beautiful East Indian satin-wood, which is of a deep yellow-colour, close-grained, heavy, and durable.

S. Chikrassee, now *Chikrassia tabularis*, is a fourth species, formed into a new genus. This is another Indian tree which is greatly admired for its beauty. The wood is very light-coloured, close-grained, and most elegantly veined, and much employed for furniture and cabinet-work.

The most important species, however, and that which now nearly alone constitutes the genus, is *S. mahogany*, a native of Campeachy and of the West Indies. It is a lofty branching tree with a large spreading head, and pinnate shining leaves. The timber, which is so well known from its extensive employment for furniture and cabinet-making, is of a reddish or yellowish-brown colour, of different degrees of brightness, much mottled and streaked, very little liable to shrink or warp, free from taste or smell, except when kept for some time, when it acquires an agreeable odour, from the exudation of a semi-resinous juice, which serves to preserve the wood from the attacks of insects. It does not appear to have been imported into this country before 1724. The quality of the wood varies much, according to the situations in which it grows: that which is produced on rocky soil and exposed situations is the best. Spanish mahogany is imported in logs of about 10 feet long, and from 20 to 26 inches square. From the elevated parts of the West Indies and from the Spanish Main the wood is close-grained, and of a darker colour than the Honduras mahogany. This is imported in logs of from 2 to 4 feet square, though both kinds are no doubt produced by the same tree. Some years ago the Messrs. Broadwood gave the large sum of 3000*l.* for three logs of mahogany, which were each about 15 feet long and 38 inches square. The wood was extremely beautiful, and capable of taking the highest polish.

SWIFT. [SWALLOW-TRIBE.]

SWIMMING. A large number of animals transmit themselves from place to place by swimming in liquids; and when we take a view of the variety of forms presented by the locomotive organs of these animals, it must be apparent that they perform their movements very differently. All those land animals which constantly breathe the air, especially man and the higher orders, must float on the surface of the water in swimming; they die of suffocation when water chokes up the air-tubes of the lungs, which constitutes drowning. Of all animals, there is perhaps none so helpless in water, without training, as man; and notwithstanding his vast superiority in other respects to other air-breathing animals, he is inferior to them in the employment of the locomotive organs for the purposes of swimming. Indeed it is well known that by far the greater number of persons who are precipitated into deep water, if they cannot swim, are drowned. This arises from the improper use they make of their limbs.

The cause of this misapplication of the limbs by man, when immersed in water, is owing to the totally different mode in which they are used in walking and running on land to that in which they should be exercised in water, as we shall see.

In preparing to swim, in man, the limbs should be arranged in such a manner that they can be made to act favourably as soon as the body is resting, unsupported by other media, in the water.

In order to propel the body there must be some movement of the limbs; and it is by the flexion and abduction of the arms, and by the extension and adduction of the legs, that the process of swimming is performed, which movements must be produced rhythmically. Suppose a person standing up to his breast in water and about to strike off in swimming; the hands are placed close to each other with the palms undermost near the breast, the body is thrown forward in the water, the hands are thrust out, and when the arms are fully extended as in *fig.* 1, they diverge horizontally (the backs of the hands being

Fig. 1.

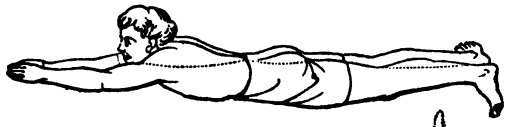
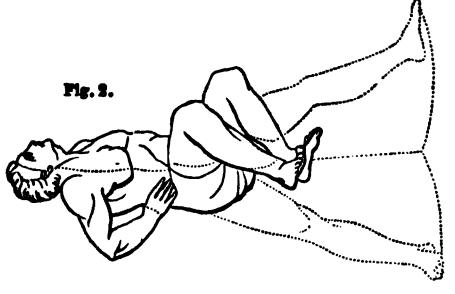


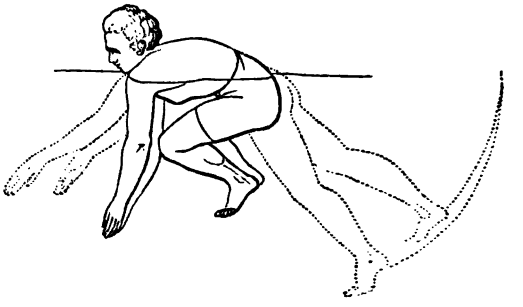
Fig. 2.



turned towards each other), describing curves until they are brought round under the armpits, and again extended. It should be observed that the arms must always be kept in advance of a line passing through the axes of the shoulder-joints.

Let us now advert to the action of the legs. Whilst the arms are describing their curves the legs are drawn forwards under the body, the knees being separated as much as possible, and the toes turned outwards as in *fig.* 3, and whilst the arms are regaining their extended

Fig. 3.



position the legs are extended backwards and outwards with a moderate degree of velocity, the soles of the feet being turned outwards, and are then brought together again, simultaneously with the arms, into the attitude shown in *fig.* 1.*

It will be observed that the arms and legs have each four *distinct* kinds of motion, namely, extension, abduction, adduction, and flexion, but the effects of these motions are different. The extension of the arms retards the motion of the body, whilst that of the legs accelerates it: the abduction of the arms accelerates, and of the legs slightly retards; the adduction of the arms slightly retards, and of the legs accelerates; and the flexion of both arms and legs retards. The simultaneous performance of these motions is exhibited in the following tabular form:—

Arms.	Legs.
Abduction	Flexion
Adduction }	{ Extension
Flexion }	{ Abduction
Extension	Adduction

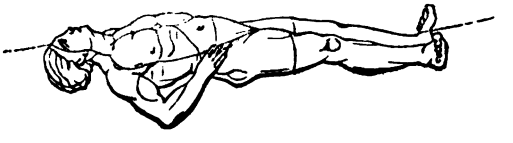
It is upon the rhythm with which these periodic movements are performed that the success of swimming depends, the whole being seen in outline in *figs.* 1 and 3.

We may also observe, that when the arms are abducted, or drawn outwards and backwards, the legs are drawn forwards; and when the arms are flexed and brought together, the legs are extended outwards; and lastly, when the arms are thrust forwards, the legs are brought close together; so that whilst the force of the arms is positive, that of the legs is negative, and vice versâ: but it is evident that the effective forces in swimming preponderate, or the body would either remain stationary or move backwards, and this results from the shape of the limbs and the manner in which they can be made to act.

From what has been said, we may easily perceive how differently the limbs act in swimming from what they do in walking, and that the arms and legs interchange their effective strokes alternately. These movements are not difficult to perform, but it requires some attention and practice in order to accomplish them with precision. Indeed they may be practised out of water, and sufficient habit be obtained to know how to act if by chance a person were suddenly immersed and in danger of being drowned. But it should also never be forgotten that almost all persons will float, if the chest be kept well filled whilst immersed in the water. It however requires great fortitude and self-possession to keep the limbs quiet and under water, and at the same time to stop the inspiratory movement until the mouth rises above the surface of the water.

Swimming on the back is usually effected by means of the legs alone. The attitude preparatory to this movement is seen in *fig.* 4.

Fig. 4.



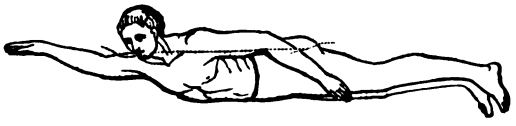
The head is bent backwards so far that the water may cover the forehead, and reach to the level of the eyes; the chest is elevated, and the hands placed on the hips; the motions of the legs are indicated by the dotted lines in *fig.* 2, and are the same as those of the legs in swimming on the breast. We may here state that any one who can swim on his breast will experience no more difficulty in

* These figures are reduced from the 'Elementary Course of Gymnastic Exercises' by Captain Clias.

turning himself round on his back in the water than in turning himself in his bed.

Some persons can accomplish swimming on the side, and others on the back, without using the legs; and many other feats, such as with the arms acting in different directions as seen in *fig. 5*, and again

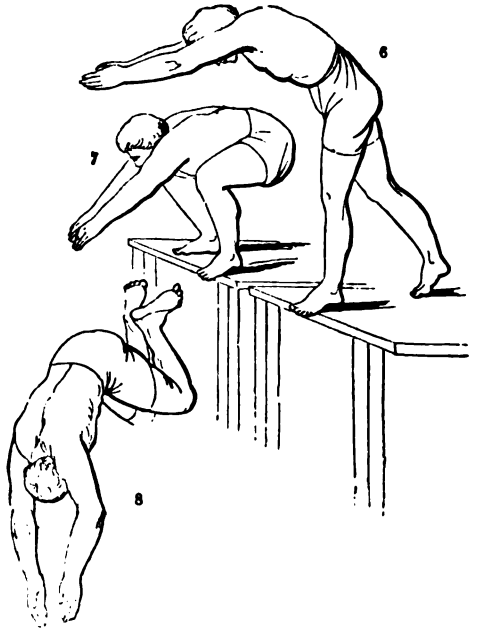
Fig. 5.



with one hand alone. In diving, two methods are recommended: one by leaping into the water with the feet downwards, the other head foremost; the former is most desirable in shallow water, the latter when the head is subject to giddiness and fulness of blood.

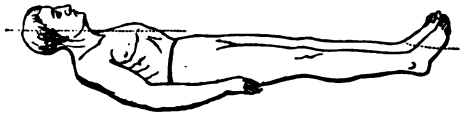
Figs. 6 and 7 show the attitude preparatory to plunging into the water, and *fig.* 8 the position of the limbs in diving to the bottom of the river.

Figs. 6, 7, and 8.



The position of greatest ease in the water is floating. The body lies on the back, with the face only above the water; the limbs are perfectly quiescent, and extended as in *fig.* 9. This state can only be maintained when the specific gravity of the body is less than that of the water.

Fig. 9.



Sea-water, being heavier than that of rivers, is best calculated to support a person in swimming, and those who are specifically heavier than river-water may be sustained in a floating position in sea-water. It may be observed that man being so nearly of the same specific gravity as water, and air being nearly 1000 times lighter, that a few cubic inches of air in a bag are sufficient to keep one who cannot swim permanently at its surface; or a few pounds of cork fastened to the body will accomplish the same object: and it is astonishing that, notwithstanding the great number of persons who are annually drowned in the Thames alone, no means are adopted to provide some such simple method for sustaining the body in water by boatmen; and still more that we hear of watermen being frequently drowned in consequence of not having learned to swim. Swimming ought to form a part of our physical education; all our youth of both sexes may do so with advantage, for the purpose of cleanliness and to increase their health and strength, as well as to provide a safeguard against subsequent accidents.

The specific gravity of nearly all Mammiferous Quadrupeds is less than that of water, and hence they are capable of floating on its surface without requiring the interposition of the limbs. We have familiar examples of the specific gravity of quadrupeds in the horse, dog, cat, deer, &c. If, for instance, we cause either of the above-named animals to be thrown into deep water, we observe that they speedily rise to the surface, and remain there as long as the limbs are quiescent, and when the limbs move they strike out in the proper direction with precision, although they may never previously have been out of their depth in water. But if we inquire how it happens that these animals are enabled, without the aid of experience, to swim at once the first time they are plunged into water, we find on investigation that the limbs of Mammiferous Quadrupeds move in water precisely as they do on land, and no new action, either as regards direction or order, is required, as is the case with man, to enable them to swim; and as they are specifically lighter than water, they need no force to be employed to keep them above the surface. In hunting the stag or the fox, it is not an uncommon occurrence for the animal, when hard pressed in the chase, to plunge into a stream and swim across the water, the hounds following. The huntsman, relying on the tact of his horse, plunges fearlessly with it into the water, and arrives safely on the opposite bank. In these cases the horse carries its rider above the surface, thus showing that the specific gravities of the man and horse combined are much less than that of the water.

Most of the Mammiferous Animals are amphibious, and possess the faculty of sustaining themselves during lengthened periods under water. Of these, several species have the feet furnished with a membrane between the fingers and toes; such, for example, as the Otter tribe. These animals are excellent swimmers, and their agility in the water is surprisingly great. It appears that nearly all mammiferous animals can swim if necessitated to do so; and it should be borne in mind that this has been accounted for by their being gifted with two qualities essential in swimming—the one arising from specific gravity, and the other from the circumstance of the natural movements of the limbs being the same both on land and in water.

Amongst the Birds, those of the order *Natatores* are, as their generic name implies, best adapted for swimming. The figure of the breast resembles that of the keel of a boat; the body being clothed with a thick plumage, tends to increase the bulk without very materially augmenting the weight. The plumage is very compact, and being lubricated with an oleaginous secretion, the water cannot penetrate to the skin. The bones of the skeleton are extremely light, and many of them are hollow, so that the specific gravity of birds is much less than that of water; indeed, were it not so, they would be utterly unable to swim, and much less to fly in the rarer medium of air. The specific gravity of birds is so much less than that of water, that we observe, as in the Grebe, Petrel, &c. (*fig.* 10), that by far the greater

Fig. 10.

Grebe Petrel.

portion of the body is above the water as they lie flat on its surface. They require therefore no action of the limbs to sustain them on the

Fig. 11.

Foot of Grebe.

water, and, for the purpose of progression, the feet, which act as oars, are variously and most exquisitely contrived. For example, in the Grebe each toe is furnished with a distinct membrane (*fig.* 11), the margins of which overlap each other; but in the Merganser, and many other aquatic birds, such as the Duck and Goose, the same membrane extends to the three toes. (*Fig.* 12.) In swimming, the

Fig. 12.

Eider Duck.

effective stroke is produced by the feet alternately; that is, whilst one foot is pushed backwards the other is drawn forwards. (*Fig.* 13.)

Fig. 13.

Parakeet Auk.

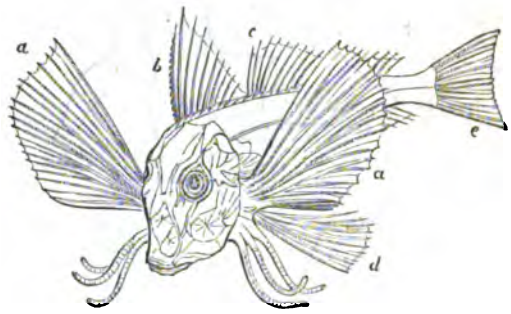
In the effective stroke the foot is extended and the toes expanded so as to present the greatest surface possible to the water; it is then driven backwards with force, the effect of which is to drive the body forwards. In the back stroke the foot is flexed, and the toes are brought together so as to present the least surface to the water, and produce as little action as possible. The back stroke of the leg tends to retard the body, and it is only the difference in the amount of the force of these strokes that is effective. Sometimes both feet are driven backwards and drawn forwards simultaneously, and the body moves by a series of jerks.

Some of the water-birds make use of their wings as sails; the swan, for instance, may be often observed partially to elevate the wings and spread them out to the wind, and thus move by the force of the wind alone, like a sailing vessel.

It is well known that Fishes reside constantly in water; they are indeed so organised that they can neither live nor move out of it but for a very short time. Their specific gravity is very nearly equal to that of water; but they are also endowed with the power of varying their specific gravity, so as to raise or lower themselves in the fluid at pleasure. We have seen that the human race can vary the specific gravity of the body, by drawing in and expelling the air from the lungs; but fishes, not having the same kind of respiratory organs, cannot do so in the mere act of respiration. As a large number of fishes however are obliged to sustain themselves surrounded on all sides by the water, it would require an endless play of muscular force to retain them in such a position, if their specific gravity were either greater or less than that of the water. To prevent this continual waste of vital power, they have been provided with an air-bladder, which they have the power of distending and contracting at pleasure: this bladder is placed in the body immediately under the spine, and above the centre of gravity, being the best position to keep the body steady, and prevent its turning over when the air-bladder is distended. When the air-vessel is filled the animal is lighter than water, and it rises; and when the air is expelled it becomes heavier, and sinks. This hydrostatic apparatus cannot but strike with admiration every one who contemplates the beautiful adaptation of fishes to the end they are destined to serve in animal creation.

Some fishes, such as the rays and soles, are destitute of a swimming-bladder; but as they generally reside at the bottom of the sea, they do not require one: when they swim, in order to prevent their sinking, they must use as much extra force as is conferred on other fishes by the air-bladder. The locomotive organs of fishes consist of fins and tail, the former of which are variable in size, number, and direction. The figures of fishes are also various, but in some of them, such as the cod, salmon, and mackerel, the figure is supposed to approximate, more nearly than others, to that which is considered by mathematicians to offer the least resistance to their progress in the dense medium they inhabit. In the perch tribe we find the greatest number of fins, being as many as eight; these are termed the two pectoral, two dorsal, two ventral, one anal, and one caudal. These several names are given in consequence of their relative situations on the body. The pectoral fins are supposed to represent the arms, and the anal fins the legs, of the higher orders of animals. In the gurnard it may be remarked that the pectoral fins (*fig.* 14, *a*, *a'*) are very large, as

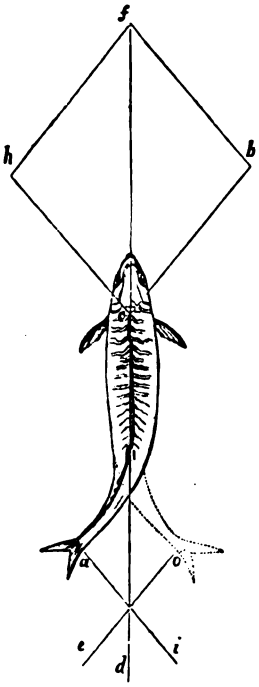
Fig. 14.



Gurnard.

are also the dorsal (*b c*); the caudal (*c*) increases in surface as it recedes from the body. The whole of the fins are more or less employed in certain kinds of movements.

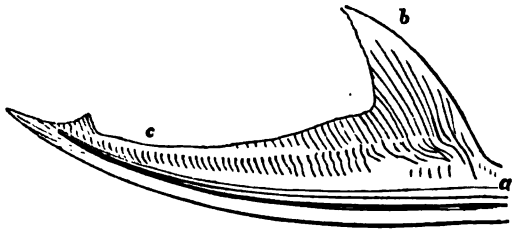
Fig. 15.



In order to ascertain the true use of the fins in swimming, Borrelli having cut off the ventral fins of a living fish, put it back again into the pond. It then rolled from side to side like a drunken man, and could not keep an upright position. When the fish move with great velocity the pectoral fins are laid close to the body, in order that they may not retard its motion; and in rapid motion the tail becomes the great propelling organ of motion. We shall therefore now investigate its mode of action. The first movement of a fish from a state of rest is produced by the flexion of the tail (as seen in *fig.* 15, at *a*); during this movement the centre of gravity (*c*) is drawn slightly backwards. When the tail has arrived at *a*, it is forcibly extended by its muscles in the direction *a i*, perpendicular to its plane: the force of its action upon the water, in *a i*, is translated to the fish in the direction of *i a*, causing the centre of gravity (*c*) to move obliquely forwards, in the direction *c h*, parallel to *i a*. The tail having reached the central line *c d*, its power of urging the body forwards not only ceases, but during its flexion on the opposite side in the line *a o*, it tends to draw the body backwards, in the direction *o e*. Having reached the point *o*, it is again rapidly extended in the line *o e*, causing an impulse on the centre of gravity in *e b*, parallel to *o e*. If the two forces *c h* and *c b* acted simultaneously, we should obtain the resultant *c f*; but as they do not, the point (*c*) will not move exactly in the right line *c f*, but in a curved

line which lies evenly between *d e f* and a line drawn parallel to it through *h*. The fish being in motion whilst the tail moves from side to side, according to Borrelli, it describes an ellipse instead of a circular arc, which would be the case if the body were stationary and the tail only moving. The velocity with which fishes move, and the continuance of their movements, are enough to give us an idea of the great strength of their muscles, especially when we reflect on the density of the fluid which is opposed to their speed. Those fishes which have occasion for great speed (such as the shark, as well as other predaceous fishes), have their tails forked (*fig.* 16). In these the area of the surface

Fig. 16.



Tail of Shark.

of the tail is in the inverse ratio of the distance from its axis of motion. This figure is that which may be considered best adapted for great velocity of progression. When the surface of the tail increases as its distance from the centre of gravity of the animal, the muscles act at a mechanical disadvantage, and the animal can proceed but slowly. In whales the surface of the tail is proportional to the enormous bulk of the body; but the plane of the tail is transverse, or in the mesial plane of the body, instead of being perpendicular as in fishes; and its action is at right angles to that of fishes also. The force of the tail must be very great, inasmuch as they have been observed to throw themselves quite out of the water, many feet in height, into the air.

As we descend lower in the scale of organised beings, we find an illimitable number of aquatic animals. The lobster, prawn, and shrimp, swim backwards by the action of the tail; but in these the effective stroke is during the flexion of the tail, and not the extension, as in fishes. Many insects are also aquatic, such as the *Dytiscus* and others. [FLYING; LOCOMOTION IN ANIMALS.*]

SWIMMING-BIRDS. [NATATORES.]

SWINE. [SUIDÆ.]

SWORD-FISH. [SCOMBRIDÆ]

SYCAMORE. [ACER.]

SYCAMORE-FIG. [FICUS.]

SYCO'CRINUS. [ECHINODERMATA.]

SYLLIS. [ANNELIDA.]

SYLVIA. [ERYTHACA; SYLVIADÆ.]

SY'LVIADÆ (Vigors), a family of Birds belonging to the tribe *Dentirostres* and the order *Insessores*.

Mr. Vigors remarks that the *Sylviadæ*, the Warblers of our British ornithologists, assimilated as they are to the *Merulidæ* in the sweetness and compass of their vocal power, are separated from that family chiefly by their more delicate structure and more subulate bill. That portion of the Linnæan *Motacilla*, or rather of the *Sylvia* of Latham, he observes, which Bechstein has separated from the genus under the title of *Accentor*, in conjunction with that which embraces the Nightingale (*Sylvia luscinia*), appears to be the group most nearly approaching the Thrushes by the comparative strength of its formation. Here also, perhaps, he thinks we may find the *Hylophilus* (Temm.) of the New World, and the *Iora* (Horf.) of the East, to be united by their stronger bills. Hence, he continues, a number of intervening groups (among which *Brachypteryx*, and that which includes *Sylvia rubecola*, the Redbreast, are specially noticed by him) conduct the inquirer by their gradually lessening bill and more slender form to those birds in which the delicate body, the tapering legs, and the gracile and subulate bill point out their typical supremacy in the family. To these latter groups he considers *Melizophilus* (Leach), the Dartford Warbler, and *Malurus* (Vieill.), the representative of *Sylvia* in Australasia (in both of which the bill deviates from that of the conterminous genera in the culmen being somewhat arched), nearly allied, and also the Wrens (*Troglodytes* and *Regulus*, Cuv.). To these he makes succeed a number of groups whose lengthened tarsi indicate that their natural station is on the ground, such as *Budytes* (Cuv.), the true *Motacilla* of authors; and *Enicurus* (Temm.); and here he would add *Megalurus* (Horsf.) and *Anthus* (Bechst.), which unite, in his opinion, the *Dentirostres* with the *Conirostres*, by means of the Larks (*Alauda* of authors). Mr. Vigors then states that *Saxicola* (Bechst.) is nearly allied to the Larks in its terrestrial habits and general conformation; but which, by its increasing bill, brings us round to the earlier groups of the present family, and thence to the *Merulidæ*, with the section of which it is, he thinks, nearly connected. The circular disposition by which the extremes of different families may be brought into contact with each other, explains, in his view of the case, the manner in which the genus *Saxicola*, the section of Merles Saxicoles, the genus *Myiothera*, and the more delicate forms of *Thamnophilus*, all birds decidedly approaching each other, yet belonging to the different families of *Sylviadæ*, *Merulidæ*, and *Laniadæ*, still preserve their union, and are brought together into a conterminous assemblage.

The True Wrens display, in his opinion, so close a similarity in their general appearance and habits to *Parus* (Linn.), the Titmouse, that we may at once acknowledge the affinity between the latter family and the *Paridæ*, upon which family he enters by the Titmice. ('Linn. Trans.,' vol. xiv.)

Mr. Swainson thus arranges this family, "marked by peculiarities of habit no less than by a variation of structure applied to such habits:"—

Circles.	*Sylviadæ*, or Warblers.	Sub-Families.
1. Typical	Bill very slender, compressed; lateral toes equal	*Sylvianæ*.
2. Subtypical	Bill and general structure more robust	*Philomelinæ*.
3. Aberrant	Bill depressed at its base; legs lengthened; strong	*Saxicolinæ*.
	Claws lengthened, and but slightly curved; live upon the ground	*Motacillinæ*.
	Bill strong, almost entire; hinder toe and claw large	*Parianæ*.

Of this group the *Motacillinæ*, in Mr. Swainson's opinion, form the most aberrant division. Purely insectivorous, they are, he remarks, well exemplified by the four common and well-known species distributed through this country and Europe generally. "They live," says Mr. Swainson, "almost entirely upon the ground, where alone they seek their food, which consists entirely of insects: damp meadows, and the sides of standing or running waters, are the favourite haunts of these birds; and they run with such celerity, that, in this respect, as well as in their general black and white plumage, they can only be compared to the plovers." He considers them, in fact, as collectively representing the tenuirostral type of the perchers; or, what is the same, the grallatorial type among birds.

Mr. Swainson enters among the *Parianæ*, or Tits, by the American genus *Sciurus;* and among the True Warblers (*Sylvianæ*) by the genus *Culicivora*, comprising the Gnat-Snappers.

The union of all these sub-families is, in Mr. Swainson's view of the case, effected by the *Gryllivoræ*, a genus of *Saxicolinæ* uniting to *Enicurus*, which stands at the confines of the Wagtails (*Motacillinæ*).

The following genera are comprised under this family, according to Mr. Swainson's arrangement:—

Sylviadæ.—Size universally small. Bill very slender, distinctly notched. Feet formed for walking, perching, or climbing. Tarsus slender, lengthened. (Sw.)

Saxicolinæ, Stonechats.—Bill depressed at the base: gape with diverging bristles. Feet lengthened. Tail rather short. Head large.

Genera:—*Gryllivora*, Sw.; *Thamnobia*, Sw.; *Saxicola*, Bechst.; *Erythaca*, Bechst. (Robins) (with the sub-genera *Erythaca*, Sw., and *Sialia*, Sw.); *Petroica*, Sw.

Philomelinæ, Nightingales.—General structure larger and more robust than the typical warblers. Feet formed for perching.

Genera:—*Phœnicura*, Sw. (Redstarts); *Philomela*, Antiq. (Nightingales); *Curruca*, Bechst.; *Bradypetus*, Sw.; *Agrobates*, Sw.

Sylvianæ, True Warblers.—Size very small. Structure weak. Bill very slender, straight, and with the under mandible much thinner than the upper. (Sw.)

Genera:—*Orthotomus*, Horsf.; *Malurus*, Vieill. (with the sub-genera *Hemipteryx*, Sw.; *Drymoica*, Sw.; *Melizophilus*, Leach; *Malurus*, Vieill.); *Sylvia*, Lath (with the sub-genera *Sylvia*, *Acanthiza*, Horsf. and Vigors; *Regulus*, Ray; and *Cyanotis*, Sw.); *Culicivora*, Sw.; *Praticola*, Sw.

Parianæ, Titmice.—Bill either entire or very slightly notched, more or less conic. Tarsus never shorter than the hind toe, which is large and strong. Lateral toes unequal. (Sw.)

Genera:—*Setophaga*, Sw.; *Sylvicola*, Sw. (with the sub-genera *Dumecola*, Sw.; *Sylvicola*, Sw.; *Vermivora*, Sw.; *Mniotilta*, Vieill.; *Zosterops*, Horsf. and Vigors); *Parus*, Linn. (with the sub-genera *Ægithina*, Vieill.; *Ægithalus*, Vig.; *Parus*, Linn.; *Parisoma*, Sw.; and *Hylophilus*, Temm.); *Accentor*, Bechst. (with the sub-genus *Sciurus*, Sw.); *Trichas*, Sw.

Motacillinæ, Wagtails.—Bill lengthened; very straight and slender. Legs long, formed for walking. The hind toe much longer than the rest. Wings pointed. Tail narrow, and much lengthened. (Sw.)

Genera:—*Lessonia*, Sw.; *Budytes*, Cuv.; *Motacilla*, Linn.; *Enicurus*, Temm.; *Anthus*, Bechst.

The family stands between the *Merulidæ* and the *Ampelidæ*. ('Classification of Birds.')

The *Calamoherpinæ*, *Sylvinæ*, *Saxicolinæ*, *Motacillinæ*, *Parinæ*, and *Sylvicolinæ*, are arranged by Prince Bonaparte under his family of *Turdidæ*. [MERULIDÆ]

Mr. G. R. Gray makes the *Sylviadæ* the first family of his third tribe (*Dentirostres*) of *Insessores*, with the following sub-families:—

1. *Malurinæ*.

Genera:—*Orthotomus*, Horsf. (*Edela*, Less.); *Prinia*, Horsf.; *Drymoica*, Sw. (*Sylvia*, Lath.); *Cyanotis*, Sw. (*Sylvia*, Vieill., *Tachuris*,

* This article forms the concluding part of LOCOMOTION IN ANIMALS, for which we are indebted to Mr. J. Bishop.

D'Orb.); *Regulus*, Gray; *Bradypterus*, Sw. (*Sylvia*, Vieill., *Cysticola*, Less.); *Apalis*, Sw.; *Praticola*, Sw. (*Calamanthus*, Gould, *Anthus*, Vig. and Horsf.); *Cysticola*, Less. (*Salicaria* (?) Gould, *Sylvia*, Temm.); *Melizophilus*, Leach (*Motacilla*, Gm.); *Hemipteryx*, Sw. (*Sylvia*, Vieill., *Cysticola*, Less.); *Stipiturus*, Less. (*Drymoica*, Sw., *Sylvia*. Lath., *Malurus*, Temm.); *Malurus*, Vieill. (*Motacilla*, Gm.); *Cincloramphus* Gould (*Megalurus*, Vig. and Horsf.); *Sphenura*, Licht. (*Turdus*, Lath., *Malurus*, Temm.); *Megalurus*, Horsf. (*Malurus*, Reinw.); *Yuhina*, Hodgs. With reference to *Yuhina*, Mr. Gray remarks that it is the same perhaps as the preceding genus.

2. *Sylvinæ.*

Genera:—*Cettia*, Bonap. (*Sylvia*, Marm., *Salicaria* (?), Gould); *Pseudo-Luscinia*, Bonap. (*Sylvia*, Savi.); *Locustella*, Ray (*Sylvia*, Lath., *Salicaria*, Selby, *Calamoherpe*, Brehm, *Curruca*, Sw., *Arundinaceus*, Less.); *Calamodyta*, Bonap. (*Sylvia*, Temm., *Arundinaceus*, Less.); *Acrocephalus*, Naum. (*Calamoherpe*, Boie, *Motacilla*, Linn., *Salicaria*, Selby. *Curruca*, Sw., *Arundinaceus*, Less.); *Hippolais*, Brehm (*Asilus*, Bechst, *Arundinaceus*, Less., *Motacilla*, Linn.); *Regulus*, Ray (*Motacilla*, Linn.; *Phyllopneuste*, Meyer (*Sylvia*, Lath., *Phylloscopus*, Boie, *Asilus*, Briss., *Trochilus*, Lafr.); *Sylvia*, Lath. (*Philomela*, Sw.); *Curruca*, Briss. (*Motacilla*, Gm., *Sylvia*, Lath.); *Nisoria*, Bonap. (*Curruca*, Brehm, *Philomela*, Sw.); *Luscinia*, Briss. (*Philomela*, Sw., *Daulias*, Boie, *Motacilla*, Gm., *Sylvia*, Lath.).

3. *Saxicolinæ.*

Genera:—*Copsychus*, Wagl. (*Gracula*, Gm., *Gryllivora*, Sw., *Cercotrichas*, Boie, *Lalage* (Boie), Sundev., *Kittacincla*, Gould, *Notodela*, Less.); *Ruticilla*, Ray (*Ficedula*, Bechst., *Phœnicura*, Sw., *Motacilla*, Linn.); *Cyanecula*, Briss. (*Pandicilla*, Bl., *Motacilla*, Linn., *Sylvia*, Lath.); *Calliope*, Gould (*Accentor*, Temm., *Motacilla*, Linn. *Turdus*, Gm.); *Orocetes*, G. R. Gray (*Phœnicura*, Vig., *Petrophila*, Sw.); *Rubecula*, Briss. (*Dandalus*, Boie, *Erythaca*, Sw., *Motacilla*, Linn.); *Sialia*, Sw., (*Sylvia*, Lath.); *Petroica*, Sw. (*Muscicapa*, Gm.); *Origma*, Gould (*Muscicapa*, Lewin., *Saxicola*, Vig. and Horsf.); *Ædon*, Boie (*Erythropygia*, Smith, *Arundinaceus*, Less., *Salicaria*, Gould, *Agrobates*, Sw.); *Thamnobia*, Sw. (*Sylvia*), *Bessonornis*, Smith; *Campicola*, Sw. (*Sylvia*, Lath., *Saxicola*, Temm.); *Vitiflora*, Briss. (*Œnanthe*, Vieill., *Saxicola*, Bechst., *Motacilla*, Linn.); *Rubetra*, Briss. (*Motacilla*, Linn., *Saxicola*, Bechst.).

4. *Accentorinæ.*

Genera:—*Accentor*, Bechst., (*Motacilla*, Gm.); *Enicocichla*, G. R. Gray (*Sciurus*, Sw. (*Turdus*, Will.); *Trichas*, Sw., (*Turdus*, Linn.); *Sericornis*, Gould (*Acanthiza*, Vig. and Horsf.); *Acanthiza*, Vig. and Horsf.; *Psilopus*, Gould; *Symmorphus*, Gould; *Iora*, Horsf. (*Motacilla*, Linn.).

5. *Parinæ.*

Genera:—*Ægithalus*, Vig. (*Remiz*, Cuv., *Pendulinus*, Brehm, *Parus*, Linn.); *Melanochlora*, Less. (*Parus*, Lafr.); *Parus*, Linn.; *Suthora*, Hodgs.; *Minla*, Hodgs.; *Mesia*, Hodgs.; *Bahila*, Hodgs.; *Siva*, Hodgs.; *Megistina*, Vieill. (*Parus*, Gm.); *Tyrannulus*, Vieill. (*Pipra*, Spix., *Sylvia*, Lath.); *Sphenostoma*, Gould; *Calamophilus*, Leach (*Mystacinus*, Boie, *Parus*, Linn.); *Megistura*, Leach (*Orites*, Mœhr, *Paroides*, Brehm, *Parus*, Linn.); *Parisoma*, Sw. (*Sylvia*, Vieill.); *Psaltria*, Temm.; *Ægithina*, Vieill.; *Hylophilus*, Temm.

6. *Sylvicolinæ.*

Genera:—*Sylviparus*, Burt; *Dumecola*, Sw.; *Sylvicola*, Sw. (*Parus*, Linn., *Sylvia*, Lath., *Chloris*, Boie, *Parula*, Bonap.); ———? (*Wilsonia*, Bonap., *Muscicapa*, Wils., *Setophaga*, Sw.); *Vermivora*, Sw. (*Ficedula*, Briss., *Sylvia*, Lath.); *Mniotilta*, Vieill. (*Oxyglossus*, Sw., *Sylvia*, Lath., *Sylvicola*, Jardine); *Zosterops*, Vig. and Horsf. (*Sylvia*, Sw.).

7. *Motacillinæ. Motacilla*, Linn.

Genera:—*Muscisaxicola*, D'Orb. (*Lessonia*, Sw., *Plionura*, Gould); *Motacilla*, Linn.; *Budytes*, Cuv. (*Motacilla*, Linn.); *Enicurus*, Temm. (*Motacilla*, Linn.; *Turdus*, Vieill.); *Grallina*, Vieill. (*Tanypus*, Oppel.); *Ephthianura*, Gould (*Acanthizitha*, J. and S.); *Anthus*, Bechst.; *Corydalla*, Vig. (*Anthus*, Vieill.). [MOTACILLINÆ.]

Of these names, *Petrophila* and *Wilsonia* are terms employed in botany.

The *Sylviadæ*, in Mr. G. R. Gray's arrangement, are followed by the *Turdidæ*. ('List of the Genera of Birds.')

We shall illustrate this family by describing some forms which are not found in other parts of this work.

The genus *Phœnicura*, to which the Common Redstart belongs, may be regarded as typical of this family. The beak is slender and nearly straight, compressed towards the point, slightly deflected, and emarginated; nostrils basal, lateral, oval, pierced in a membrane, and partly concealed by the feathers of the forehead; wings of moderate size, the first quill very short, the second equal in length to the sixth, the third, fourth, and fifth nearly equal, but the fourth the longest; tail more or less red in all the species; legs with the tarsus lengthened and slender, longer than the middle toe; outer toes nearly equal in length.

P. ruticilla, the Common Redstart. It is the *Motacilla Phœnicura* of Linnæus. Belon is of opinion that this is the *Φοινίκουρος* of Aristotle ('Hist. Anim.,' ix. 49). It is the Corossolo, Codirosso, Culo Ranzo, and Culo Rosso of the Italians; Rossignol de Mur ou de Murailles of the French; Schwarzkehliger Sanger, Schwarzkehlein, and Garten-Rothschwänzchen of the Germans; Gekraagde Roodstart of the Netherlanders; Rodstjert of the Swedes; Roedstiert of the Danes; Blodfugl of the Norwegians; Rhonell Goch of the Welsh; Redtail, Brantail, and Firetail of the English.

The old male has the forehead and eyebrows pure white; a small band on the root of the bill, space between that and the eye, throat, and upper part of the neck, deep black; head and upper part of the back bluish ash; breast, sides, rump, and lateral tail-feathers, brilliant ruddy; abdomen whitish, lower coverts of the tail deep ruddy, two middle feathers brown.

The female (which may easily be confounded with that of *P. Suecica*, the Blue-Throated Warbler) with the upper parts gray strongly shaded with rusty; great wing-coverts bordered with ruddyish yellow; throat white, breast and sides rusty, belly whitish, under tail-coverts pale rusty. The very old have the throat blackish, spotted with rusty.

The young males of the year have no white on the forehead; black of the throat broken with whitish lines; ruddy colour of the breast varied with white; upper parts rusty ash, tail-coverts and feathers bordered with rusty.

The young females may be distinguished from the nightingale by the black bill and feet, and the two middle tail-feathers, which are always blackish-brown.

This bird is found in Denmark, Norway, Sweden, Russia, Europe generally, particularly Holland, France, Provence, Spain, and Italy. Trebizond, and to the south-east of that locality, Erzerum, and Japan.

In Britain it arrives about the middle of April, penetrating as high as Sutherlandshire in Scotland. Pennant says that it extends no farther west than Exeter, but it has been seen in the eastern portion of Cornwall, and is far from uncommon in the western part. The Welsh name above given, from Pennant, indicates that the bird must have been formerly known in Wales: it certainly is now, and has even been found near Belfast in Ireland; but this appears to be a singular instance. They quit England generally at the commencement of September.

Redstart (*Phœnicura ruticilla*).
Lower figure, male; upper figure, female.

The Redstart is a sweet and indefatigable singer, and has been heard in a wild state as late as ten o'clock at night, and as early as three o'clock in the morning. The skirts of woods, lane and meadow hedge-rows, orchards, gardens, the old ivied-wall of a ruin, are all favourite haunts. The male shows himself, as if proud of his pretty plumage, whilst he is uttering his soft, sweet song, vibrating his tail the while, on some low branch of a not high tree, or weather-beaten stone, nor does his music cease as he flies to another station to continue his strain.

A crevice in a wall, a hollow tree, a nook in a building sheltered

behind a limb of ancient ivy, or even of an old fruit-tree trained against it, sometimes a hole in the ground, receives the nest, the outside of which is rough and rich with moss, and lined with hair and feathers. Four, six, and even eight greenish-blue eggs are deposited, and the first brood, for there are generally two in a season, are frequently fledged by the second week in June. The food consists of worms and insects, fruit, and berries.

Bechstein speaks highly of its attractive qualities in plumage, gesture, and song; and says it will add to its natural notes parts of the songs of other birds. He tells us that those which built under his roof imitated tolerably the chaffinch that hung in a cage at his window; and his neighbour had one in his garden that repeated the strains of a black-cap which had its nest near.

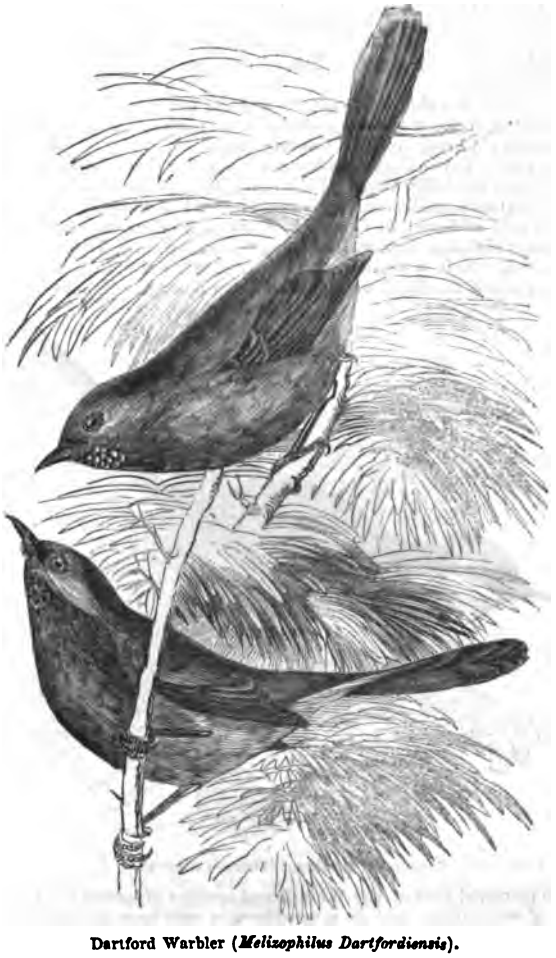
In captivity Redstarts become so tame that they will take a meal-worm from the hand. Sweet says that, when kept in confinement, he considers this bird the most sensible, and, if brought up from the nest, the most attached of all small birds; but he adds that it may be deemed the most tender of all the tribe. It is, he observes, a real mocker, and, if bred up from the young state, will learn the note or call of almost any other bird: it will also learn a tune, and will sing by night as well as by day, as long as a light is kept burning. He had one that whistled the Copenhagen Waltz.

The 'Portraits des Oyseaux' has the following quatrain under the cut of this Wall Nightingale:—

"Ce Rossignol est nommé de muraille,
Pource qu'es murs il bastit sa maison,
Fait ses petits: mais en comparaison
Au Rossignol, il ne dit rien qui vaille."

Notwithstanding the censure involved in the last line and a half however the Redstart is a very charming songster. In comparison with the nightingale, every other bird's song must fade.

Melizophilus has a slender beak, upper mandible slightly bent from the base and finely emarginated near the tip; under mandible straight, shorter than the upper, and shutting within it; nostrils basal, lateral, cleft longitudinally; base of the beak surrounded with hairs. Wings short, the first quill-feather very small, the second shorter than either of the next four feathers; the fourth and fifth the longest in the wing. Tail elongated, cuneiform. Tarsi strong, and longer than the middle toe; claws of moderate length, sharp.



Dartford Warbler (*Melizophilus Dartfordiensis*).
Upper figure, male; lower figure, female.

M. Dartfordiensis, the Dartford Warbler. It is the Pitte-Chou de Provence of the French; the Magnanina of Savi.; and Provenser Sanger of Meyer.

The old male has all the upper parts, with the exception of the tail, fine deep-gray; throat, breast, and sides, purple-reddish, or the colour of wine-lees; middle of the belly white; tail very long, blackish-brown, the external feather only terminated with white: quills ash-coloured externally, but black on the internal barbs; wings very short; feet yellowish; bill black, but yellowish-white at its base; iris brown. Length 5 inches.

The female has the tints generally less vivid than those of the male; on the throat a greater number of fine whitish striæ than in the male, which, when old, presents hardly any traces of them.

The young of the year have a great number of small stripes on the throat, the lower parts varied with whitish feathers. (Temm.)

This bird is found in southern Europe, the countries that border the Mediterranean, Spain, and the south of Italy, but Prince C. L. Bonaparte notes it as rare, and as found in summer in mountainous situations. It is comparatively scarce in Germany and Holland. Permanent in England, but not generally diffused. Frequent in the neighbourhood of London, and also at Bagshot, Chobham, and their vicinities. Devonshire, Cornwall, and Berkshire, possess it also.

The furze-brake and tangled heath are its favourite haunts. Mr. Gould observes, that its form closely allies it to the Superb Warblers (*Malurus*) of Australia, while its relationship to the Common Whitethroat is strikingly apparent. With reference to its secluded habits, the same author well remarks that in the spring it becomes more lively and more frequently visible, "rising on quivering wing above the tops of the furze, and uttering a hurried babbling song, much after the manner of the Whitethroat; at these times it erects the feathers of the head into a crest, and distends the throat, exhibiting many attitudes and gesticulations."

Dry stalks and grass intertwined with fibres of plants and roots form the nest, which is generally snugly hid in the very heart of a thick furze-bush not far from the ground. Eggs greenish-white, with brown speckles and ashy spots, and thus resembling those of the Whitethroat.

The Dartford Warbler is, generally speaking, insectivorous, but fruits do not come amiss to it, that is, such berries as it may find near its retreats.

Sylvicola.—This genus is well-represented by the Myrtle Bird of America.

S. coronata, the Yellow-Crowned Warbler, or Myrtle-Bird. In summer plumage it is blackish slate-colour, streaked with black; beneath white; breast spotted with black; crown, sides of the breast, and rump, yellow; wings bifasciated with white; tail black; three lateral tail-feathers spotted with white. Winter plumage edged with brownish-olive, the yellow of the crown partly concealed by a margin of the same olivaceous hue; no black on the head or face.

Young browner, the yellow much paler and nearly without black. Length from 5 to 6 inches; alar extent from 8 to 9 inches.

It arrives in the Middle and Northern states of the Union from the south towards the end of April or beginning of May, and then probably passes north to breed. In August they re-appear in those states, and remain about the gardens and woods till about the end of November, feeding almost exclusively at this period on the Myrtle-Wax Berries (*Myrica cerifera*), or those of the Virginian Juniper. "These," says Mr. Nuttall in continuation, "with other late and persisting berries, and occasional insects, constitute their winter food in the Southern States, where, in considerable numbers, in the swamps and sheltered groves of the sea-coast, they pass the cold season. In fine weather, in the early part of October, they may be seen at times collecting grass-hoppers and moths from the meadows and pastures, and, like the Blue-Bird, they often watch for the appearance of their prey from a neighbouring stake, bough, or fence-rail; and at this time are so familiar and unsuspicious, particularly the young, as fearlessly to approach almost within reach of the silent spectator. At the period of migration they appear in an altered and less brilliant dress; the bright yellow spot on the crown is now edged with brownish-olive, so that the prevailing colour of this beautiful mark is only seen on shedding the feathers with the hand; a brownish tint is also added to the whole plumage; but Wilson's figure of this supposed autumnal change only represents the young bird. The old is, in fact, but little less brilliant than in summer, and I have a well-founded suspicion that the wearing the edges of the feathers, or some other secondary cause, alone produces this change in the livery of spring, particularly as it is not any sexual distinction. While feeding, they are very active, in the manner of Flycatchers, hovering among the cedars and myrtles with hanging wings, and only rest when satisfied with gleaning food. In spring they are still more timid, busy, and restless. Of their nest we are wholly ignorant. When approached, or while feeding, they only utter a feeble plaintive 'tship' of alarm. This beautiful species arrives here about the 7th or 8th of May, and now chiefly frequents the orchards, uttering, at short intervals, in the morning, a sweet and varied, rather plaintive warble, resembling in part the song of the Summer Yellow-Bird, but much more the farewell, solitary, autumnal notes of the Robin Redbreast of Europe. The tones at times are also so ventriloqual and variable in elevation,

that it is not always easy to ascertain the spot from whence they proceed. While thus engaged in quest of small caterpillars, it seems almost insensible to obtrusion, and familiarly searches for its prey, however near we may approach." ('Manual.')

Yellow-Crowned Warbler (*Sylvicola coronata*).

S. æstiva, the Summer Yellow-Bird, is remarkable for its skilful prevention of the designs of the Cow Troopial. [MOLOTHRUS.] "It is amusing," says Nuttall, "to observe the sagacity of this little bird in disposing of the eggs of the vagrant and parasitic Cow Troopial. The egg, deposited before the laying of the rightful tenant, too large for ejectment, is ingeniously incarcerated in the bottom of the nest, and a new lining placed above it, so that it is never hatched to prove the dragon of the brood. Two instances of this kind occurred to the observation of my friend Mr. Charles Pickering, and last summer I obtained a nest with the adventitious egg about two-thirds buried, the upper edge only being visible, so that in many instances it is probable that this species escapes from the unpleasant imposition of becoming a nurse to the sable orphan of the Cow-Bird. She however acts faithfully the part of a foster-parent when the egg is laid after her own."

Ephthianura is an Australian genus.

E. albifrons, White-Fronted Ephthianura. The male has the forehead, face, throat, and all the under surface pure white; occiput black; chest crossed by a broad crescent of deep black, the points of which

White-Fronted Ephthianura (*Ephthianura albifrons*), male. (Gould.)

run up the sides of the neck and join the black of the occiput; upper surface dark-gray with a patch of dark-brown in the centre of each feather; wings dark-brown; upper tail-coverts black; two centre tail-feathers dark-brown, the remainder dark-brown, with a large oblong patch of white on the inner web at the tip; irides in some beautiful reddish-buff, in others yellow with a slight tinge of red on the outer edge of the pupil; bill and feet black.

The female has the crown of the head, all the upper surface, wings and tail grayish-brown, with a slight indication of the oblong white spot on the inner webs of the latter; throat and under surface buffy-white; a slight crescent of black on the chest. (Gould.)

Mr. Gould first met with this species in a state of nature on the small islands in Bass's Strait, where, he says, it had evidently been breeding, as he observed several old nests in the Barilla and other stunted bushes which clothe other isolated spots, particularly chalky and green islands immediately contiguous to it in Flinders. He did not observe it in Van Diemen's Land or to the southward of the localities above mentioned. He thinks however that it extends over the whole of the southern portion of the Australian continent, for he has specimens which were killed at Swan River, in South Australia, and in New South Wales. The extent of its range northward is not, he remarks, known. He had never seen examples from the north coast.

Curruca has a short rather stout bill, upper mandible slightly curved at the point, which is emarginated; gape with a few hairs. *Nostrils* basal, lateral, oval, exposed. Wings of moderate size; the first quill-feather very short, the second longer than the fifth, the third the longest in the wing. Legs with the tarsus short, but longer than the middle toe; the toes and claws short, and formed for perching.

C. cinerea, the Whitethroat; *Motacilla sylvia* and *Sylvia cinerea* of authors. It is the Fauvette Grise, or Grisette, of the French; Macchetta and Sterpazzola of the Italians; Klapper Grasmucke, Fahle, Grauliche, Rostgraue, and Grauköpfige Heckengrasmücke of the Germans; Kogsnetter and Mesar of the Swedes; Common Whitethroat, Muggy, Muggy-Cut-Throat, Whey-Beard, Wheetie-Why-Bird, Muff, Charlie Muftie, Peggy, Peggy-White-Throat, Churr, and Whautie, of the English; and Y Gwddfgwyn of the Welsh.

The male has the top of the head and space between the eye and the bill ash-colour; other parts gray, strongly tinged with rust-colour, which last predominates principally on the top of the back; wings blackish, all their coverts bordered with very bright rusty; quills edged with this colour, except the external one, which is edged with white; throat and middle of the belly pure white; breast slightly tinged with rose-colour; sides and abdomen rusty-gray; tail deep-brown; quills of equal length, except the most external, which is much the shortest; this last has the outside barb and the extremity pure white; the succeeding feather is only terminated with whitish. Length 5 inches.

The female has the tints less pure and the upper parts more clouded with rusty; white of the throat and of the external tail-feather clouded with rusty; no rosy tinge on the breast.

The young have more rust-colour on the upper parts; space between the eye and the bill white, and the rusty borders of the wing-coverts wider; external quill edged with rusty instead of white.

This bird is found in Denmark, Norway, Sweden, Russia, Siberia, Germany, Holland, France, Provence, Spain, Sardinia, Italy, Smyrna, Trebizond. It is a regular summer visitor to the British Islands, arriving about the third week in April, and departing in autumn.

Common Whitethroat (*Curruca cinerea*).

The principal food of the Whitethroat consists of insects: it is very fond of caterpillars, and is a considerable consumer of berries and smaller garden-fruits, such as raspberries, currants, &c., among which they and their young make much havoc in July and August. A dwarf

bush or a low tangled thicket of brambles, nettles, weeds, and rank grass, is generally selected for the nest, which is seldom found at a greater distance from the ground than 2 or 3 feet, and has the outside framed almost entirely of the stems of dried grass. The upper part or cup of the nest is very thin and flimsy at the sides, and the inside is lined with finer grass stalks and panicles. The eggs, which amount to four or five, are white with a greenish tinge, speckled and spotted with ashy-brown and ashy-green of two shades.

C. garrula, the Lesser Whitethroat. It is the *Sylvia Curruca* of Latham and authors; Fauvette Babillarde of the French; Fichten, Doon, and Kleinschnablige Klappergrasmücke of the Germans; Bigiarella of the Italians. The whole of the top of the head is of a pure ash-colour; space between the eye and the bill and feathers that cover the orifice of the ears deeper ash; nape, mantle, and rump, ashy-brown; tail blackish, external feathers ash-colour, bordered and terminated with white, but white on the whole of the external barb; the two next feathers only terminated by a small white spot; the breast, sides, and abdomen, white slightly tinged with rusty; the rest of the lower parts pure white. Length 5¼ inches.

The female not quite so large as the male, which has been seen in two instances with a beautiful tinge of carmine on the breast. It is found in Denmark, Sweden, Russia, and the temperate and warmer parts of Europe, Asia, and the Deccan of Hindustan. In these islands it is rare as far north as Northumberland, and rarer in Scotland. In Ireland it does not appear to have been seen. It arrives and departs about the same time as the Common Whitethroat.

In Germany it is termed Das Müllerchen, or the Little Miller, from some of its clacking tones being supposed to resemble the noise of a mill, according to Bechstein, who remarks that, as these notes are heard more distinctly than the others, they are erroneously thought to be its whole song; but the rest, he adds, though certainly very weak, is so soft, so varied, and so melodious, that it surpasses other warblers. Whilst singing in this under-tone, says Bechstein in continuation, it is continually hopping about the bushes; but when going to utter 'clap, clap,' it stops and employs the whole strength of the larynx to pronounce this syllable. To enjoy the beauty of its song, Bechstein remarks that it should be alone in a room, and then no other singing-bird is more agreeable, as it rarely utters its call. Both Sweet and Blyth speak favourably of its song, though the former, who gives a very pleasing account of one which he bred up from the nest, says it is not so agreeable as that of most of the other species of warblers.

C. hortensis, Greater Pettychaps, is the *Sylvia hortensis* and *Motacilla hortensis* of authors; the Beccafico of the Italians. [BECCAFICO.]

The whole of the upper parts is oil-green, with a shade of ash-gray; on each side of the lower part of the neck is a patch of ash-gray; throat grayish-white; breast and flanks yellowish-gray, inclining to wood-brown; belly and vent grayish-white; orbits of the eyes white; sides brown; bill wood-brown; legs and claws bluish-gray.

The female is similar in plumage to the male bird.

The young of the year have the region of the eyes grayish-white; head, upper part of the neck, back, rump, and wing-coverts, yellowish-brown, passing into oil-green; quills greenish-gray, edged with oil-green; cheeks and sides of neck yellowish-gray; throat, breast, sides, and under tail-coverts, wine-yellow; middle of the belly white; legs, toes, and claws, pearl-gray. (Selby.)

Greater Pettychaps (*Curruca hortensis*).

The Greater Pettychaps seems to have been first described as a British species by Latham, who received it from Sir Ashton Lever. The bird was obtained in Lancashire. It has since become better known, and its arrival with the other warblers in April and May has been regularly noticed. Montagu, who observes that he traced it through the greater part of England, fixes the Tyne as its northern boundary; but he is corrected by Selby, who says, "I have often seen it on the north of the river Tweed."

All who have heard the bird agree in their praise of its song, which is little inferior to that of the nightingale. Montagu states that it frequently sings after sunset. "Some of the notes," says that ornithologist, "are sweetly and softly drawn; others quick, lively, loud, and piercing, reaching the distant ear with pleasing harmony, something like the whistle of the blackbird, but in a more hurried cadence." Selby corroborates this, observing that its song, although inferior in extent of scale, almost equals that of the nightingale in sweetness. It is seldom seen; for, like the rest of the tribe, it haunts the shadiest coverts, and usually sings from the midst of some close thicket. Lewin says that it makes its nest for the most part with fibres and wool, sometimes with the addition of green moss, often in the neighbourhood of gardens, which it frequents, with the White-Throat and Black-Cap, for the sake of currants and other fruits. Montagu, who has recorded this habit, states also that it inhabits thick hedges, where it makes a nest near the ground, composed of Goose-Grass (*Galium Aparine*, Linn., and other fibrous plants, flimsily put together, like that of the common Whitethroat, with the addition sometimes of a little green moss externally. Selby gives much the same description. It lays four, sometimes five eggs, about the size of a hedge-sparrow's, or hedge-warbler's, of a dirty-white, blotched with light brown (Selby says wood-brown), the blotches being most numerous at the larger end. Its alarm-call, according to Selby, is very similar to that of the Whitethroat. Early in September it leaves us, and Prince Bonaparte notes it as common near Rome in the autumn.

Sylvia has a straight beak, slender, conical, pointed, slightly notched at the tip, sides compressed, base furnished with fine hairs; nostrils basal, lateral, oval. Wings with the first quill very short, the second shorter than the third, the third the longest in the wing. Legs with the tarsi longer than the middle toe; toes three before, one behind; the outer toe jointed at the base to the middle toe.

S. sylvicola, the Wood-Warbler, or Wood-Wren. It is the *Motacilla trochilus* of Bewick; *Sylvia sibilatrix* of Bechstein; *Curruca sibilatrix* of Wood; Bec-fin Siffleur of Temminck; La Fauvette Sylvicole of Vieillot; Lui Verde of Savi; Grüner Sänger of Meyer; and Schwirrender, Grosschnäbliger, und Nordischer Laubvogel of Brehm.

Mr. Yarrell, after tracing the steps of its history as a British bird through the works of White of Selborne, Pennant, and Montagu, observes that the bird is now very well known, and is at once distinguished from the True *Trochilus*, or Willow-Warbler, with which it is most likely to be confounded, by the broad streak over the eye and ear-coverts of bright sulphur-yellow, by the pure-green colour of the upper parts of the body, and by the delicate and unsullied white of the belly and under tail-coverts.

Wood-Wren (*Sylvia sylvicola*).

In addition to these distinctions, which, Mr. Yarrell observes, on comparing the two birds, will be found very obvious, he points out the fact that the wing of the Wood-Warbler is nearly half an inch longer from the carpal joint to the end of the quill-feathers than that of the Willow-Warbler, although the birds themselves differ but little in their respective whole lengths; the wings of the Wood-Warbler, when closed, reaching over three-fourths of the length of the tail, while those of the Willow-Warbler reach only to the end of the upper

tail-coverts, or less than half way along the tail-feathers. The two birds here named, and a third species, the Chiff-Chaff, so called from its peculiar note, are, Mr. Yarrell remarks, the only British species included in the genus *Sylvia* as at present restricted. These, he states, differ from the Warblers generally in the colour of their plumage, and in not being fruit-eaters. Their nests are covered or domed at the top.

It is a Swedish summer visitor, but rare there, as it is in northern Europe generally. Of frequent occurrence in Germany, Holland, France, Provence, and Italy, in the summer. It is found in England and Wales, but not recorded in Scotland nor identified in Ireland. Supposed winter-quarters, Egypt and Asia.

The song, if song it may be called, of this species is to be heard in the woodlands of England and Wales in the spring, and during the greater part of the summer, accompanied by a shivering of the wings. Mr. Yarrell well describes the note as resembling the word 'twee,' sounded very long, and repeated several times in succession, at first but slowly, afterwards much quicker, and as accompanied, when about to conclude, by a peculiar tremulous motion of the wings, which are lowered by the side. A lofty elm in a hedgerow is often, he observes with equal truth, selected as the singing station, and the note is occasionally uttered while the bird wings its way from place to place.

Insects and their larvæ form its food, which is captured both on the wing and among the leaves of trees. The oval and domed nest is framed, amid the herbage on the ground, of dry grass, leaves, and a little moss, with a finer lining of grass and hairs, but no feathers, which last are present in the nests of other warblers that build on the ground, with the exception of the other two *Sylviæ* noticed above. The white eggs, most thickly speckled with purple-red and ash, are generally six in number.

The following is a list of the British species of this family, as given in Yarrell's 'British Birds':—

Accentor alpinus, Alpine Accentor.
A. modularis, the Hedge Accentor, or Hedge-Warbler.
Erythaca rubecula, the Redbreast, or Robin. [ERYTHACA.]
Phœnicura Suecica, the Blue-Throated Warbler. [BLUE-BREAST.]
P. ruticilla, the Redstart. [MOTACILLINÆ.]
P. tithys, the Black Redstart.
Saxicola rubicola, the Stonechat. [SAXICOLA.]
S. rubetra, the Whinchat. [SAXICOLA.]
S. œnanthe, the Wheatear. [SAXICOLA.]
Salicaria locustella, the Grasshopper Warbler. [SALICARIA.]
S. phragmites, the Sedge Warbler. [SALICARIA.]
S. luscinoides, Savis Warbler. [SALICARIA.]
S. arundinacea, the Reed Warbler. [SALICARIA.]
Philomela luscinia, the Nightingale. [PHILOMELA.]
Curruca atricapilla, the Black-Cap Warbler. [CURRUCA; BLACK-CAP.]
C. hortensis, the Garden Warbler.
C. cinerea, the Common Whitethroat.
C. sylviella, the Lesser Whitethroat.
Sylvia sylvicola, the Wood Warbler.
S. Trochilus, the Willow-Warbler.
S. hippolais, the Chiff-Chaff.
Melizophilus Dartfordiensis, the Dartford Warbler.
Regulus cristatus, the Golden-Crested Regulus. [REGULUS.]
R. ignicapillus, the Fire-Crested Regulus. [REGULUS.]
R. modestus, the Dalmatian Regulus. [REGULUS.]
(Yarrell, *History of British Birds.*)

SYLVICAPRA. [ANTILOPEÆ.]

SYLVI'COLA. [SYLVIADÆ.]

SYLVIPARUS. [SYLVIADÆ.]

SYMA. [HALCYONIDÆ.]

SYMMORPHUS (Gould), a genus of Birds. The bill is rather short, tumid; the upper mandible slightly notched at the tip; the culmen and commissure subarcuate; the nostrils basal, oval, and nearly hidden by the frontal feathers. Wings moderate; first quill shorter than the second by one-half; third, fourth, and fifth longest and nearly equal. Tail moderate, the external tail-feather on each side shorter than the rest by one-fourth. Tarsi and feet moderate, the former scutellated anteriorly; the posterior toe with its claw shorter than the middle one, the two lateral toes unequal, the inner shortest. *S. leucopygus* is a native of Australia.

SYMPATHETIC NERVES. [NERVOUS SYSTEM.]

SYMPHORICARPOS, or SYMPHORIA, a genus of Plants belonging to the natural order *Caprifoliaceæ*. The tube of the calyx is globose, with a small limb, and 4-5-toothed; corolla funnel-shaped, 4-5-lobed; stamens 5; ovary 4-celled, with simple style and semi-globose stigma, the fertile cells containing one ovule, sterile ones several; fruit a berry, having 4 cells, 2 of which contain single seeds and 2 are empty. The species are natives of North and South America. They are elegant, bushy, oppositely-branched shrubs, with oval entire leaves, small white or rose-coloured flowers with short pedicels, seated on one or many-flowered peduncles, and furnished with two bracts.

S. vulgaris, Common St. Peter's-Wort. Flowers disposed in axillary capitate clusters, and seated on very short pedicels. It is a native of Pennsylvania, the Carolinas, and Virginia, in sandy dry districts. It bears red cup-shaped berries, which are about the size of a hempseed, and ripen in winter. It grows to the height of from 3 to 6 feet, and flowers in August and September.

S. racemosus, Snow-Berry. Flowers disposed in loose, often leafy, interrupted racemes; corolla bearded internally; stamens and style included. It is a native of North America, and grows on the banks of the Missouri, in Upper Canada, and on the north-west coast at Paget's and Nootka Sounds. This is a very handsome shrub, and was introduced into our gardens in 1817, since which time it has become very common. It has rose-coloured flowers, with entire leaves glaucous beneath. The fruit is about the size of a small cherry, and quite white, remaining on the tree after the leaves have dropped off, and giving it a very beautiful appearance.

S. occidentalis, Wolf-Berry, Western St. Peter's-Wort. Flowers in spikes, dense, terminal, axillary, and drooping; style and stamens protruded. It is a native of British North America, and is abundant about the Saskatchewan and Red River. It is a shrub from 4 to 6 feet high, and has the same general characters as the last, but has not yet been cultivated in Great Britain.

S. microphyllus and *S. glaucescens* are natives of Mexico.

SYMPHYNOTA. [NAIADÆ.]

SY'MPHYTUM, a genus of Plants belonging to the natural order *Boraginaceæ*. It has a 5-parted calyx; a cylindrical-campanulate corolla, the throat of which is furnished with 6 subulate vaulted processes which connive to form a cone; 4 1-celled ovate nuts fixed at the base of the calyx, imperforate. The species are rough herbaceous plants, with broad leaves and terminal twin racemes of flowers. They are natives chiefly of Europe and Asia.

S. officinalis, Common Comfrey. Fusiform-branched roots; branched stem; leaves decurrent, the upper ones lanceolate, the lower ovato-lanceolate, scabrous above and hairy beneath; limb of the corolla 3-toothed, with the teeth recurved; the anthers twice the length of the filament. It is an inhabitant of the banks of rivers and streams and watery places throughout Europe. "Comfrey-root," Woodville observes, "abounds in a tasteless mucilage like that of the marsh-mallow; and being more easily obtained, it ought not to be omitted in lists of medicinal plants." The flowers are of a yellowish-white colour. A variety not uncommon in Scotland and the continent has bluish-purple flowers, red before expansion: it was called by Sibthorp *S. patens*. *S. Bohemium* is also a variety of this species. It has red or reddish-purple flowers.

S. tuberosum, Tuberous-Rooted Comfrey. Rhizoma oblique, thickened by scales, furnished with short branches; leaves partly decurrent, upper ones elliptical, lower ones ovate; corolla tubulose, funnel-shaped, 5-toothed; teeth recurved. This plant is not so stiff and hairy as the last. It is a native of Germany, Austria, France, Spain, and Italy. It has also been found in Scotland near Edinburgh, and in Durham in England. Its flowers are of a yellowish-white colour, and appear in April and May.

S. asperrimum, Rough Comfrey. Stems branched, covered with tubercles; leaves ovate, heart-shaped, pointed, running into petioles, hairy above, strigose beneath, upper ones opposite, subsessile; calyx tuberculated, acute; limb of corolla campanulate. It is a native of the Caucasus, and grows on the banks of streams and rivulets. It is a tall plant, very rough, with handsome flowers, which are red before expansion, and afterwards blue. There are several other species.

SYMPLECTES. [PLOCEINÆ.]

SYMPLESITE. [IRON.]

SYMPLOCARPUS, a genus of Plants belonging to the natural order *Araceæ*. It has a cucullate spathe, a short spadix covered with tetrandrous floscules. The ovaries are 1-celled, with an ovule in each and a minute stigma; berries consolidated; seeds without albumen.

S. fœtidus, Skunk-Weed, or Skunk-Cabbage, has a large abrupt tuber with numerous crowded fleshy fibres; the spathe is præcocious, ovate, turgid, various in width, spotted, and sometimes covered with dull brownish purple; the spadix is oval, on a short peduncle covered with perfect tetrandrous flowers, and of the same colour as the spathe. It has 4 fleshy wedge-shaped sepals, truncate at the top, and edges inflated; the 4 stamens are opposite the sepals, with subulate filaments equal in length to the calyx. When the spathe decays, the spadix continues to grow, and every part of the plant, excepting the anthers. Within the spadix at the base of each style is a round fleshy seed as large as a pea, white, tinged with green and purple, and invested with a separate membranous coat, and with a prominent embryo situated in a depression at the top. The leaves spring up some time after the flowers; they are numerous, large, crowded, oblong, heart-shaped, and on long channelled petioles. The plant emits an offensive odour; its tubers are acrid, but when dried and powdered are antispasmodic.

(Lindley, *Flora Medica.*)

SY'MPLOCOS (from *συμπλοκή*, a knitting together), a genus of Plants belonging to the natural order *Styraceæ*. This genus was made the type of a natural order, *Symplocineæ*, by D. Don, which contained only this example. It has a 3-parted half-inferior calyx; rotate monopetalous 3-10-parted corolla, imbricate in æstivation; indefinite stamens inserted in the lobe of the corolla, with the filaments cuspidate at the apex, and polyadelphous at the base; erect anthers bursting longitudinally; 3-5-celled ovary with 4 ovules in each cell,

The fruit is a fleshy drupe, containing a 3-5-celled nut; the cells containing but one seed, which has an inverted embryo lying in albumen, and a superior radicle. The species are trees, having alternate either entire or serrated leaves without stipules, and turning yellow in drying. The flowers are axillary, sessile, or pedunculate, few, of a white or scarlet colour, and supplied with bracteas at their base. Upwards of 30 species have been described. They all possess an astringent principle in their leaves, and some are used in dyeing.

S. Alstonia, Alston's Symplocos, is the *Alstonia theæformis* of Linnæus, and was named after Charles Alston, professor of botany in the University of Edinburgh. The plant is glabrous in every part, and has shining coriaceous roundish-elliptic or oblong leaves, obtuse, rounded at the base, and obscurely crenated at the apex. Sessile flowers arranged in threes and fours. It is a native of New Granada, near Santa Fé de Bogota, and Popayan.

S. tinctoria, Dyer's Symplocos, Sweet-Leaf, Yellow-Leaf. Leaves oblong or lanceolate ovate, serrated, glaucous, shining; flowers axillary, 8 or 16, together. This plant is the *Hopea tinctoria* of Linnæus, and is a native of the Carolinas, in the United States of America.

S. racemosa, Racemose-Flowered Symplocos. Leaves oblong, glabrous, serrated; flowers arranged in racemes, mostly axillary; nut of fruit 3-celled. This plant is a native of Burdwar and Midnapore, in Bengal. It is used extensively by the natives as a red dye.

The nuts of *S. spicata* are very hard, and resemble a little fluted pitcher. This plant is a native of Silhet.

SYNÆTHERES. [HYSTRICIDÆ.]

SYNALLAXIS, M. Vieillot's name for a genus of Birds placed by Mr. Swainson in the family *Certhiadæ*. The bill is short, rather strong, straight; both mandibles of equal thickness, entire, and much compressed; the margins of the upper mandible inflexed beyond the nostrils. Frontal feathers rather rigid. Wings very short, and much rounded; the primaries scarcely exceeding the tertials. Tail broad, more or less lengthened, and either graduated or cuneated; the webs soft and loose, but the shafts rather rigid; the tips lanceolate. Feet very large; tarsus lengthened; middle toe longer than the hinder; lateral toes equal; claws slender, acute, and but slightly curved; the three anterior rather small. (Sw.)

Synallaxis garrulus (reduced from Mr. Swainson's figure).

Nest in tree (after the same).

S. garrulus is brown, whitish beneath; feathers on the front of the head rigid, pointed, and rufous; lines before and behind the eye whitish. Tail moderate, rounded.

It is remarkable for its very singular nest, which is so large as to form a feature in the woodland scenery of Bahia. The nest is built in low trees, formed externally of dried sticks, without any neatness, usually three or four feet long, and resembling at a distance a thick twist of bean-stalks thrown in the branches by accident. Sometimes two of these nests appear as if joined together, and there is an opening on the side, besides one at the top.

SYNAPTÆ, a family of *Echinodermata*, belonging to the order *Holothuriadæ*. It is characterised in this order by the absence of suckers. It is represented in the British seas by the genus *Chirodota*, which has a cylindrical and vermiform body, elongated tentacula, digitate at their extremities.

C. digitata has a vermiform body, white with orange spots, the tentacula long, pedunculated, digitate. This animal was first found by Montagu on the shores of South Devon. It is very rare. Professor E. Forbes, in his 'History of British Star-Fishes,' says that he had never seen a living specimen.

SYNBATHO'CRINUS. [ECHINODERMATA.]

SYNDA'CTYLES, a group comprehending those Birds which have the external toe nearly as long as the middle one, and united to it as far as the penultimate articulation. This group contains the Bee-Eaters (*Merops*, Linn.), the Motmots (*Prionites*, Ill.), the King-Fishers (*Alcedo*, Linn.), the Todies (*Todus*, Linn.), and the Hornbills (*Buceros*, Linn.).

SYNEDRA. [DIATOMACEÆ.]

SYNETHE'RES, or SYNÆTHERES. [HYSTRICIDÆ.]

SYNGNATHA, according to Dr. Leach, the second order of the class *Myriapoda*, comprising the species of that class which were by Linnæus included under the head *Scolopendra*.

This order is divided by Latreille into two sections. The species of the first have only 15 pairs of legs, and the body when viewed from above presents less segments than when viewed from beneath; in the second section there are at least 21 pairs of legs, and the segments are of the same size and number both above and beneath. Dr. Leach also divides the present order into two sections or families, to which he applies the names *Scolopendridæ* and *Geophilidæ*, which he characterises as follows:—The first (*Scolopendridæ*) have each segment of the body provided with two legs, and the hinder legs distinctly longer than the others. To this family belongs the *Scolopendra forficata* of Linnæus, a species found commonly under stones, &c., in this country and other parts of Europe. According to the author last mentioned, this species constitutes the type of his genus *Lithobius*, distinguished by the antennæ being composed of 40 or more joints, the two first of which are the largest; the under lip is broadly notched in front, and has the margin much denticulated; the eyes are granulated; the legs are 15 on each side. The genus *Cryptops* of Leach, of which a species (*C. hortensis*) is found in gardens in Devonshire, has about 17 joints to the antennæ; the under lip is not denticulated, and is scarcely emarginated in front; the legs are 21 on each side, and the first joint of the hinder legs is spineless; the eyes are indistinct.

In the family *Geophilidæ* the legs are very numerous, and the hinder legs are not distinctly longer than the others. The species of the genus *Geophilus* (Leach) have upwards of 40 legs, the antennæ having 14 joints. Several species are found in England. They live in the ground and under stones. The *Scolopendra electrica* of Linnæus belongs to this genus.

SYNGNATHIDÆ, a family of Fishes, embracing, according to some authors, the Pipe-Fishes, the Sea-Horses, and the Winged Sea-Horses. These forms are sometimes assigned to distinct families, as in the following definitions:—

Syngnathidæ, Pipe-Fishes.—Body prolonged, slender, linear, or angulated; snout greatly prolonged, cylindrical; mouth terminal, vertical. Ventral fins absent; caudal fin wanting in some.

Hippocampidæ, Sea-Horses.—Head and body compressed; snout narrow, tubular; mouth terminal. Pectorals small; dorsal single; caudal fin wanting.

Pegasidæ, Winged Sea-Horses.—Body broad, depressed; snout suddenly contracted, narrow, somewhat protractile; mouth terminal, beneath. Pectorals generally large; caudal fin small.

They all agree in having the endo-skeleton partially ossified; exo-skeleton ganoid; gills tufted (hence the group is named *Lophobranchia*), in the opercular aperture being small, and the swimming-bladder without an air-duct. We shall illustrate this family by a short description of the British species:—

Syngnathus has the body elongated, slender, covered with a series of indurated plates arranged in parallel lines. Head long; both jaws produced, united, tubular. No ventral fins.

In certain of the species the males are furnished with an elongated pouch under the tail; these are called marsupial, and include the British species *S. Acus* and *S. Typhle*.

S. Acus, the Great Pipe-Fish, is one of the most common forms of the genus. It is found on many parts of the coast, sometimes at low-water amongst sea-weeds; at other times in deep water. The most curious feature in the economy of this fish is the fact that the roe is transferred from the belly of the female to the pouch of the male.

S. Typhle (Linnæus), the Deep-Nosed Pipe-Fish, Lesser Pipe-Fish, or Shorter Pipe-Fish; *Acus Aristotelis* and *Typhle antiquorum* of Willughby. This fish is distinguished from the last by the more compressed form of the jaws. From the British species it is distinguished by the possession on the part of the male of a pouch for the reception of the ova. The habits of this fish resemble those of the last.

S. æquoreus, the Æquoreal Pipe-Fish. This fish has no subcaudal pouch. It is comparatively rare on the British coast.

S. anguineus, the Snake Pipe-Fish. Although this and the preceding species possess no subcaudal pouch, the ova after exclusion from the female are carried by the male in separate hemispheric depressions on the external surface of the abdomen.

S. ophidion, the Straight-Nosed Pipe-Fish, is known by its straight nose. It is about nine inches in length.

S. lumbriciformis, the Worm Pipe-Fish, is the smallest of the British species. It has been taken on various parts of the coast. It does not exceed five inches in length. The young of this species have been observed to undergo a curious metamorphosis. On their escape from the egg the tail is covered with a fin-like membrane, and it also possesses pectoral fins. During their growth the caudal membrane and pectoral fins are absorbed.

Hippocampus.—The jaws are united and tubular, the mouth placed at the end. The body compressed, short, and deep. The whole length of the body and tail divided by longitudinal and transverse ridges, with tubercular points at the angles of intersection; both sexes have pectoral and dorsal fins; the females only have an anal fin; neither has ventral or caudal fins.

H. brevirostris, the Sea-Horse, or Short-Nosed Hippocampus, is occasionally met with on the British coasts. The habits of these creatures are very singular. When swimming about they maintain a vertical position, but the tail is ready to grasp whatever meets it in the water. It quickly entwines in any direction round weeds or other objects, and when fixed the animal intently watches surrounding objects, and darts at its prey with great dexterity. When two are together they often twist their tails together. Their eyes move independently of each other, as in the chameleon.

Pegasus has a snout as in the previous genera, but the mouth is under it, and moveable. Two distinct ventral fins behind the pectoral, which are often large, hence the name of *Pegasus*, or Flying Horse. The species are found in Indian Seas.

(Yarrell, *History of British Fishes;* Adams, *Manual of Natural History.*)

SYNGNATHUS. [SYNGNATHIDÆ.]

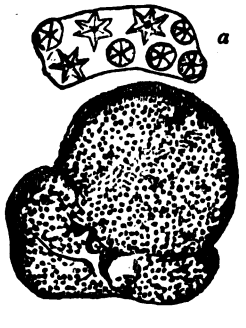
SYNODONTIS. [SILURIDÆ.]

SYNODUS. [ISOPODA.]

SYNOI'CUM, a genus of Ascidians, thus defined by M. De Blainville:—Body more or less cylindrical, vertical, or horizontal, adhering by the cephalic extremity, and united together by the sides of their external envelope, so as to constitute a common mass, which is a little diversiform and fixed; the two apertures of each composing animal hidden at the bottom of a more or less deep cavity, and having only a papillæ external orifice, furnished ordinarily with six tentaculiform papillæ.

M. De Blainville thus divides the genus:—

A. Species united into a convex rounded mass. (*Pulmonella*, Lam.; *Aplidium*, Sav.) Ex. *S. Ficus.*



Synoicum Ficus. *a*, a portion highly magnified.

B. Species in which the horizontal bodies unite together in a mammillated crust. Ex. *S. subgelatinosum.*

C. Species in which the vertical bodies also unite together in a crust. (*Didermum*, Sav.) Ex. *S. fungosum.*

D. Species in which the very long vertical bodies unite together in a species of cylinder, having only a single external orifice common to all the individuals.

Synoicum turgens.

M. De Blainville remarks that this genus, although very closely approximated to *Botryllus*, is really very distinct from it, in consequence of the manner in which the apertures of each composing animal terminate in a common cavity, with a single external orifice. He adds that it contains no more species than the genera above proposed, and that they appear all to belong to our seas. ('Malacologie.')

SYNO'VIA, or Joint-Oil, is the name applied to the fluid by which the joints of the bodies of animals are lubricated. It is separated from the blood which circulates in the vessels immediately surrounding the joint. These form a very close capillary network in the tissue which bounds the cavity of the joint, and which, when it can be separated in a distinct layer, is termed the Synovial Membrane. [ARTICULATION.] Synovia is a pale yellow viscous fluid, which, when rubbed between the fingers, is peculiarly slippery, without being in any degree oily. In the horse, it was found by John (whose analysis is confirmed by those of several other chemists) to consist of—

Water	92·80
Albumen	6·40
Uncoagulable Animal Matter, with Carbonate and Hydro-Chlorate of Soda	0·60
Phosphate of Lime	0·15
Traces of Ammoniacal Salts and of Phosphate of Soda	0·05
	100

Its quantity is in direct proportion to the size of the joint, and is always sufficient to keep the articular surfaces smooth and slippery, and to fill up those recesses in the joint into which the adjacent soft tissues do not exactly fit.

SYRINGA (from σύριγξ, a pipe), the name of a genus of Plants belonging to the natural order *Oleaceæ*. The English name of this genus, Lilac, is derived from 'lilag,' the Persian for a flower. It is known by a small 4-toothed calyx; funnel-shaped corolla, with a 4-parted limb; 2 stamens; a trifid stigma; a 2-celled, 2-valved, 2-seeded capsule; the valves boat-shaped, with a dissepiment in the middle. The species are natives of Europe and the colder parts of Asia. They are deciduous shrubs, with simple leaves, having purple or white flowers, which are arranged in beautiful thyrsoid terminal panicles, and are very fragrant.

S. vulgaris, the Common Lilac, known by its ovate heart-shaped pointed leaves. It is a native of Persia, Hungary, and the borders of the Danube. Dr. Sibthorp found it wild on Mount Hæmus, but not in Greece. This shrub has been long cultivated by the Turks, and was brought from Constantinople to Vienna by the ambassador Busbequius, in the middle of the 16th century, from whence it spread over the rest of Europe. It is now one of the commonest ornaments of our shrubberies, blossoming, together with the laburnum, in May. It is one of the few shrubs that resists the injurious influence of the smoke of cities, and flourishes in great perfection in most of the squares of London. It grows to the height of 20 feet and upwards, and sends up from the parent stem an abundance of suckers, which, if allowed to grow, form a dense mass of stems; these are commonly left, but if cut down as they are produced, the parent stem may be trained so as to grow as a small tree. It grows very fast, as much as from eighteen inches to three feet in the year, and endures, according to the soil, for twenty to fifty years. Several varieties are well known.

S. Josikea, Josikas Lilac, has elliptic-lanceolate, acute, ciliated, wrinkled, glabrous leaves, seated on short petioles, and white on the under surface, and purple flowers. It is a native of Transylvania, and was discovered by the Baroness von Josika, after whom it was named by Jacquin. It attains the height of six or eight feet, and has broad leaves, shining and dark green above and hoary beneath. It grows in

damp shady places near water. Though very dissimilar in appearance to the common lilac, it has been suspected to be only a variety of that species. It is not yet very common in our nurseries.

S. Persica, the Persian Lilac. Leaves small, lanceolate. Flowers purple. It is a native of Persia, and is a small shrub, from four to six feet high. It is one of the most ornamental of low deciduous shrubs, and on that account is very commonly cultivated. When planted in pots and forced, it may be made to flower at Christmas; but by this process the fragrance of the flowers is lost. Of this species also three varieties are found in the nurseries, the White, the Cut-Leaved, and the Sage-Leaved Persian Lilacs.

S. Chinensis, Chinese Lilac. Leaves ovate-lanceolate. Flowers purple. It is a native of China. In character it is intermediate between *S. vulgaris* and *S. Persica*, and agrees with a hybrid plant produced at Rouen by M. Vain, and called *S. Rotomagensis*, the Rouen Lilac. It is a plant that grows vigorously, and attains a height of ten or twelve feet. The sorts known in nurseries as the Belgic Lilas de Marly and the Lilas Saugé are varieties of this species.

S. Emodi has elliptical-oblong leaves, glaucous beneath, attenuated at the base, and acuminated at the apex, with purple flowers. It is a native of Kumaon near the Himalayas. *S. villosa* has villous leaves, and is found in China on mountains about Pekin, but neither of these species is cultivated in this country, although both would probably bear this climate.

Syringa is also the name that is commonly but improperly given to the species of *Philadelphus*, or Mock-Orange. The name *Syringa* was given to the Lilac on account of its stems being used for the manufacture of Turkish pipes. The stems of the *P. coronarius* are also used for the same purpose, and equally with the Lilac it had the name of Pipe-Privet, or Pipe-Tree, given it when first introduced into this country, and afterwards the name *Syringa*. [PHILADELPHUS.]

SYRINGO'DEA, a genus of Plants belonging to the natural order *Ericaceæ*. This genus was formed by David Don out of the old genus *Erica*. It possesses the following characters:—Calyx 4-leaved, glumaceous; corolla long, tubular, usually rather dilated at top, rarely a little contracted; limb short, 4-lobed; stamens for the most part inclosed, filaments capillary, anthers 2-parted, cells of anthers short, obtuse, mutic or aristate at the base, dehiscing by an oblong foramen; stigma simple or capitate, and in some species annulated with an elevated disc; capsule 4-celled, many seeded; seeds oval, compressed, smooth. (Don, Miller, iii.) The species, of which 112 are described, are all natives of the Cape of Good Hope. They are erect shrubs, with loose leaves and large showy flowers, which are crowded at the tops of the branches on every side, and form a spike-like inflorescence.

SYRINGO'PORA. [MADREPHYLLIDÆ.]

SYRINX. [SIPUNCULIDÆ.]

SYRNIUM, Savigny's name for a sub-genus of Owls. Ex. *Syrnium Aluco*, the well-known Brown Owl, Tawny Owl, or Ivy-Owl, or Wood-Owl, of these islands.

SY'RPHIDÆ, a family of Dipterous Insects of the section *Brachystoma* of Macquart, the species of which are distinguished by their having the palpi inflated at the extremity, the fore part of the head often with a prominence, the labrum large, arched, and emarginated; the stylet of the antennæ is usually dorsal; the abdomen is most frequently depressed and elongated; the wings have one discoidal cell, three posterior cells, the first of which is closed, and the second extends along the posterior margin of the wing; sometimes there are some small terminal nervures; the anal cell is large, and a longitudinal nervure divides the discoidal cell, as well as the posterior.

The present family contains upwards of 40 genera, a great portion of which have representatives in this country. The species frequent flowers and woods; the larvæ of the species of *Syrphus* are in the form of an elongated cone; they fix themselves, &c., with a kind of glue, and feed exclusively on aphides. Some of the *Syrphidæ* inhabit the nests of the Humble-Bees (*Bombus*), and these so much resemble the species of *Bombi*, that they might at a first glance be mistaken for them. Other *Syrphidæ* live in the larva state in water and mud; and these larvæ are provided with a long slender tail, through the extremity of which they respire, it being raised to the surface of the water or mud for the purpose.

SYRRHAPTES. [TETRAONIDÆ.]

SYSTEM, SEXUAL, in Botany, is the name given to the method by which Linnæus arranged the Vegetable Kingdom. In this system plants are divided into twenty-four classes, each of which is distinguished by the number and relative position of the stamens. The following are the classes:—

I. Flowers with Stamens and Pistils.

Class 1. *Monandria;* flowers with 1 stamen.
2. *Diandria* . . . . 2 stamens.
3. *Triandria* . . . 3 „
4. *Tetrandria* . . . . 4 „
5. *Pentandria* . . . 5 „
6. *Hexandria* . . . 6 „
7. *Heptandria* . . . 7 „
8. *Octandria* . . . . 8 „
9. *Enneandria* . . . 9 „
Class 10. *Decandria* . . . . 10 stamens.
11. *Dodecandria* . . 12-19 „
12. *Icosandria* . . . 20 or more stamens inserted into the calyx.
13. *Polyandria* . . . 20 or more stamens inserted on the receptacle.
14. *Didynamia* . . . 4 stamens; 2 long and 2 short.
15. *Tetradynamia* . . 6 stamens; 4 long and 2 short. [CRUCIFERÆ.]
16. *Monadelphia;* flowers with the filaments of the stamens united in one set.
17. *Diadelphia;* flowers with the filaments of the stamens united in 2 sets. (In this class the flowers are papilionaceous.)
18. *Polyadelphia;* flowers with the filaments of the stamens united in 3 or more sets.
19. *Syngenesia;* flowers with the anthers of the stamens united. [COMPOSITÆ.]
20. *Gynandria;* flowers with the stamens and pistils combined. [ORCHIDACEÆ.]

II. The Stamens and Pistils on different Flowers.

21. *Monœcia;* flowers with the stamens and pistils on the same individual.
22. *Diœcia;* flowers with the stamens and pistils on different individuals.
23. *Polygamia;* flowers perfect and unisexual, on the same or on different individuals.

III. Fructification concealed.

24. *Cryptogamia.* [ACROGENS.]

It will at once be seen that this system is exceedingly artificial, and that the great object of arrangement and classification in natural history is not attained by it. The effort of the naturalist in all systems should be to bring together those objects which most resemble each other, and to separate those which differ. A classification like the above, which takes only one organ or part of an organised being as a means of arrangement, is therefore certain to frustrate the great aim of the systematist. The only ground on which artificial classification such as the above can be tolerated is that of convenience in finding out the name of any particular object. It was undoubtedly this that led to the general adoption of the sexual system of Linnæus by botanists. It is now however fast falling into disuse; and our catalogues of plants and manuals of indigenous Floras are written on the plan of the Natural System.

Linnæus divided the above classes into orders in the same artificial way. The orders in the first thirteen classes were founded on the number of styles or stigmas in each flower. Thus, flowers having one style were placed in the order *Monogynia*, those with two in the order *Digynia*, with three in *Trigynia*, and so on. Thus the name of the orders are repeated in each of the thirteen classes. In the remaining classes however other points of structure are adopted. In *Didynamia* the orders are two, according as the fruit is 4-lobed or capsular. The first order is called *Gymnospermia*, and the second *Angiospermia*. These names were given by Linnæus under the erroneous supposition that the 4-lobed ovary was a series of naked seeds.

The class *Tetradynamia* was divided into two orders, according to the form of the fruit. *Siliculosa* embracing the species with the fruit a silicle, and *Siliquosa* those with a silique.

In the classes *Monadelphia*, *Diadelphia*, and *Polyadelphia*, the number of the stamens was made the text of the orders, and these were named as the classes. Thus we have the order *Decandria*, class *Monadelphia*, and the order *Decandria*, class *Diadelphia*.

With regard to *Syngenesia* the following plan will afford the best idea of the nature of the orders:—

Order 1. *Polygamia Equalis.*—Florets all hermaphrodites.

Order 2. *Polygamia Superflua.*—Florets of the disc hermaphrodite, those of the ray pistilliferous and fertile.

Order 3. *Polygamia Frustanea.*—Florets of the disc hermaphrodite, those of the ray neuter.

Order 4. *Polygamia Necessaria.*—Florets of the disc staminiferous, those of the ray pistilliferous.

Order 5. *Polygamia Segregata.*—Each floret having a separate involucre.

Order 6. *Monogamia.*—Anthers united, flowers not compound.

This large class thus divided by Linnæus forms the natural order *Compositæ*, and has been recently subdivided in a much less artificial manner than in the orders above given. [COMPOSITÆ.]

The class *Gynandria* was divided into orders by the number of the stamens. It includes the natural orders *Orchidaceæ* and *Aristolochiaceæ*.

The classes *Monœcia* and *Diœcia* are also formed into orders according to the number of stamens, and the orders are again named as preceding classes. Thus we have order *Diandria*, class *Diœcia*, &c.

The class *Polygamia* has the following orders:—

Order 1. *Monœcia.*—Hermaphrodite, staminiferous, and pistilliferous flowers on the same plant.

Order 2. *Diœcia.*—Flowers on two plants.
Order 3. *Triœcia.*—Flowers on three plants.
The *Cryptogamia* were divided into the orders :—

Filices	Ferns.
Musci	Mosses.
Hepaticæ	Liverworts.
Lichenes	Lichens.
Algæ	Sea-Weeds.
Fungi	Mushrooms.

For the arrangement of the vegetable kingdom, according to the Natural System, see the articles EXOGENS; ENDOGENS; ACROGENS.

SYZY'GIUM, a large tropical genus of Plants belonging to the natural order *Myrtaceæ*, so named from *σύζυγος*, coupled, in consequence of the manner in which the branches and leaves are united together in pairs. The calyx-tube is obovate, with the limb nearly entire. Petals 4-5, forming a calyptra; stamens numerous, free; style single; stigma simple; ovary 2-celled, ovules several in each cell. Berry 1-celled, 1- or few-seeded. Trees, or shrubs, of a highly ornamental appearance from their smooth shining leaves, which are opposite and entire.

Of the species, *S. Guineense*, a native of the coast of Guinea and Senegal, has been employed as a remedy in rheumatism. *S. pomiciatum*, a native of the Isle of Bourbon, is there called Bois à Ecorce Blanche. *S. Jambolanum* is a native of the East Indies, and there most extensively diffused, being planted near villages in clumps of trees, chiefly on account of its fruit, which is sometimes called Jam Plum by Europeans, but Jamoon by the natives. It is of a rich purplish colour, but of a subastringent sweetish taste, which is more agreeable to the native than to the European palate. The fruit is sometimes soaked for an hour in salt and water, when it makes an approach to the flavour of olives. The bark is astringent, and dyes of a brown colour; the wood is hard, close-grained, and durable, and therefore much employed.

T

TABERNÆMONTA'NA, a genus of Plants belonging to the natural order *Apocynaceæ*, found in the West Indies and South America, also in Australia, India, and other tropical parts of Asia. The genus is characterised by having monopetalous inferior flowers; corolla salver-shaped; stamens 5, included; anthers sagittate; ovaries 2; style filiform; stigma dilated at base, trifid. Seeds in a follicle, immersed in pulp. The flowers of many species are very sweet-scented, and the double-flowered variety of *T. coronaria* is a very ornamental shrub, and one of the most common in Indian gardens. The deep red pulp surrounding the seeds of this species appears capable of yielding a beautiful colour. The cream-like sap of *T. utilis*, the Milk-Tree, or Hya-Hya of Demerara, is not only of an innoxious character, but said to be very nourishing. It affords a remarkable example of a tree of this suspected family yielding an article of food. Some of the other species are employed as medicines in the countries where they are indigenous. The sap of *T. persicariæfolia* is considered a poison in Mauritius. The wood is employed in turnery.

TABULAR SPAR. [WOLLASTONITE.]

TACCA, a genus of Plants belonging to the natural order *Taccaceæ*, placed near *Aroidaceæ* and *Aristolochiaceæ*, and resembling *Dioscoreaceæ*, in having radical tubers which abound in fæcula. The genus is named from the Malay name of one of the species, which are found in the hotter parts of India and in the South Sea Islands. The genus is characterised by having a 6-partite calyx, with a 6-partite corolla, and 6 stamens which are inserted in the calyx; styles 3; stigmas stellate. Berry dry, hexangular, many-seeded. The plants have perennial tubers, with a short compressed rhizoma, from which proceed the stalked and the so-called radical leaves and herbaceous scapes. The plants of this family are possessed of some acridity both in their tubers and in their herbaceous parts, but the roots lose some of this quality by culture, at the same time that they become larger. Those of *T. pinnatifida*, the best-known species, and a native of the Malayan Peninsula, the Moluccas, Madagascar, and Australia, are roundish, red, the size of a man's fist, extremely bitter, and acrid. The tubers of this plant, and also those of *T. dubia* and *T. montana*, are rasped and macerated for four or five days in water; a white highly nutritious fæcula like arrow-root is then separated, and, like sago, is employed as an article of diet by the inhabitants of the Malayan Peninsula and the Moluccas. In Tahiti and some of the Society Islands they make cakes of the tubers of *T. pinnatifida*, which are the Tacca Youy of some navigators. They form an article of diet in China and Cochin-China, and also in Travancore, in India, where, according to Dr. Ainslie, they attain a large size, and the natives eat them with some acid to subdue their acrimony. (Royle's 'Illustr.,' p. 378.) The petioles and stalks boiled for some time are also used as articles of diet in China and Cochin-China. In Tahiti the plant is called Tya: its fæcula is largely prepared, and is sometimes preferred to that of arrow-root by the English, to whom it is sold under that name by the native converts at the missionary station, and exported to London. It is also sometimes called Tahiti Salep. This plant must not be confounded with the *Arum macrorhizum*, the tuberous root-stalk of which is also edible, and when prepared is called Taka, which similarity in name and in uses has frequently caused confusion, and the mistaking of one plant for the other. In Singapore *T. cristata* is called Water-Lily.

TACCA'CEÆ, a small natural order of Endogenous Plants belonging to the Epigynose group. There are but two genera belonging to this order, *Tacca* and *Ataccia*. The species are large perennial herbaceous plants, with a tuberous root, a short stem bearing scapes, and having exstipulate radical pedatifid pinnatifid rarely entire leaves, with curved parallel veins. The flowers, which are placed on the top of a single scape, are in umbels, and are united; the tube of the perianth is superior, and united to the germen; limb petaloid, equal or unequal, persistent; stamens 6; filaments dilated; ovary composed of 3 connected carpels, with 5 parietal polyspermous placentæ; styles 3, connate. The fruit baccate, with seeds lunate, striated, and the embryo situated on the outside of fleshy albumen.

The species are found in the hotter parts of India, in the South Sea Islands, also in tropical Africa. [TACCA.]

TACHYDROMUS. [ZONURIDÆ.]

TACHYGLOSSUS, Illiger's name for the *Echidna*. [ECHIDNA.]

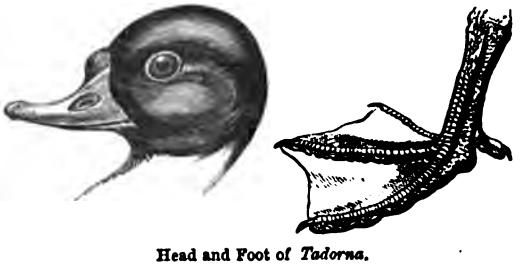
TACHYLITE, a Mineral which resembles Obsidian, and has also been supposed to be similar to Isopyre. It occurs in *plates* and massive. No cleavage. Fracture small, conchoidal. Hardness 6·5. Translucent, opaque. Lustre vitreous, vitreo-resinous. Colour brownish and greenish-black. It is found in small masses at *Sässbühl*, near Göttingen, in basalt and wacke.

TACHY'PETES. [PELECANIDÆ.]

TACHYPHO'NUS. [FRINGILLIDÆ.]

TACONIC SYSTEM. [*See* SUPPLEMENT.]

TADORNA (Leach), a genus of birds belonging to the family *Anatidæ*, having the bill very much flattened towards the extremity, and elevated into a protuberance or projecting boss at its base. [DUCKS.]



Head and Foot of *Tadorna*.

TADPOLE. [AMPHIBIA.]

TADPOLE-FISH. [RANICEPS.]

TÆNIA. [ENTOZOA.]

TÆNIOI'DES, a family of Acanthopterygious Fishes nearly allied to the Mackerels. The species comprising it are all long flattened fishes, with very small scales. The following are among the principal genera.

Lepidopus, tæniioid fishes with elongated snouts, a wide gape, projecting under jaw, and strong sharp cutting teeth. The ventral fins are reduced to small scaly plates. The tail is well formed. The *L. argyreus* or Scabbard-Fish is an example. It is of a bright silver-colour, and attains a length of six feet. It is one of the rarest of British fishes.

Trichiurus resembles the last genus in the character of the head, but has neither ventral nor caudal fins, the tail being represented by a long slender compressed filament. The *T. lepturus* of Linnæus, an inhabitant of the Atlantic, attains a length of more than 12 feet, and resembles a beautiful silver riband.

The genus *Lophotes* of Giorna has a short head with a bony crest bearing a long and stout spine. The caudal fin is distinct, but very small. The *Stylephorus* of Shaw is allied to *Gymnetrus*, but has the tail prolonged into a slender filament, exceeding the length of the body. [GYMNETRUS; CEPOLA.]

TÆNIOPTERI'NÆ, Mr. G. R. Gray's name for his second family of *Muscicapidæ*.

TÆNIO'PTERIS, a Fossil Fern from the Oolite.

TAL, a name for the Palmyra palm. [BORASSUS.]

TALAUMA. [MAGNOLIACEÆ.]

TALC, a Mineral which occurs crystallised and massive, and it is probable that some distinct species of minerals have been so called. Primary form of the crystal a rhomboid, but it usually occurs in the secondary form of hexagonal laminæ, and sometimes in long prisms.

Cleavage distinct, perpendicular to the axis. It is easily separable into thin plates, which are flexible, but not elastic. It is easily scratched with a knife, and the powder is unctuous to the touch. Colour white, green, grayish, and blackish-green and red. Becomes negatively electrical by friction. Lustre pearly. Transparent, translucent, opaque. Specific gravity 2·713.

Crystallised Talc is mostly white, or of a light-green colour; is met with in serpentine rocks in small quantity, with carbonate of lime, actinolite, steatite, and massive talc, &c. It is found in the mountains of Salzburg and the Tyrol: it occurs in many other parts of the world, as in Cornwall, in Kynance Cove, where a bed of it underlies serpentine. It also occurs in Scotland, in Glen Tilt, Perthshire; and in Saxony, Silesia, and Piedmont, &c.

The massive varieties of Talc are less flexible than the crystallised: they are principally of an apple-green colour, and sometimes of a radiated structure. It is met with in considerable quantity in beds in micaceous schists, gneiss, and serpentine.

Some of the varieties of Talc are infusible; others become white, and yield a small button of enamel with borax.

Indurated Talc is massive, of a greenish-gray colour; the structure is schistose and curved: it is of a shining and sometimes of a pearly lustre, and somewhat translucent. It is soft and rather unctuous to the touch. Its specific gravity is 2·9.

It occurs in primitive mountains in clay-slate and serpentine, in several countries on the continent of Europe; in Britain, in Perthshire and Banffshire in Scotland, and in the Shetland Islands. According to Vauquelin, Lamellar Talc consists of—

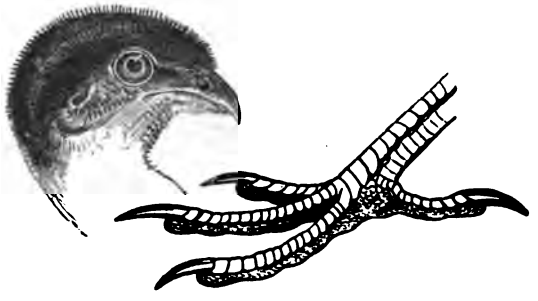
Silica	62·0
Magnesia	27·0
Alumina	1·8
Oxide of Iron	3·2
Water	6·0
	——100

Steatite, Chlorite, Potstone, and other magnesian minerals are nearly allied to Mica, and they are by some mineralogists considered as varieties of the same substance. [Steatite, Chlorite.]

TALEGALLA, a genus of Birds belonging to the *Megapodiinæ*, which Mr. G. R. Gray makes the third and last sub-family of his *Palamedeidæ*.

The *Megapodiinæ* comprise the following genera:—*Talegalla*, Less. (*Alectura*, Lath.; *Talegallus*, Less.; *Numida*, James; *Catheturus*, Sw.); *Megapodius*, Quoy et Gaim.; *Menura* (?), J. Geoffr.; *Menura*, Shaw (*Parkinsonius*, Bechst.; *Megapodius*, Wagl.); *Alecthelia*, Less. (nec Swains.). [Cracidæ.]

Talegalla has the bill very robust, very thick, one-third of the length of the head compressed above, with the upper mandible convex; nostrils basal, lateral, oval-oblong, pierced in a large membrane; lower mandible less high but wider than the upper, nearly straight below, with smooth edges, the branches widened at the base, and that width filled up by a feathered membrane; cheeks entirely naked; head and neck furnished with feathers with simple barbules. Wings rounded, moderate, the first quill very short, the second rather longer, the third longest of all, the fourth and fifth diminishing in length after the third. Tail rather long, rounded; tarsi rather robust, moderately long, furnished with large scutella in front; toes rather long, the middle longest, the external shortest; the three front toes furnished at their origin with a membranous border, which is widest between the external and middle toes; claws convex, flattened below, slightly curved, and moderately robust; the hind-toe long, resting entirely on the ground, and furnished with an equally robust claw. (Lesson.)



Head and Foot of *Talegalla*. (Gould.)

T. Lathami. Latham, in his 'General History of Birds' (vol. i.), described and figured this bird under the name of the New Holland Vulture; but, correcting his error, he in the tenth volume, placed it among the Gallinaceous Birds, with the generic name of *Alectura*, which had been previously employed to designate a group of Fly-catchers.

M. Lesson places the genus at the end of the *Phasianidæ*.

Mr. Swainson places it amongst the *Vulturidæ*: yet it is no bird of prey at all.

Mr. Gould, to whom we are indebted for a full and satisfactory account of the habits of this extraordinary bird, says:—"After all the facts that have been stated, I trust it will be evident that its natural situation is among the *Rasores*, and that it forms one of a great family of birds peculiar to Australia and the Indian Islands, of which *Megapodius* forms a part; and in confirmation of this view I may add, that the sternum has the two deep emarginations so truly characteristic of the *Gallinaceæ*; at all events it is in no way allied to the *Vulturidæ*, and is nearly as far removed from *Menura*." It seems to us that *Talegalla Lathami* may be considered, in a degree, as the representative of the Turkey in Australia.

The adult male of this bird has the whole of the upper surface, wings, and tail, blackish-brown; the feathers of the under surface blackish-brown at the base, becoming silvery-gray at the tip; skin of the head and neck deep pink-red, thinly sprinkled with short hair-like blackish-brown feathers; wattle bright yellow, tinged with red where it unites with the red of the neck; bill black; irides and feet brown.

Female about a fourth less than the male in size, but so closely the same in colour as to render a separate description unnecessary. She also possesses the wattle, but not to so great an extent. (Gould.)

It is about the size of a turkey.

Wattled Talegalla (*Talegalla Lathami*). (Gould.)

Mr. Gould gives the following synonyms:—New Holland Vulture, Latham; genus *Alectura*, Latham; *Alectura Lathami*, J. E. Gray; Australian Vulture, *Catheturus Australis*, Swainson; *Meleagris Lindesargii*, Jameson; Brush Turkey of the colonists; Weelah of the aborigines of the Namoi.

Mr. Gould describes *Talegalla Lathami*, or the Wattled Talegalla, as a gregarious bird, generally moving about in small companies, much after the manner of the *Gallinaceæ*, and, like some species of that tribe, as very shy and distrustful. When it is disturbed, he states that it readily eludes pursuit by the facility with which it runs through the tangled brush. If hard pressed, or where rushed upon by their great enemy, the native dog, the whole company spring upon the lowermost bough of some neighbouring tree, and, by a succession of leaps from branch to branch, ascend to the top, and either perch there or fly off to another part of the brush. They resort also to the branches of trees as a shelter from the sun in the middle of the day, a habit which Mr. Gould notices as greatly tending to their destruction; for the sportsman is enabled to take a sure aim, and the birds, like the ruffed grouse of America, will allow a succession of shots to be fired till they are all brought down.

But the most remarkable circumstance connected with the economy of this bird is its nidification, for it does not hatch its eggs by incubation. It collects together a great heap of decaying vegetables, as the place of deposit of its eggs, thus making a hot-bed arising from the decomposition of the collected matter, by the heat of which the young are hatched. Mr. Gould describes this heap as the result of several weeks' collection by the birds previous to the period of laying, as varying in quantity from two to four cart-loads, and as of a perfectly pyramidical form. This mound, he states, is not the work of a single pair of birds, but is the result of the united labour of many: the same site appeared to Mr. Gould to be resorted to for several years in succession, from the great size and entire decomposition of the lower part, the birds adding a fresh supply of materials on each occasion previous to laying.

"The mode," says Mr. Gould in continuation, "in which the materials composing these mounds are accumulated is equally singular, the bird never using its bill, but always grasping a quantity in its foot, throwing it backwards to one common centre, and thus clearing the surface of the ground for a considerable distance so completely, that scarcely a leaf or a blade of grass is left. The heap being accumulated, and time allowed for a sufficient heat to be engendered, the eggs are deposited, not side by side, as is ordinarily the case, but planted at the distance of nine or twelve inches from each other, and

buried at nearly an arm's depth, perfectly upright, with the large end upwards: they are covered up as they are laid, and allowed to remain until hatched. I have been credibly informed, both by natives and settlers living near their haunts, that it is not an unusual event to obtain nearly a bushel of eggs at one time from a single heap; and as they are delicious eating, they are eagerly sought after. Some of the natives state that the females are constantly in the neighbourhood of the heap about the time the young are likely to be hatched, and frequently uncover and cover them up again, apparently for the purpose of assisting those that may have appeared; while others have informed me that the eggs are merely deposited, and the young allowed to force their way unassisted. In all probability, as nature has adopted this mode of reproduction, she has also furnished the tender birds with the power of sustaining themselves from the earliest period; and the great size of the egg would equally lead to this conclusion, since in so large a space it is reasonable to suppose that the bird would be much more developed than is usually found in eggs of smaller dimensions. In further conformation of this point, I may add, that in searching for eggs in one of the mounds, I discovered the remains of a young bird, apparently just excluded from the shell, and which was clothed with feathers, not with down, as is usually the case: it is to be hoped that those who are resident in Australia, in situations favourable for investigating the subject, will direct their attention to the further elucidation of these interesting points. The upright position of the eggs tends to strengthen the opinion that they are never disturbed after being deposited, as it is well known that the eggs of birds which are placed horizontally are frequently turned during incubation. Although unfortunately I was almost too late for the breeding-season, I nevertheless saw several of the heaps, both in the interior and at Illawarra: in every instance they were placed in the most retired and shady glens, and on the slope of a hill, the part above the nest being scratched clean, while all below remained untouched, as if the birds had found it more easy to convey the materials down than to throw them up. In one instance only was I fortunate enough to find a perfect egg, although the shells of many from which the young had been excluded were placed in the manner I have described. At Illawarra they were rather deposited in the light vegetable mould than among the leaves, which formed a considerable heap above them. The eggs are perfectly white, of a long oval form, three inches and three quarters long by two inches and a half in diameter." ('Birds of Australia.')

The same author relates that these birds, while stalking about the wood, frequently utter a loud clucking noise; and, in various parts of the bush, he observed depressions in the earth, which the natives informed him were made by the birds in dusting themselves. The stomach is stated by Mr. Gould to be extremely muscular; and he found the crop of one which he dissected filled with seeds, berries, and a few insects.

The composure with which these birds sit to be shot at, as above noticed, must, as Mr. Gould observes, lead to an early extinction of the race; an event, he remarks, much to be regretted, since, independently of its being an interesting bird for the aviary, its flesh is extremely delicate, tender, and juicy. There is no doubt that this species may be domesticated, and it would make a noble addition to those foreign denizens of the poultry-yard which enrich our homesteads and tables. Living specimens are now (1855) existing in the Gardens of the Zoological Society, Regent's Park.

M. Lesson describes the species from New Guinea, which serves as the type of his genus *Talegalla Cuvieri*, figured in the 'Zoologie de la Coquille,' as entirely black, of the size of a common small hen, and recalling to the observer some of the forms of the Porphyriones. [Rallidæ.]

We subjoin descriptions of the genus *Leipoa*, and a species of *Megapodius*, which deposit their eggs in mounds as done by *Talegalla*.

Leipoa (Gould).—Bill nearly as long as the head, slender, tumescent at the base, the edges undulated and incurved at the base; the nostrils ample, oblong, covered with an operculum, and placed in a central hollow; head subcrested. Wings ample, rounded, concave; fifth primary quill the longest; the tertiaries nearly as long as the primaries. Tail rounded, tail-feathers 14. Tarsi moderate, robust, covered with scuta anteriorly, and posteriorly with scales, which are rounded and unequal. Toes rather short; lateral toes nearly equal. (Gould.)

Head and Foot of *Leipoa*.

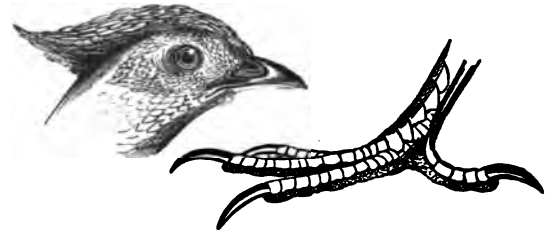
L. ocellata, Ocellated Leipoa (Gould). In size this beautiful bird is inferior to *T. Lathami*, and it is more slender and more elegantly formed. According to Mr. Gould, it is the Ngow of the aborigines of the lowland; Ngow-oo of the mountain districts of Western Australia; and Native Pheasant of the colonists of Western Australia.

Mr. Gould, in his 'Birds of Australia,' gives an account of this bird. It is described as a ground-bird, never taking to a tree except when closely hunted: when hard pursued, it will frequently run its head into a bush, and is then easily taken. Its food generally consists of seeds and berries. The note is mournful, very much like that of a pigeon, but with a more inward tone. The eggs are deposited in a mound of sand, the formation of which is the work of both sexes. According to the natives, the birds scratch up the sand for many yards around, forming a mound about three feet in height, the inside of which is constructed of alternate layers of dried leaves, grasses, &c., among which twelve eggs and upwards are deposited, and are covered up by the birds as they are laid; or, as the natives express it, "the countenances of the eggs are never visible." Upon these eggs the bird never sits, but when she has laid out her lay, as the hen-wives say, the whole are covered up, when the mound of sand resembles an ants' nest. The eggs, which are white, very slightly tinged with red, and about the size of a common fowl's egg, are hatched by the heat of the sun's rays, the vegetable lining retaining sufficient warmth during the night: they are deposited in layers, no two eggs being suffered to lie without a division. This bird is a native of Western Australia.

Ocellated Leipoa (*Leipoa ocellata*). (Gould.)

The species of *Megapodius* [Cracidæ] which has the habit of these birds, is *M. tumulus*. It is thus described by Mr. Gould:—Head and crest very deep cinnamon-brown; back of the neck and all the under surface very dark gray; back and wings cinnamon-brown; upper and under tail-coverts dark chestnut-brown; tail blackish-brown; irides generally dark-brown, but in some specimens light reddish-brown; bill reddish-brown, with yellow edges; tarsi and feet bright orange, the scales on the front of the tarsi from the fourth downwards, and the scales of the toes, dark reddish-brown. Size about that of a common fowl.

This is the Ooregoorga of the aborigines of the Cobourg Peninsula the Jungle-Fowl of the colonists of Port Essington.



Head and Foot of *Megapodius*. (Gould.)

Mr. Gould gives a highly interesting account of the habits of this bird. He states that on Mr. Gilbert's arrival at Port Essington, his attention was attracted to numerous great mounds of earth which were pointed out to him by some of the residents as being the tumuli of the aborigines. The natives, on the other hand, assured him that they were formed by the Jungle-Fowl for the purpose of hatching its eggs. But this last statement appeared so extraordinary, and so much at variance with the general habits of birds, that no one in the settlement believed them, and the great size of the eggs brought in by them as the produce of this bird strengthened the doubt of the veracity of their information. Mr. Gilbert however, knowing the habits of *Leipoa*, took with him an intelligent native, and proceeded about the middle of November to Knocker's Bay, a part of Port Essington harbour comparatively but little known, and where he had been informed a number of these birds were to be seen. He landed beside a thicket,

and had not advanced far from the shore when he came to a mound of sand and shells, with a slight mixture of black soil, the base resting on a sandy beach, only a few feet above high-water mark; it was enveloped in the large yellow-blossomed *Hibiscus*, was of a conical form, twenty feet in circumference at the base, and about five feet high. On asking the native what it was, he replied 'Oregoorgă Rambal' (Jungle-Fowl's house or nest). Mr. Gilbert scrambled up the side of it, and found a young bird in a hole about two feet deep; the nestling, apparently only a few days old, was lying on a few dry withered leaves.

Mr. Gilbert afterwards secured several eggs from the nests. On one occasion, after an hour's excessive labour, Mr. Gilbert obtained an egg from the depth of about five feet. It was in a perpendicular position. The holes in this mound (which was 15 feet high and 60 feet in circumference at the base, and, like the majority of those that he had seen, so enveloped in thickly-foliaged trees as to preclude the possibility of the sun's rays reaching any part of it) commenced at the outer edge of the summit, and ran down obliquely towards the centre: their direction, therefore, Mr. Gilbert observes, is not uniform. The mound was quite warm to the hands.

How the young effect their escape does not appear: some natives told Mr. Gilbert that the nestlings effected their escape unaided; but others said that the old birds, at the proper time, scratched down and released them. The natives say that only a single pair of birds are ever found at a mound at a time.

Mound-Raising Megapode (*Megapodius tumulus*), with nest in the distance. (Gould.)

TALIPAT-, or TALIPOT-PALM. [CORYPHA.]

TALLIERA. [CORYPHA.]

TALLOW, a name applied to various forms of solid oils and fat. [FAT; ADIPOSE TISSUE; OIL.]

TALLOW, MINERAL or MOUNTAIN. [HATCHETINE.]

TALLOW-TREE. [STILLINGIA.]

TALPA. [TALPIDÆ.]

TALPASO'REX. [SORECIDÆ.]

TA'LPIDÆ, a family of Animals belonging to the order *Insectivora*, and including the Moles.

The genus *Talpa* of Linnæus, as it stands in the 12th edition of the 'Systema Naturæ,' between the genera *Didelphis* and *Sorex*, comprises two species only, *Talpa Europæa*, the Common Mole, and *T. Asiatica*. [CHRYSOCHLORIS.]

Cuvier places the Moles, confining them to the genus *Talpa*, between *Sorex* [SORECIDÆ] and *Condylura*.

Mr. Swainson places the genus *Talpa* between *Chrysochloris* and *Centenes*.

and working of the muzzle. The part which extends from the internal side of the jaws terminates in three points, the one in the

Skull of Mole.

middle larger and more distant from the external edge than the other two. The very short arm attached by means of a long bladebone, and sustained by a vigorous clavicle, carries an extremely wide hand, the palm of which is always turned outwards or backwards. No known living form has the compressed phalangeal bones seen in *Glyptodon* except the Mole. [GLYPTODON.] The second phalanx of the anterior digits or fingers of the Mole is the only known living analogue of the similar bone in the hind foot of Glyptodon. The sternum, like that of the Birds and Bats, has an elevation or crest affording room for the large pectoral muscles. The pelvis and hinder extremities are comparatively feeble. The bones of the pubis are not joined.

This bony framework is set in motion by very powerful muscles. Those of the anterior extremities, the chest, and the neck are most vigorous, and in the cervical ligament a peculiar bone is even formed. The wide hand, which is the great instrument of action, and performs the offices of a pickaxe and shovel, is sharp-edged on its lower margin, and, when clothed with the integuments, the fingers are hardly distinguishable, but the terminating claws project long, strong, flat, and trenchant.

The muzzle of the Mole is evidently a delicate organ of touch, and that sense is considerably developed in the large and broad hands and feet. Neither is the tail without a considerable share of sensation, to give notice to the animal of the approach of any attack from behind. The gustatory and olfactory nerves, especially the latter, appear to be very sensitive.

The eye is so hidden in the fur, that its very existence was for a long time denied. It appears to be designed for operating only as a warning to the animal on its emerging into the light; and indeed more acute vision would only have been an incumbrance.

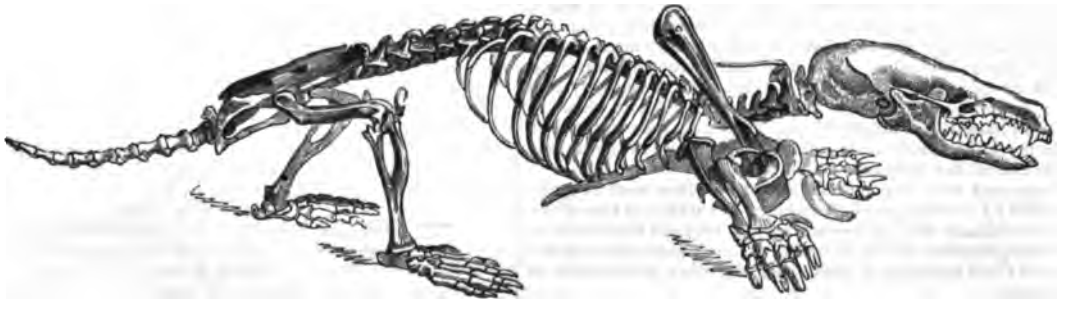
The sense of hearing is very highly developed, and the tympanum very large, though there is no external ear, or rather, no projecting concha.

There is nothing that calls for any particular notice in the digestive system of the Mole. The alimentary canal is short, simple, without a cæcum. The voracity of the Mole corresponds with the activity and rapidity of its digestive powers. An interesting series of preparations illustrative of the anatomy of the Mole, will be found in the Museum of the Royal College of Surgeons, London.

The family *Talpidæ* is thus characterised:—Head long, narrow, somewhat depressed; nose much prolonged, pointed flexible; eyes very minute; ears hidden; feet plantigrade; anterior limbs largely developed.

Talpa.—Body stout and thick, furry; head elongated, pointed; muzzle cartilaginous, strengthened by the snout-bone; eyes very small; no external ears; anterior feet short and wide, with five united toes armed with trenchant nails proper for digging; posterior feet with five toes also, but weak. Tail short.

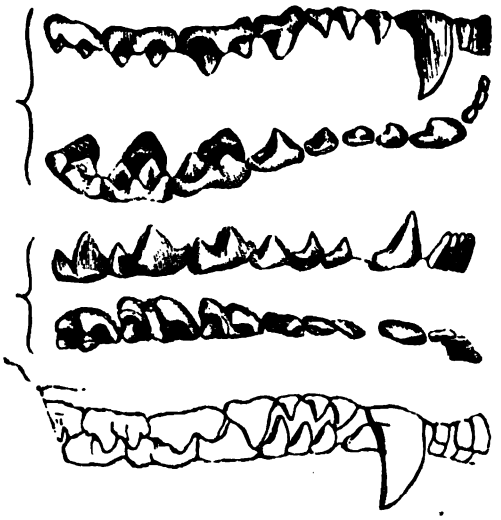
Dental Formula:—Incisors, $\frac{6}{8}$; Canines, $\frac{1-1}{0-0}$; Molars, $\frac{7-7}{7-7}=44$.



Skeleton of Mole. (De Blainville.) The nuchal bone and accessory carpal sabre-shaped bone are here shown.

The organisation of these animals is very peculiar. The cranium is elongated and pointed, and there is a peculiar bone for the support

T. Europæa, the Common Mole. This well-known animal, so familiar to all that it would be a needless waste of space to describe



Teeth of Mole, considerably enlarged. (F. Cuvier.)

it, is La Taupe of the French, Talpa of the Romans and Italians, Topo of the Spanish, Toupeira of the Portuguese, Maulwerf of the Germans, Mol of the Dutch, Mulvad and Surk of the Swedes, Muldvarp of the Danes; Mole, Mole-Warp, Moldwarp, and Want of the English; and Gwadd and Twrch-Daear of the Welsh.

"A subterraneous life," says Pennant, speaking of the Mole, "being allotted to it, the seeming defects of several of its parts vanish; which, instead of appearing maimed or unfinished, exhibit a most striking proof of the fitness of their contrivance. The breadth, strength, and shortness of the fore feet, which are inclined sideways, answer the use as well as the form of hands, to scoop out the earth, to form its habitation, or to pursue its prey. Had they been longer, the falling in of the earth would have prevented the quick repetition of its strokes in working, or have impeded its course: the oblique position of the fore feet has also this advantage, that it flings all the loose soil behind the animal.

"The form of the body is not less admirably contrived for its way of life: the fore part is thick and very muscular, giving great strength to the action of the fore part, enabling it to dig its way with great force and rapidity, either to pursue its prey or elude the search of the most active enemy. The form of its hind parts, which are small and taper, enables it to pass with great facility through the earth that the fore feet had flung behind; for had each part of the body been of equal thickness, its flight would have been impeded and its security precarious.

"The skin is most excessively compact, and so tough as not to be cut but by a very sharp knife; the hair is very short and close-set, and softer than the finest silk; the usual colour is black, not but that there are instances of these animals being spotted, and a cream-coloured breed is sometimes found in my lands near Downing.

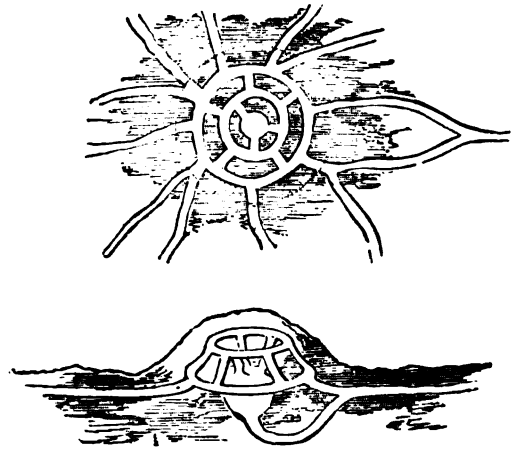
"The smallness of the eyes (which gave occasion to the ancients to deny it the sense of sight) is to this animal a peculiar happiness; a small degree of vision is sufficient for an animal ever destined to live underground; had these organs been larger, they would have been perpetually liable to injuries by the earth falling into them; but nature, to prevent that inconvenience, hath not only made them very small, but also covered them very closely with fur. Anatomists mention (besides these) a third very wonderful contrivance for their security, and inform us that each eye is furnished with a certain muscle, by which the animal has the power of withdrawing or exerting them, according to its exigencies.

"To make amends for the dimness of its sight, the Mole is amply recompensed by the great perfection of two other senses, those of hearing and of smelling: the first gives it notice of the most distant approach of danger; the other, which is equally exquisite, directs it in the midst of darkness to its food: the nose also, being very long and slender, is well formed for thrusting into small holes in search of the worms and insects that inhabit them. These gifts may with reason be said to compensate the defect of sight, as they supply in this animal all its wants and all the purposes of that sense.

"It is supposed that the verdant circles so often seen in grass-grounds, called by country-people fairy-rings, are owing to the operations of these animals, who, at certain seasons perform their burrowings by circumgyrations, which, loosening the soil, give the surface a greater fertility and rankness of grass than the other parts within or without the ring.

"The Mole breeds in the spring, and brings four or five young at a time: it makes its nest of moss, and that always under the largest hillock, a little below the surface of the ground. It is observed to be most active and to cast up most earth, immediately before rain, and in the winter before a thaw, because at those times the worms and insects begin to be in motion and approach the surface: on the contrary, in very dry weather this animal seldom or never forms any hillocks, as it penetrates deep after its prey, which at such seasons retires far into the ground. During summer it runs in search of snails and worms in the night time among the grass, which makes it the prey of owls. The Mole shows great art in skinning a worm, which it always does before it eats it; stripping the skin from end to end and squeezing out the contents of the body."

Le Court, a French writer, has given the most complete account of the habitation of the Mole:—The principal point is the habitation, or, as it has been termed, the fortress; and is constructed under a considerable hillock raised in some secure place, often at the root of a tree, under a bank, or any shelter that offers protection. The fortress is domed by a cement, so to speak, of earth which has been beaten and compressed by the architect into a compact and solid state. Within, a circular gallery is formed at the base, and communicates with a smaller upper gallery by means of five passages, which are nearly at equal distances. Within the lower and under the upper of these galleries is the chamber, or dormitory, which has access to the upper gallery by three similar passages. From this habitation, we should here observe, the high road by which the proprietor reaches the opposite end of the encampment extends, and the various galleries or excavations open into this road, which the mole is continually carrying out and extending in its search for food, and which has been termed its hunting-ground. But to return to the chamber. From it another road extends, the direction of which is downwards at first, and that for several inches, when it again rises to open into the high road of the territory. Some eight or nine other passages open out from the external circular gallery, but the orifices of these never come opposite to the passages which connect the external gallery with the internal and upper gallery. The extent of these passages is greater or less according to circumstances, and they each return by an irregular and semicircular route, opening at various distances from the habitation into the high road, which differs considerably from all the other passages and excavations, both in construction and with regard to the use to which it is applied. From the habitation this road is carried out nearly in a straight line, and forms the main passage of communication between the habitation, the different portions of the encampment, and the alleys leading to the hunting-ground which open into it on each side. In diameter it exceeds the body of a mole, but its size will not admit of two moles passing each other. The walls, from the reiterated pressure of the mole's sides against them, become smooth and compact, and its course is remarkable for the comparative absence of mole-hills, which are frequent in connection with the alleys and quarries, as they have been termed, in constructing which the earth is removed out of the way to the surface. Sometimes a mole will lay out a second or even a third road in order to the extension of its operations. Sometimes several individuals use one road in common, though they never trespass on each other's hunting-grounds. In the event of common usage, if two moles should happen to meet, one must retreat into the nearest alley, unless both should be pugnacious; in which case the weakest is often slain. In forming this tunnel the mole's instinct supplies the place of science, for he drives it at a greater or less depth, according to the quality of the soil, or concurrent circumstances. When there is nothing superincumbent threatening a disturbance of its security, it is often excavated at a depth of some four or five inches; but if it is carried under a road or a stream, a foot and a half of earth, sometimes more, is left above it. Thus does the little animal carry on the subterraneous works necessary for his support, travelling, and comfort; and his tunnels never fall in.



Habitation or Fortress of Mole.

The alleys opening out from the sides of the high road have generally a somewhat downward inclination from their commencement

towards their end. It has been observed that when, on opening one of these alleys, a plentiful supply of food is found, the mole proceeds to work out branch-alleys from its termination, upheaving new mole-hills as it advances in quest of prey. Should however the soil be barren of the means of existence, the animal commences another alley at a different part of the high road. The quality and humidity of the soil, which regulate the abundance of earth-worms, determine the greater or less depth of the alleys.

The main road being the highway of communication to its different hunting-grounds, it is necessarily passed through regularly in the course of the day, and it is in this road that the mole-catcher sets his traps or practices his devices to intercept the animal between its habitation and the alley where it is carrying on its labours. Some mole-catchers will tell you that the hours when the moles move are nine and four, and others, that near the coast their movements are influenced by the tides; to which statements the reader is at liberty to give as much credence as he chooses. Besides the various traps which are set for them, there is, or very lately was, a man who travelled the country with a dog and destroyed them without any trap at all, by the following process:—Taking his station at the proper time and place, attended by his dog, and armed with a spear or spud, he waits till the dog indicates the presence of the mole, and then spears or spuds the animal out as it moves in its run. Pointers will stop at moles as steadily as at game when the latter are straying on the surface.

Besides the excavations already noticed, the moles pursue another mode of hunting in light loose soils, newly sown, when gentle rains have led the earth-worms towards the surface, along which they follow the worms up, rapidly digging a shallow trench in the superficial layer of the soil. The female, when with young, is said to be principally addicted to this easier method of subsistence.

We must not omit to notice the provision of this animal to secure a supply of water, for its voracity makes it a great drinker. If a pond or ditch be at hand in those cases where many moles use the same common highway, a run is always made to the reservoir: when it is too distant, the animal sinks little holes in the shape of deep perpendicular shafts, which hold water. These wells have sometimes been seen brim-full.

During the season of love, at which time bloody battles are fought between the males, the male pursues the female with ardour through numerous divaricating superficial runs wrought out with great rapidity, termed 'coupling runs' and 'running angles' by our mole-catchers, and 'traces d'amour' by the French. The young are generally produced in April, but have been found from that month to August. From four to five is the general number, though from three to six have been recorded, and in one case seven in one nest. The nest is distinct, usually distant from the habitation, and not always crowned with a hillock; but when a hillock exists it is much larger than an ordinary mole-hill. It is constructed by enlarging and excavating the point where three or four passages intersect each other; and the bed of the nest is formed of a mass of young grass, root-fibres, and herbage. In one case, Geoffroy St. Hillaire and Le Court counted 204 young wheat-blades.

Heavy charges have been brought against the Mole by agriculturists and horticulturists, and the more grave accusation of being ancillary to the destruction of dykes has been in some instances proved upon it. Mr. Bell, in his interesting 'History of British Quadrupeds,' sums up the evidence against it and in its favour. On the whole there appears to be no ground for the war of extermination which is carried on against it.

Moles are good swimmers, and their bite is very sharp. When their blood is up, their ferocity is great, and they keep their hold like a bull-dog.

The Common Mole is found throughout the greater part of the continent of Europe and its larger islands. In Greece it is said to be comparatively rare. We are overrun with it in most parts of England and Wales, but it does not appear to have been found in the northern extremity of Scotland, though it is frequent enough in the south. There is no record of its having been seen in the Orkney Isles, Zetland, or Ireland.

Fossil remains of the Mole have been found in the bone-caverns; as, for example, in the cave at Köstritz and at Paviland. (Buckland, 'Reliquiæ Diluvianæ.') They have also been found in the bone-caverns in Belgium (Schmerling).

Bones of Moles have been obtained from the brown clay of Norfolk.

TAMA'NDUA. [Ant-Eater.]

TAMARICA'CEÆ, *Tamarisks*, a small natural order of Plants, belonging to the syncarpous group of Polypetalous Exogens. The species are either shrubs or herbs, having rod-like branches, with alternate entire leaves, resembling scales; the flowers are in dense spikes or racemes. The calyx is 4-5-parted, persistent; the petals inserted into the calyx, both with imbricate æstivation; stamens hypogynous, distinct or united, equal in number with the petals or twice as many; ovary superior, with a short style and 3 stigmas; fruit a capsule, 3-valved, 1-celled, with numerous seeds, which are comose; embryo straight with an inferior radicle.

The species are found only in the Old World; the greatest number being met with in the basin of the Mediterranean.

The plants of this order are innocuous, and all are more or less astringent; and their ashes after burning are remarkable for possessing a large quantity of sulphate of soda. *Myricaria Germanica* is recommended as a diuretic. [Tamarix.]

Tamarix Germanica.

a, cutting, showing the straight branches and scale-like leaves; *b*, single flower; *c*, flower with calyx and corolla removed, showing monadelphous stamens; *d*, capsule with comose seeds escaping.

TAMARIN. [Midas.]

TAMARIND. [Tamarindus.]

TAMARINDU'S, a genus of Plants belonging to the Rectembryous division of the natural order *Leguminosæ*. It possesses the following characters:—Calyx cleft, tubular at the base, the three upper lobes reflexed, the two lower ones joined together, but usually indentate at the apex; petals 3, alternate with the three upper lobes of the calyx, the middle one cucullate and the lateral ones ovate; the stamens are 9 or 10 in number, two or three of which are longer than the others, united at the base, and bearing anthers, whilst the remainder are sterile; the fruit is a legume seated on a pedicel, 1-celled, compressed, with from 3 to 6 seeds, and the valves filled with pulp between the endocarp and epicarp, their inner and outer lining; the seeds are ovato-quadrate in form, possessing cotyledons unequal at the base.

There are only two species belonging to this genus, both of which are trees with abruptly pinnate leaves, bearing many pairs of small leaflets and racemes of flowers.

T. Indica, the East Indian Tamarind, was the earliest known species, for a knowledge of which, in Europe, we are indebted to the Arabians. It is distinguished by its elongated legumes, which are six times or more longer than they are broad. It is a native of various districts in the East Indies and also of the tropical parts of Africa. It forms a handsome tree with spreading branches, bearing leaves of a light colour and flowers with a straw-coloured calyx and yellow petals, streaked with red: the filaments of the stamens are purple and the anthers brown. The timber of this tree is very firm, hard, and heavy, and is applied to many useful purposes in building.

A second species is the *T. occidentalis*, the West Indian Tamarind, which is distinguished from the other by possessing short legumes not more than three times longer than they are broad. It is a native of South America and the West Indian Islands, forming also a large spreading tree, with yellowish flowers streaked with red, and purplish stamens.

TAMARIX, the name of a genus of Plants, the type of the natural order *Tamaricaceæ*. It has a 4- or 5-parted calyx; 4 or 5 petals; 4 or 5 stamens alternating with the petals, united at the base; a tapering ovary with 3 stigmas; erect tufted seeds, the tuft being composed of a number of hairs proceeding from the apex of the seed. The species have generally paniculated spikes of small flowers of a red colour.

T. Gallica, the French Tamarisk, is a glabrous glaucous shrub, with minute acute leaves clasping the stem, with slender lateral spikes of flowers five times longer than broad. This species is a native of France, and also along the Mediterranean; it is also a native of the coasts of Cornwall, Hampshire, and Sussex, in England. Ehrenberg has described a great number of varieties of this species, one of which, the *T. G. mannifera*, known by its glaucous powdery appearance, he says, produces the manna of Mount Sinai. This is one of the species

of this genus remarkable for the large quantity of sulphate of soda which its ashes contain.

T. Indica, the Indian Tamarisk, is a glabrous greenish plant, with stiff twiggy branches; short ovate-acute leaves with white edges; elongated spikes of flowers, with bracts shorter than the flowers and longer than the pedicels, and stamens longer than the corolla. This plant is a native of the East Indies. It is subject to the attacks of a cynips, which produces galls that possess astringent properties, and, according to Dr. Royle, they are on this account used in medicine by the native doctors of India. The same property also renders them valuable in dyeing. Other Indian species of the Tamarisk produce galls, which are used for the same purposes as those of *T. Indica*.

T. Africana, the African Tamarisk, is a glabrous glaucous shrub, with lanceolate imbricated leaves; with dense, scaly, simple, sessile racemes; with ovate chaffy bracts; and a 3-valved capsule. This is a native of the sands along the shores of the Mediterranean. It is found in Mauritania, around the Bay of Naples, in Egypt, and in the Levant. It has very much the appearance of *T. Gallica*, but its flowers are larger, and the bark darker. Like *T. Gallica*, its ashes yield a large quantity of sulphate of soda.

T. orientalis, the Eastern Tamarisk, is a tree attaining a height of from 10 to 20 feet; it is glabrous all over, with minute, distant, sheathing, mucronate leaves, with slender lateral spikes of flowers, and a 4-valved capsule. This tree is a native of Arabia, Persia, and the East Indies, and is one of the largest and most elegant of the species of the Tamarisk. One of the finest specimens of this tree existing is at Babylon.

TAMA'TIA. [Barbets.]

TA'MIAS. [Sciuridæ.]

TAMUS, a genus of Plants belonging to the natural order *Dioscorcaceæ*. This genus is dioecious, the stamens growing on one plant, and the pistils on another. The flowers are alike in having a perianth, which is 6-parted, the calyx and corolla being indistinguishable. In the male flowers there are 6 stamens. In the female flowers the remains are seen of 6 abortive stamens; the ovary is trilocular; the style trifid, with 3 stigmas; the fruit a berry. This genus is supposed to be the *Uva Taminia* of Pliny, hence its present name.

T. communis, the Common Black Briony, has undivided cordate-acuminate leaves, and is a very common plant in hedges and thickets throughout Europe. It is a frequent plant in England. It has a long twining stem, spreading in all directions, and reaching from branch to branch of hedges and thickets: its flowers are greenish-white; the fruit is of a red colour, and hangs in bunches from its trailing branches. The berries are unwholsome, but not poisonous.

TANACE'TUM, a genus of Plants belonging to the natural order *Compositæ* and the sub-order *Corymbiferæ*. The florets of the disc hermaphrodite, the involucre hemispherical imbricated, the receptacle naked, the fruit oblong and angular, with a large epigynous disc crowned with a slight membranous border.

T. vulgare, Tansy, has pinnatifid leaves and serrated leaflets. The heads in a terminal corymb. The florets of a bright-yellow. The fruit with an entire crown. The stem is from 1½ to 3 feet high, erect, and rather angular. The root moderately creeping. Every part of the plant is bitter, and emits a strong but not unpleasant scent. It is found by roadsides in Europe and the Crimea.

TANAGER. [Tanagrinæ.]

TANAGRINÆ, or TA'NAGERS, a tribe of Birds belonging to the family *Fringillidæ*. The genus *Tanagra* of Linnæus stands, in the 12th edition of the 'Systema Naturæ,' between *Emberiza* and *Fringilla*, in the order *Passeres*. [Fringillidæ.]

Cuvier characterises the genus as having a conical bill, triangular at its base, slightly arched at its arête, and notched towards the end: wings and flight short. He observes that they resemble our sparrows in their habits, and seek for seeds as well as berries and insects. The greater part, he remarks, force themselves upon the attention of the spectator of an ornithological collection by their vivid colours. He places the genus between the Drongos (*Edolius*, Cuv.) and the Thrushes (*Turdus*, Linn.), thus subdividing it:—

1. The Euphonous or Bullfinch Tanagers (Euphones ou Tangaras Bouvreuils).

These have a short bill, presenting, when it is seen vertically, an enlargement on each side of its base: tail short in proportion. Ex. *Tanagra violacea*, *T. Cayennensis*, &c.

2. The Grosbeak Tanagers.

Bill conic, stout, convex, as wide as it is high; the back of the upper mandible rounded. Ex. *T. magna*, *T. atra*, &c.

3. Tanagers, properly so called.

Bill conic, shorter than the head, as wide as it is high, the upper mandible arched and rather pointed. Ex. *T. Talao*, *T. tricolor*, &c.

4. Oriole Tanagers (Tangaras Loriots).

Bill conic, arched, pointed, notched at the end. Ex. *T. gularis*, *T. pileata*, &c.

5. Cardinal Tanagers.

Bill conic, a little convex, with an obtuse projecting tooth on the side. Ex. *T. cristata*, *T. brunnea*, &c.

6. Ramphocele Tanagers.

Bill conic, with the branches of the lower mandible convex, backwards. Ex. *T. Jacapa*, *T. Brasilia*, &c.

Mr. Swainson makes the *Tanagrinæ*, which he places between the *Coccothraustinæ* and the *Fringillinæ*, consist of the following genera and sub-genera, all of which he characterises:—

Tanagrinæ.—Bill equally conic; the upper mandible more or less arched, and very distinctly notched; feet formed for perching; claws broad and fully curved.

Tardivola, *Tanagra* (with the sub-genera *Pityius*, *Tanagra*, and *Ramphopis*). *Phænisoma* (with the sub-genera *Phænisoma*, *Tachyphonus*, and *Leucopygia*). *Nemosia*. *Aglaia* (with the sub-genera *Euphonia* and *Tanagrella*). And *Pipillo* (with the sub-genus *Arremon*). ('Classification of Birds.')

Prince Bonaparte places the *Tanagrinæ* between the *Fringillinæ* and the *Emberizinæ*.

Mr. G. R. Gray makes the *Tanagrinæ* the third sub-family of the *Fringillidæ*, arranging it between the *Coccothraustinæ* and *Fringillinæ*. The following genera are enumerated by Mr. Gray as belonging to it:—

Emberizoides, Temm.; *Pipilo*, Vieill.; *Embernagra*, Less.; *Arremon*, Vieill; *Cissopis*, Vieill.; *Pityius*, Cuv.; *Tanagra*, Linn.; *Saltator*, Vieill.; *Spindalis*, Jard. and Selby; *Ramphopsis*, Vieill.; *Lamprotes*, Sw.; *Pyranga*, Vieill.; *Lanio*, Vieill.; *Tachyphonus*, Vieill.; *Nemosia*, Vieill.; *Tanagrella*, Sw.; *Euphonia*, Desm.; *Calaspiza*, G. R. Gray *Stephanophorus*, Strickl.; *Cyanagra*, Less.

Tanagra rubra, the Scarlet Tanager, or Black-Winged Summer Red-Bird. The male is scarlet-red, with the wings and notched tail black: the base of the plumage is ash, then white. The female, young, and male in autumn, are dull-green, inclining to yellow in the latter: yellow beneath; wings and tail dusky. Length about 6¼ inches; alar extent 10¼ inches. It is a native of the United States of America.

"This splendid and transient resident," says Nuttall, "accompanying fine weather in all his wanderings, arrives from his winter station in tropical America from the beginning to the middle of May, and extends his migrations probably to Nova Scotia as well as Canada. With the shy, unsocial, and suspicious habits of his gaudy fraternity, he takes up his abode in the deepest recesses of the forest, where, timidly flitting from observation, he darts from tree to tree like a flashing meteor. A gaudy sylph, conscious of his brilliance, and the exposure to which it subjects him, he seems to avoid remark, and is only solicitous to be known to his humble mate, and hid from all beside. He therefore rarely approaches the habitations of men, unless perhaps the skirts of the orchard, where he sometimes however builds his nest, and takes a taste of the early and inviting though forbidden cherries.

"Among the thick foliage of the tree in which he seeks support and shelter, from the lofty branches, at times, we hear his almost monotonous 'tship-wĭtee, tship-ĭdee,' or 'tshŭkadee, tshŭkadee,' repeated at short intervals, and in a pensive under-tone, heightened by the solitude in which he delights to dwell. The same note is also uttered by the female when the retreat of herself and young is approached; and the male occasionally utters, in recognition to his mate, as they perambulate the branches, a low whispering ''tait,' in a tone of caution and tenderness. But besides these calls on the female, he has also, during the period of his incubation, and for a considerable time after, a more musical strain, resembling somewhat, in the mellowness of its tones, the song of the Fifing Baltimore. The syllables to which I have hearkened appear like ''tshoove 'wait 'wait, 'vehŏwit wait,' and ''wait, 'vehŏwit vea wait,' with other additions of harmony, for which no words are adequate. This pleasing and highly musical meandering ditty is delivered for hours, in a contemplative mood, in the same tree with his busy consort. If surprised, they flit together, but soon return to their favourite station in the spreading boughs of the shady oak or hickory. This song has some resemblance to that of the Red-Eyed Vireo in its compass and strain, though much superior, the ''wait 'wait' being whistled very sweetly in several tones, and with emphasis; so that, upon the whole, our *Pyranga* may be considered as duly entitled to various excellencies, being harmless to the farmer, brilliant in plumage, and harmonious in voice."

The same author describes the nest (which is built about the middle of May, on the horizontal branch of some shady forest tree, commonly an oak, but sometimes in an orchard tree) as but slightly put together, and usually framed of broken rigid stalks of dry weeds or slender fir-twigs, loosely interlaced together, and partly tied with narrow strips of Indian Hemp (*Apocynum*), some slender grass-leaves, and Pea-Vine runners (*Amphicarpa*), or other frail materials; the interior being sometimes lined with the slender wiry brown stalks of the Canadian Cistus (*Helianthemum*), or with slender pine-leaves; the whole so thinly platted as to admit the light through the interstices. The three or four eggs are dull blue, spotted with two or three shades of brown or purple, most numerous towards the larger end. As soon as their single brood, which is fledged early in July, is reared, they leave for the south, generally about the middle or end of August.

"The female," he says, "shows great solicitude for the safety of her only brood; and, on an approach to the nest, appears to be in great distress and apprehension. When they are released from her more immediate protection, the male, at first cautious and distant,

now attends and feeds them with activity, being altogether indifferent to that concealment which his gaudy dress seems to require from his natural enemies. So attached to his now interesting brood is the Scarlet Tanager, that he has been known, at all hazards, to follow for half a mile one of his young, submitting to feed it attentively through the bars of a cage, and, with a devotion which despair could not damp, roost by it in the branches of the same tree with its prison."

The food of this species consists mostly of winged insects, such as wasps, hornets, and wild bees, the smaller kind of beetles, and other *Coleoptera*. Seeds are supposed to be sometimes resorted to, and they are very fond of whortle and other berries.

It is in August that the moult of the male "when he exchanges his nuptial scarlet for the greenish-yellow livery of the female," commences. ('Manual of the Ornithology of the United States and of Canada.')

TANGHIN POISON. [CERBERA.]

TANGHI'NIA, a genus of Plants belonging to the natural order *Apocynaceæ*. It has an infundibuliform corolla, with a clavate tube, and 5-toothed throat; the anthers are subsessile. The fruit is a drupe, with a fibrous ligneous putamen or stone, which contains one or two seeds. The specific name, *T. venenifera*, was given to the plant which yields the poison. It has dense leaves, with erect branches, and paniculated terminal flowers. In its native island this plant attains the size of a tree, and has a hard wood, which may be used for many kinds of carpentery; but the part which yields the poison is the kernel of the fruit. Although this kernel is small, not much larger than an almond, Mr. Telfair says that it contains enough poison to kill twenty persons. Its great use in Madagascar was as a means of trial, the innocent being supposed able to resist its action, whilst the guilty suffered under its influence.

TANGLES. [ALGÆ.]

TANSY. [TANACETUM.]

TANTALIDÆ. [SCOLOPACIDÆ.]

TANTALITE. [COLUMBITE.]

TANTALUS. [ABOU-HANNES; SCOLOPACIDÆ.]

TANYSIPTERA. [HALCYONIDÆ.]

TAP-ROOT. [ROOT.]

TAPE-WORM. [ENTOZOA.]

TAPHOZO'US. [CHEIROPTERA.]

TAPIO'CA. [FOOD; JANIPHA.]

TAPIRUS, *Tapir*, the name of a genus of Animals belonging to the family *Pachydermata*.

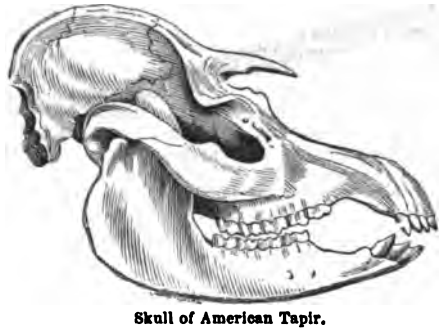
Linnæus does not notice the Tapir in the 12th (his last) edition of the 'Systema Naturæ:' but Gmelin quotes it as the '*Hippopotamus* (terrestris) pedibus posticis trisulcis.' ('Syst. Nat.')

Gmelin introduces it under the title Tapir, between *Hippopotamus* and *Sus*.

Cuvier arranges the genus as the last of his Pachydermes Ordinaires, making it immediately succeed the extinct *Palæotheria* and Lophiodons. The genus was well known to the older zoologists who wrote on the natural products of America.

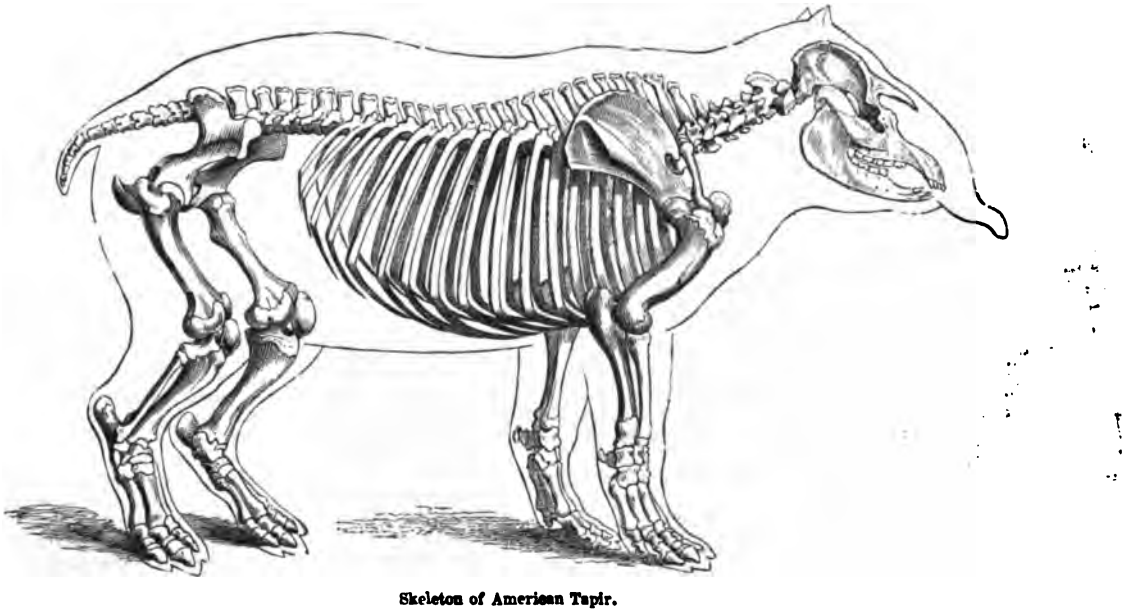
frontal bones: these are early united and directed a little backwards. At the middle of the base of this triangle, to which the bones of the nose are articulated, is a point which penetrates between them; and from the two sides above the orbits descends a deep furrow produced by the structure of the upper border of the orbit, and which approaches towards the suborbital hole: it serves for the insertion of the muscles of the proboscis. The orbit descends lower than the mid-height of the head, is very wide, and has the postorbital apophyses but little marked.

The lower jaw exhibits a striking width at its ascending ramus, and presents a rounded contour backwards at its posterior angle. Its coronoid apophysis elevates itself in the form of a pointed falx above the condyle, which is transverse and large. The two jaws are a little concave laterally at the vacant interval of the teeth, and are very much narrowed there; their edge is trenchant.



Skull of American Tapir.

The lateral apophyses of the atlas are wide, but little extended outwards; the spinous process of the axis is an elevated crest; the transverse processes are small and irregular; the odontoid is large and obtuse; the transverse processes of the three succeeding vertebræ descend obliquely, are a little widened at the end, and cut nearly square; their spinous processes are very small. The fifth cervical vertebra has a small apophysis on its transverse process, which, for the rest, resembles that of the preceding vertebræ, but is rather longer; its spinous process is also rather longer; still more is that of the seventh vertebra, the transverse process of which is very small—in short, a simple tubercle. The articular facets of the cervical vertebræ rise obliquely from within outwards, so that the articular facet of one vertebra is below that which responds to the preceding vertebra. The bodies of the vertebræ are convex forward and concave behind, an organisation which is more or less repeated in the rest of the spine. The number of dorsal vertebræ amounts to twenty; the spinous apophysis of the second is the longest. They decrease and incline backwards to the eleventh, from which they become



Skeleton of American Tapir.

When viewed in profile, the pyramidal elevation of the skull of the Tapir, calling to mind what is to be seen in the hog, strikes the observer forcibly. But the pyramid of the Tapir differs from that of the hog in having only three faces; and also in this, that its anterior line is formed by the meeting of the lateral faces, and it is only towards the front that it is dilated into a triangle, which is due to the straight, square, and nearly equal. Their articular apophyses are so fitted that those of one vertebra are in advance and above those which correspond with it in the vertebra below. Cuvier found twenty pairs of ribs in one individual, nineteen in another, eight of which are true, all slender and rounded for the greatest part of their length. The breast-bone is composed of five bones; its anterior portion is com-

pressed, and projects in the form of a plough-share. There are four lumbar vertebræ, the transverse apophyses of which are rather large. Those of the last, which are rather shorter and oblique, are articulated with the first sacral vertebra. These transverse apophyses have on their base the same elevated crests as the dorsals have for articulation with the ribs. The os sacrum of the adult consists of seven vertebræ, the spinous apophyses of which are distinct and inclined backwards; the last five of these apophyses are short and terminate by a widened disc. The tail has seven vertebræ.

The bones of the extremities are remarkably strong, and in many points resemble those of the Rhinoceros, especially the bone of the carpus.

Cuvier, in his osteological comparison of the Indian Tapir with the American form, observes that a glance at the profile of their respective crania is sufficient to impress upon the observer their specific differences. The forehead of the Indian Tapir is, he observes, so convex, that it rises higher than the occiput: it elevates in its rise the nasal bones, which much prolongs the ascending part of the jaws and the descending portion of the frontal bones along the external aperture of the bony nostrils, thus giving much wider room for the comparatively large proboscis, and adding length to the furrows where the muscles are inserted. This organisation, he observes, explains why the Indian Tapir has a more powerful and extensible trunk than that of the American Tapir. There is even, he adds, in the Indian species, on the base of the nasal bones at their junction with the frontal bones, and on each side, a deep fossa which does not exist in the other species. This elevation of the forehead is accompanied by a depression of the occipital crest, which, far from forming a pyramid, as in the American species, rather descends backwards. The aperture of the bony nostrils, so enlarged by the prolongation of the maxillary bones, terminates below and forwards by more elevated intermaxillaries, which are for the rest anchylosed together in early youth as in the American Tapir.

The interval between the canine and the first molar is less in proportion in the Indian Tapir, whose dentition is otherwise the same with that of the American species.

The zygomatic apophysis of the Indian species is a little higher backward and less forward: its mastoid apophysis is more transversely turned.

Cuvier remarks that the rest of the skeleton of the two species does not offer such appreciable differences.

Mr. Yarrell, in the fourth volume of the 'Zoological Journal,' gives an account of the post-mortem appearances in an American Tapir brought to this country by Lieutenant Maw, R.N., which survived its arrival in the gardens of the Zoological Society in the Regent's Park only a few hours.

When dead, the animal, which was said to be about 12 months old, measured from the nose to the root of the tail 48 inches, and its girth was 35 inches.

Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{4-4}{3-3} = 30$.

The incisor teeth were very much used, the edges coming into close contact when the molars are in action. The canines were small in the upper jaw, and removed a short distance from the lateral incisor, for the admission of the larger canines of the lower jaw.

Mr. Yarrell refers to Sir Everard Home's paper in the 'Philosophical Transactions' (1821), in which Sir Everard points out the differences existing in the skulls of the Sumatran and American Tapirs, and has described a part of the viscera of the former. In the Sumatran Tapir the stomach is large, the intestinal canal very long, and the cæcum small; in the American Tapir the stomach is small, the intestines of moderate length, and the cæcum large.

Mr. Yarrell adds that, of the species described, the length of the Sumatran Tapir is 8 feet; and the whole length of its intestinal canal is 89 feet 6 inches. Proportion as 11 to 1.

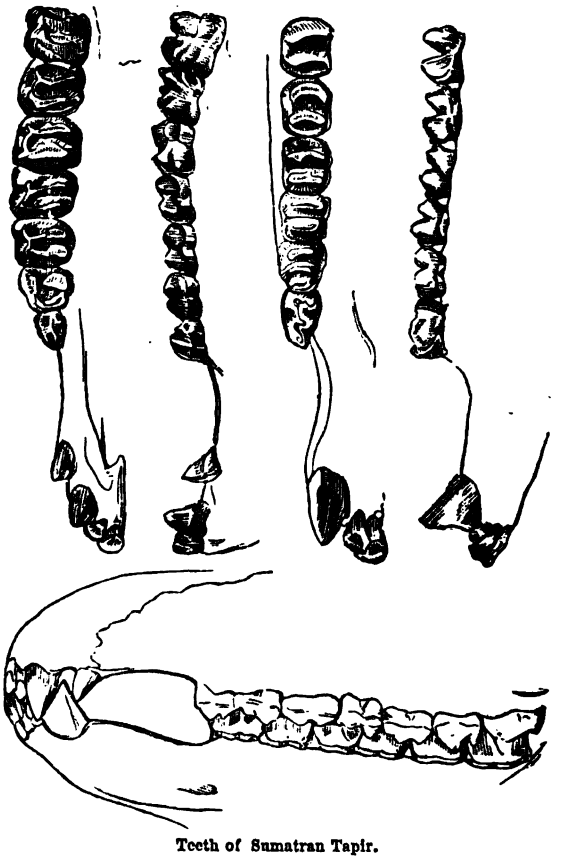
The length of the American Tapir is 4 feet; and the whole length of its intestinal canal 28 feet. Proportion as 7 to 1.

Tapirus has the following generic characters:—Molars presenting on their crown before they are worn two transverse and rectilineal tubercles (collines); nose terminated in a small moveable proboscis, but not terminated with an organ of touch like that of the Elephant; neck rather long; skin rather thick, and covered with hair, looking as if it had been close shorn; two inguinal mammæ. Anterior feet with four toes; posterior feet with three toes.

The species are found in Asia and America. The dental formula of the Asiatic species is as follows:—

Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{7-7}{6-6} = 42$.

T. Malayanus (*T. Indicus* of the French zoologists; Le Maiba, F. Cuv., 'Mamm.'), the Asiatic Tapir. "The Malay Tapir resembles in form the American, and has a similar flexible proboscis, which is six or eight inches in length. Its general appearance is heavy and massive, somewhat resembling the Hog. The eyes are small; the ears roundish, and bordered with white. The skin is thick and firm, thinly covered with short hair. There is no mane on the neck, as in the American species. The tail is very short, and almost destitute of hair. The legs are short and stout; the fore feet furnished with four toes, the hind feet with three. In the upper jaw there are seven molars on each side, one small canine inserted exactly on the suture of the incisor bone, and in front six incisors, the two outer of which are elongated into tusks. In the under jaw there are but six molars; the canines are large; and the number of the incisors, the outer of



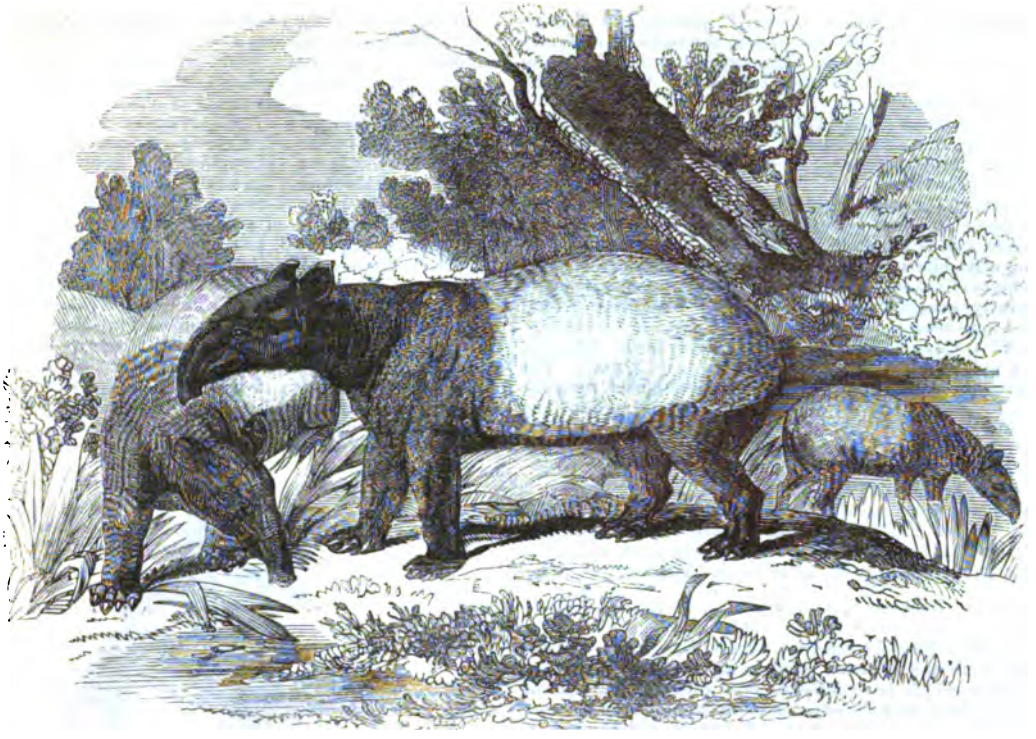
Teeth of Sumatran Tapir.

which are the smallest, is the same as in the upper jaw. The general colour is glossy black, with the exception of the back, rump, and sides of the belly, which are white, and separated by a defined line from the parts that are black." (Raffles.)

The habits of this species in a state of nature are probably similar to those of the American Tapirs. In captivity, Major Farquhar describes it as of a mild and gentle disposition. "It became as tame and familiar as a dog; fed indiscriminately on all kinds of vegetables, and was very fond of attending at table to receive bread, cakes, or the like." Sir Stamford Raffles adds, that the living specimen sent from Bencoolen to Bengal was young, and became very tractable. It was allowed to roam occasionally in the park at Barrackpore, and the man who had charge of it informed Sir Stamford that it frequently entered the ponds, and appeared to walk along the bottom under water, and not to make any attempt to swim. Sir Stamford also states that the flesh is eaten by the natives of Sumatra.

The individuals which have been exhibited in the Regent's Park Gardens have been very mild and gentle.

T. Americanus (Gmel.), the American Tapir. General colour throughout deep brown approaching to black. Sides of the lower lip, band on the under and middle part of the chin, upper edges of the ears, and naked line at the bottom of the hoofs, pure white. Scanty hair of the body very short, closely adpressed to the surface, hardly distinguishable at a short distance. The skin beneath it is of great density, being, according to M. Roulin, not less than seven lines thick on the back, and eight or nine lines on the cheek, and so tough that Sonnini frequently shot at a female which was crossing the river with her young without disturbing her or making her turn out of her course, though he saw the impression of a ball which he had fired on the animal's cheek. There is a thick rounded crest on the back of the neck, extending from the forehead as low as the level of the eyes to the shoulders, and bristled with a not thick mane of stiff blackish hairs. Mr. Bennett remarks that it is peculiar to the present species, but is not found, according to M. Roulin, in the female of Guyana; although D'Azara states that the female is equally furnished with it in Paraguay. In the female brought by Lieut. Maw from Para, and formerly in the menagerie of the Zoological Society of London, it was very conspicuous. Head very long; muzzle prolonged and covered above with hair of the same colour as that of the body, but naked and flesh-coloured at its extremity (which is flattened) and underneath; eyes very small, of a dull lead-colour.



Malay Tapir (*Tapir Malayanus*).

The colour of the individual dissected by Mr. Yarrell was rusty reddish-brown, with indications of lighter spots and horizontal lines on the ribs, flanks, and thighs. "These fawn-coloured spots and stripes," says Mr. Yarrell, "are common to both species of Tapir [the Sumatran and the American species then known are meant] while young; that of Sumatra not exhibiting till it is six months old any appearance of the well-defined black and white colour which afterwards distinguishes the adult animal." ('Zool. Journ.,' vol iv.)

This species is a native of South America. "Few animals of equal size," says Mr. Bennett, "have so extensive a range as the American Tapir. It is found in every part of South America to the east of the Andes, from the Straits of Magellan to the Isthmus of Darien; but appears to be most common within the tropics. M. Roulin dwells upon it as a singular fact that although it occurs as far as 40° south of the equator, it ceases suddenly at about 8° north, in a situation where it is extremely abundant, and where no adequate cause has yet been assigned to bar its further progress, no large rivers nor lofty mountains intervening, nor any change in the character of the vegetation of the country being manifest. The left bank of the Atrato near its mouth, and the part of Darien inhabited by the independent Indians, may be considered as its northern limit. Its highest range, in the province of Maraquita at least, appears to be from 3000 to 3600 feet above the level of the sea, while the new species discovered by M. Roulin is only met with at a much greater elevation."

The inmost recesses of deep forests are the chosen haunts of this species, which is not gregarious, and flies from the proximity of man. It is for the most part nocturnal in its habits, sleeping or remaining quiet during the day, and at night seeking its food, which, in its natural state, consists of shoots of trees, buds, wild fruits, &c. If we are to believe D'Azara, and he was an accurate observer, it is very fond of the barréro, or nitrous earth of Paraguay. It is however a most indiscriminate swallower of everything filthy or clean, nutritious or otherwise, as the farrago found in the stomach of the individual dissected by Mr. Yarrell showed. Pieces of wood, clay, pebbles, and bones are not unfrequently taken out of the stomachs or those which are killed in the woods; and one kept by D'Azara gnawed a silver snuff-box to pieces and swallowed the contents.

It is a powerful animal, and everything in the underwood of the forest gives way to its rush. It is in the habit of making runs or roads through the brushwood, and these beaten tracks are usually selected by travellers in passing through the forests.

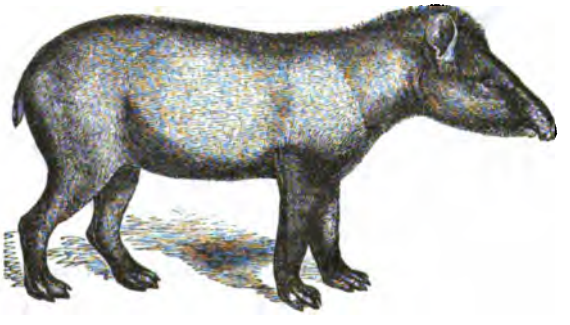
Quiet and peaceable in its demeanour, it is hunted for the sake of its tough hide and its flesh, which, though not liked by the European (for it is coarse and dry), is relished by the unsophisticated palate of the Indian.

The lasso is not often employed in its capture, not only from its haunts being generally unfavourable to that mode of hunting, but because its determined rush and strength will at a single effort snap the line which is strong enough to arrest the career of a bull. The hunters will sometimes lie in wait with their dogs near a Tapir's road as evening approaches, and so get between him and the water to which he usually directs his course for the purpose of bathing and wallowing at the commencement of his nocturnal career. He makes a good fight, and inflicts severe wounds upon the dogs with his teeth, especially if he can reach the water, where he stands at bay, breast deep, and defies the fiercest of them; for as they are compelled to swim to the attack, the Tapir bides his time, and seizing them by the backs of their necks as they successively come within his reach, shakes them off, not without biting a piece out.

But it would seem that the most common method of catching them is by imitating their sharp but not very shrill whistle, and thus bringing them within shot of the Indian's poisoned arrow.

Lieut. Maw, who brought a young animal of this species to England, speaks of it as feeding upon herbs and the branches of trees, and going much into the water, walking along or rather perhaps across the bottoms of rivers.

This species is mild in captivity, and easily domesticated. Sonnini states that tame Tapirs are permitted to go at liberty through the streets of the towns of Guyana, and to wander into the woods, whence they return in the evening to the house where they are kept and fed. He adds that they are capable of attachment to their owner, and expresses his opinion that care and attention might convert its qualities of strength, docility, and patience, to account as a beast of burden.



American Tapir (*Tapirus Americanus*).

But this is not the only American Tapir; for M. Roulin laid before the French Academy a description and figures of a new species inhabiting the mountainous parts of the same districts, the plains of which are frequented by the other; and his account is given in the 'Annales des Sciences Naturelles:' from this it would appear that the American Tapir of the mountains is more nearly allied to the Asiatic species than the American Tapir of the plains.

The Tapirs are closely allied in structure to the fossil genus *Palæo-*

therium. Three species, *T. Mastodontoides*, *T. priscus*, and *T. Avernensis* have been described as fossil, occurring in the tertiaries of France and Germany. The fossil genera, *Coryphodon* and *Lophiodon*, are referred by Professor Owen to the *Tapiroida*. [CORYPHODON; LOPHIODON; PALÆOTHERIUM.]

TAR, a resinous product obtained from the burning of the wood of *Coniferæ*. [TAR, in ARTS AND SC. DIV.]

TARAGUIRA. [IGUANIDÆ.]

TARANDUS. [CERVIDÆ.]

TARA'NTULA, the *Aranea Tarantula* of Linnæus, a species of spider of the genus *Lycosa* of Latreille. It is one of the largest of European spiders, and is found in the countries bordering the Mediterranean, where its bite is dreaded, and believed to be curable only through the effects of music. In reality however its venomous powers have been greatly exaggerated. According to Walcknaer several distinct species have been confounded under the name of *Tarantula*.

TARDI'GRADA, Cuvier's name for the first family of the *Edentata*, comprising, of living genera, the Sloths only. [AI; UNAU.] The *Tradigrada* form the eighth order in Illiger's method, and comprise the Sloths and *Prochilus*; but the latter cannot be said to have any claim to such a collocation. [BRADYPUS; BEAR.]

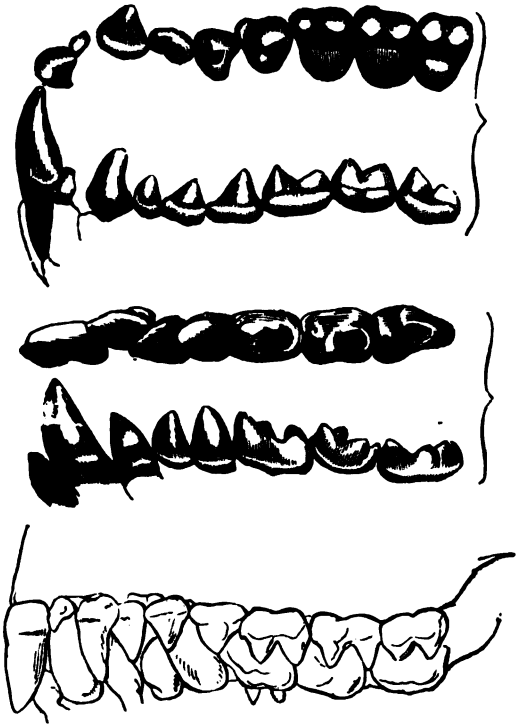
TARDI'VOLA (Swainson), a genus of Birds belonging to the subfamily *Tanagrinæ*.

TARRAGON. [ARTEMISIA.]

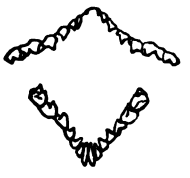
TA'RSIUS (Storr), a genus of Animals belonging to the family *Quadrumana*. It has the following characters:—Head rounded; muzzle short; eyes very large; posterior limbs very much elongated, with the tarsus thrice as long as the metatarsus. Tail long.

Dental Formula:—Incisors, $\frac{4}{2}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6}=34$.

T. Bancanus. Dr. Horsfield remarks, that although the *Tarsius* from Banca agrees in the essential points with the other species of this singular genus which have hitherto been discovered, it has no intermediate front teeth, and the exterior tooth on each side is, compared with the other species, very minute. Counting (with Desmarest) one canine tooth on each side, above and beneath, it has, says Dr. Horsfield, only five grinders in each jaw.



Teeth of *Tarsius*, much larger than the natural size. (F. Cuvier.)



Front view of the Teeth of *Tarsius Bancanus*. (Horsfield.)

The hands of this creature are small and delicate, and externally covered with a very soft down. Internally they are naked. The nails of all the fingers of the hand, as well as of the thumb and the third and fourth finger of the feet, are triangular, and represent a delicate compressed scale: on the index and middle finger of the feet they are erect, sharp, compressed, slightly curved, and not inaptly compared by Mr. Fischer to the thorns of a rose-bush, constituting one of the essential characters of this genus. The body is handsomely formed, and, as in the other species, somewhat contracted towards the pelvis; the lower extremities also have in general a similar character, but the tarsus has less of the extravagant length which is common to the other *Tarsii*. The fur is remarkably soft to the touch; it is composed of a thick and very delicate wool, which envelops the body, head, and extremities, forming a coat of an unequal surface, from which irregular straggling hairs project; at the root of the tail, and at the hands of both extremities, it terminates abruptly in the form of a ring. The general colour is brown, inclining to gray; on the breast, abdomen, and interior of the extremities it is gray, inclining to whitish; a rufous tint is sparingly dispersed over the upper parts, which shows itself most on the head and extremities; the naked parts of the tail near the root are considerably darker than the extremity. ('Zoological Researches in Java.')

Dr. Horsfield obtained this animal in Banca, near Jeboos, one of the mining districts, where, he says, it inhabits the extensive forests in the vicinity.

Tarsius Bancanus. (Horsfield).

TARSUS. [SKELETON.]

TARTAR. [POTASSIUM.]

TATOUAY. [ARMADILLO.]

TAUTOLITE, a Mineral which occurs crystallised. Primary form a right rhombic prism. Fracture conchoidal, uneven. Hardness 6·5 to 7. Very brittle. Colour velvet-black. Streak gray. Lustre vitreous. Opaque. Specific gravity 3·865. Before the blow-pipe, on charcoal, melts into a blackish scoria, which is attracted by the magnet: with borax it forms a clear green glass.

It is probably a silicate of protoxide of iron, and silicate of magnesia. It is found in the volcanic rocks of the Lake of Laach, near Bonn, on the Rhine.

TAXA'CEÆ, *Taxads*, a natural order of Plants belonging to the class *Gymnospermæ*. This order possesses the following essential characters:—The flowers are monœcious or diœcious, and are naked, or solitary surrounded by imbricated bracts, or in spikes surrounded by bracts. The male flowers have no calyx, and several stamens, mostly united at the base, with the anthers either combined or distinct. The female flowers are solitary and naked; the ovules are naked, with the foramen at the apex. The seeds are hard, and are sometimes surrounded by a succulent, coloured, cup-shaped pericarp,; they possess fleshy albumen, and a straight dicotyledonous embryo. The plants of this order are trees or shrubs, having a woody tissue marked with circular discs, with evergreen and mostly narrow rigid entire and veinless leaves.

This order is very characteristic of the class to which it belongs, in the absence of any regularly formed ovary, and the consequent exposed or naked state of the ovule and seeds. In this respect it

offers a lower state of organisation than the *Coniferæ*, or Pine Tribe, the ovules of which have a kind of protection in the hardened scale-like bracts which constitute the cones of that order. The foliage also of *Taxaceæ* differs from *Coniferæ* in their possessing a greater tendency to expand and form veins within their tissue. In the few species of *Taxaceæ* that possess veins, they are not straight and parallel, as in Endogens, but are forked and of a uniform thickness, similar to those possessed by the higher forms of *Cryptogamia*, as the Ferns.

This order consists of plants that are but thinly distributed on the surface of the earth. They are mostly natives of temperate parts of Europe, Asia, Africa, and America. The order yields trees which are valued for their timber, and, like *Coniferæ*, possess resinous properties. The branches of the *Dacrydium taxifolium* are used in New Zealand for making spruce-beer. [TAXUS; SALISBURIA.]

TAXICORNES, the second family of the Heteromerous *Coleoptera*, in Latreille's arrangement of Insects. They have no corneous tooth on the inner side of the maxillæ; they are all winged insects, with nearly square bodies, and a thorax which conceals or receives the head; they have short antennæ, and legs adapted for walking only. They live in *Fungi*, beneath the bark of trees, or on the ground under stones. This family is divided into two tribes, of which the genera *Diaperus* and *Cossyphus* are respectively the types.

TAXITES, a genus of Fossil Plants from Stonesfield.

TAXO'CRINUS. [ECHINODERMATA.]

TAXO'DIUM (from 'taxus'), the name of a genus of Plants belonging to the natural order *Coniferæ*. The plants of this genus are monœcious. The male flowers are arranged in catkins of a roundish form, disposed in racemose panicles; the pollen of each flower is contained in five cases, which are attached to the scale at its inner face. The female flowers are also arranged in small round catkins, two or three of which are attached near to the base of the spike of the catkins of male flowers. The ovules are two in each receptacle. The fruit is a globose strobilus, with peltate-angled scales; the seeds are angled with very thick integuments; the embryo with from 5 to 9 cotyledons. The leaves are linear, disposed in two ranks, and are deciduous. This genus has been distinguished from *Cupressus*, principally on account of the arrangement of its male catkins in racemose panicles, the small number of flowers in the female catkins, and the numbers of cotyledons possessed by the embryo.

T. distichum, Deciduous Cypress. This tree was introduced into Europe from North America as early as 1640. It is characterised by two-rowed, flat, deciduous leaves; leafless and panicled male flowers, and somewhat globose strobili. It is an elegant tree, and attains a height of 120 feet in its native soil. The first plant that is mentioned as existing in this country was grown in South Lambeth, and was raised from seeds brought from Virginia. Since then it has been introduced in various parts of Great Britain, and many fine specimens are now to be found. In its native districts in North America it is exceedingly abundant, and in many parts, as in Louisiana, it entirely occupies thousands of acres of the low grounds, which are thence called Cyprières, or Cypress Swamps. It is found in Delaware, on the banks of the Indian River, in 38° 50′ N. lat., which is its northern boundary, and proceeding southward it is abundant in the swamps of Virginia, the Carolinas, Georgia, and Florida.

In America, where the tree grows, its wood is used for all the purposes to which timber is applied. A number of varieties have been named. The most common is the *T. d. patens*, which has horizontal branches. Another, with pendulous branches, is known as *T. d. pendulum*; a third, with pendulous first year's shoots, as *T. d. nutans*. Other species of the genus have been described, but are not yet used or cultivated.

(Loudon, *Arb. et Frut. Brit.*, vol. iv.)

TAXUS ('taxus,' Latin), the name of a genus of Plants, the type of the natural order *Taxaceæ*. This genus is monœcious; the perianth of the barren flowers is single at the base; the stamens are numerous, with peltate anthers 6-8-celled, the opening beneath. The fertile flowers have a single urceolate scaly perianth; no style; and a fleshy drupaceous fruit, perforated at the extremity. The species of this genus are evergreen trees, with numerous mostly linear entire leaves. They are natives of Europe and North America.

T. baccata, Common Yew, has its leaves 2-ranked, crowded, linear, flat, with the flowers axillary, sessile; the receptacle of the barren flowers globular. The common yew is well known. It is indigenous to most parts of Europe, and is found in every part of Britain and Ireland. It is seldom seen growing in company with its own species, but alone, or with other species of plants.

The yew is a low tree, the trunk rising 3 or 4 feet from the ground, and then sending out numerous spreading branches, forming a head of dense foliage, which, when full grown, may be sometimes 30 or 40 feet high. It is of slow growth, attaining under favourable circumstances a height of 6 or 8 feet in ten years, and 15 feet in twenty years. The tallest yew in England is in the churchyard at Harlington, near Hounslow, and is 58 feet high. A tree continues growing for about 100 years; it mostly ceases to grow at that age, but will live for many centuries. The yew-trees at present existing at Fountains Abbey in Yorkshire are supposed to have attained their full growth when the abbey was erected in 1132.

The remarkable characters and properties of the Yew have drawn towards it at all times much attention. Dioscorides, Pliny, and Theophrastus, mention its poisonous properties. Cæsar ('Bell. Gall.,' vi. 31) relates that Cativolcus, king of the Eburones, committed suicide by swallowing the juice of the Yew. Plutarch says that its fruit is poisonous, and that its shade is fatal to all who sleep under it. This is also stated by Pliny; but there must have been some mistake on some of these points, as it is now well known that the fruit of the Yew may be eaten with impunity, and that its shade is not more deadly than that of other trees.

The Yew appears to have been employed from the earliest times in the manufacture of bows, and was used for this purpose by the nations of antiquity. The bows used by the English previous to the introduction of gunpowder were made of Yew, and there are many allusions amongst English poets to this use of its wood.

There are several remarkable specimens of old Yews existing in this country. Those at Fountains Abbey are said to have sheltered the monks whilst that magnificent pile was erecting. The Tytherley, Fortingal, Arlington, and Loch-Lomond Yews are remarkable for their size and age. Many of them, if we estimate their age in the mode proposed by De Candolle, must exceed considerably a thousand years.

TEA. [THEA.]

TEA, PARAGUAY, or MATE', is the produce of a plant belonging to the family *Aquifoliaceæ*. It was formerly supposed to be the produce of the *Ilex vomitoria*, which is found in North America, in the Carolinas, and Florida; but, from specimens sent from Brazil to Mr. Lambert, it appears to be a distinct species, which he has named *Ilex Paraguanensis*. It is a shrub attaining the size of the orange-tree; it is quite smooth, with bluntish wedge-shaped remotely serrated leaves, with umbelliferous flowers seated in the axils of the leaves. It is the Ilex Maté of Saint Hilaire, and grows wild in Paraguay and Brazil, and is called by the Spaniards Yerva Maté. The leaves of this shrub are in great repute amongst the inhabitants of South America, and are used in infusion in a similar manner to the Tea of China. Upwards of 5,000,000 lbs. of the leaves of this tree are annually collected in Paraguay, and are sent to Chili and the vice-royalty of Buenos Ayres. It is not cultivated, and merchants carry various articles of use into the interior, which they give the natives for their labour in collecting the leaves of the plant. After the branches are cut away, the ground is heated by means of a fire, and the branches being laid upon the heated ground, are dried, and afterwards they are beaten and pressed into bags, in which state it comes into the market. There are three kinds known in the market: the Caa-Cuys, which is the bud of the leaf; the Caa-Mini, the leaf torn from its midrib and veins without roasting; and the Caa-Guasu, or Yerva de Palos of the Spaniards, the whole leaf with the petioles and small branches roasted. The first does not steep well, and is seldom seen. The plant when used is steeped in boiling water, to which a little sugar and sometimes lemon-juice is added. It is drunk out of a vessel called maté, which has a spout perforated with holes for the purpose of preventing the powdered herb from passing out with the fluid. The Creoles are passionately fond of this infusion, and never partake of a meal without it. The properties of this plant are sedative and stimulant.

Another species of *Ilex*, the *I. Gonghona*, found in Brazil, is applicable to the same purposes as the last; and although inferior in quality, was used extensively as a substitute for the true Paraguay Tea, when the export of the latter from Paraguay was forbidden by the Dictator Francia.

The *I. vomitoria* produces the Cassena of Florida and the Carolinas, which is used for the purpose of correcting the flavour of water.

TEAK. [TECTONA.]

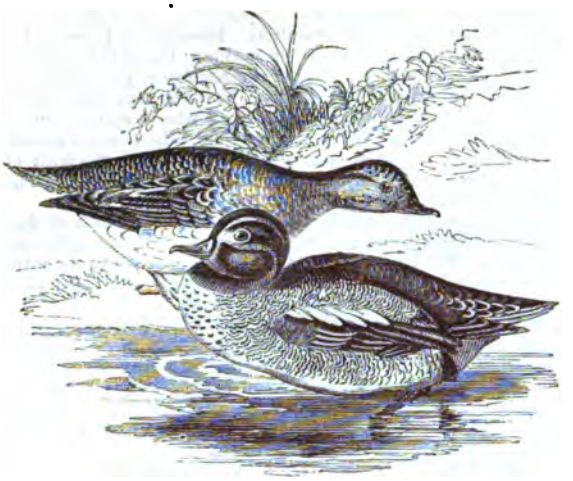
TEAL, the common name of a Natatorial Bird belonging to the family *Anatinæ*. [DUCKS.] This bird is the *Querquedula crecca*, Steph.; the *Anas crecca*, Linn. It is one of the smallest of the *Anatidæ*, and most beautiful of ducks. It is the Sarcelle, Petite Sarcelle, Cercelle, Cercerelle, Alebrande, Garsote, and Halebran, of the French; Cercedula, Cercevolo, Scavolo, Sartella, Anitrella, and Anitra d'Inverno, of the Italians; Spiegel-Entlein and Kriekente of the Germans; Winter Taling of the Netherlanders; Arta and Krocka of the Swedes; Kestelort-And of the Norwegians; Krik-And of the Danes; Cor Hwyad and Brach Hwyad of the Welsh.

This species is one of the most delicate of the ducks. Willughby remarks that, for the taste of its flesh and the wholesome nourishment it affords the body, it "doth deservedly challenge the first place among those of its kind."

In the 'Portraits d'Oyseaux' (1557), the following quatrain celebrates its excellence, and alludes to its habits:—

> "Bien peu souvent se plonge la sarcelle
> Entre deux eaux, de laquelle la chair
> Est delicate: aussi couste elle cher
> Autant qu'oyseau qui soit petit comme elle."

Accordingly we see it holding a high place in ancient feasts. We find it among the 'goodly provision' at the banquet given at the enthroning of George Nevell, archbishop of York, in the reign of Edward IV.: 'Mallardes and Teales, 4000.' The price in the Northumberland Household Book is—'Teylles, 1*d.*,' mallards being 2*d.*



Common Teal (*Querquedula crecca*).

TEAZLE. [DIPSACUS.]

TECO'MA (from Tecomaxochitl), a genus of Plants belonging to the natural order *Bignoniaceæ*. It has a campanulate 5-toothed calyx, a short-tubed corolla with a campanulate throat, and a 5-lobed bilabiate limb; 4 didynamous stamens with a sterile filament of a fifth; a bilamellate stigma; a silique-formed 2-celled capsule, having the dissepiments contrary to the valves; the seeds winged, disposed in 2 rows. The species are erect trees or shrubs or scandent plants, with unequally pinnate or digitate simple leaves with terminal panicles, and yellow or flesh-coloured flowers. They are natives of the Old and New World in tropical and sub-tropical climates. They are all elegant plants, and well worthy of cultivation.

T. radicans is a climbing glabrous plant with rough rooting branches. It grows against a wall by throwing out roots from its branches in the same manner as ivy. It has large flowers, which are called Trumpet-Flowers.

T. stans is a small tree. Its roots are reputed diuretic.

Several other species of *Tecoma* have reputed medicinal virtues. *T. speciosa* is said to be a useful diuretic, also a cathartic. *T. impetiginosa* and *T. Ipe* contain large quantities of tannin.

TECTIBRANCHIA'TA, Cuvier's name for the fourth order of Gasteropodous *Mollusca*, and described by him as having the branchiæ attached along the right side, or on the back, in form of leaves (feuillets) more or less divided, but non-symmetrical. The mantle covers them more or less, and contains nearly always in its thickness a small shell. The *Tectibranchiata* approach the *Pectinibranchiata* in the form of the organs of respiration, and live, like them, in the waters of the sea; but they are all hermaphrodites, like the *Nudibranchiata* and the Pulmoniferous *Mollusca*. [PECTINIBRANCHIATA; NUDIBRANCHIATA.]

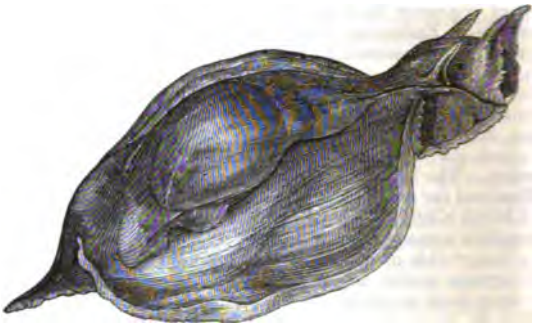
The following genera are comprehended by Cuvier under this order:—*Pleurobranchus*, Cuv.; *Pleurobranchæa*, Meckel (*Pleurobranchidium*, Blainv.); *Aplysia*, Linn.; *Dolabella*, Lam.; *Notarchus*, Cuv.; *Bursatella*, Blainv.; *Akera*, Müll.; *Gastropteron*, Meckel; and *Umbrella*, Lam.

Of these, *Pleurobranchus*, *Pleurobranchæa*, and *Umbrella* are treated of in the article SEMIPHYLLIDIANS; and *Akera*, or *Acera*, and *Gastropteron*, or *Gastroptera*, under the article BULLIDÆ. *Aplysia*, or *Laplysia* (for Linnæus writes it both ways), *Dolabella*, and *Notarchus* therefore remain to be noticed here.

Aplysia.—Edges of the foot raised into flexible crests and surrounding the back on all sides, being capable even of being reflected upon it; head carried on a neck more or less long; two upper tentacles hollowed like the ears of a quadruped; two others flattened at the edge of the lower lip; eyes below the first. On the back are the branchiæ, in form of very complicated leaves (feuillets), attached to a large membranous pedicle, and covered by a small pedicle equally membranous, which contains in its thickness a horny and flat shell. The anus is pierced behind the branchiæ, and is often hidden under the lateral crests. The vulva is in front on the right, and the penis comes out under the right tentacle. A furrow, which extends from the vulva to the extremity of the penis, conducts the semen at the time of coition. An enormous membranous crop leads to a muscular gizzard, armed within with cartilaginous and pyramidal corpuscles, which accompany a third stomach beset with pointed hooks, and a fourth in form of a cæcum. The intestine is voluminous. These animals feed on sea-weed (*Fucus*). A particular gland pours out by an orifice situated near to the vulva a limpid humour, which is said to be very acrid in certain species; and from the border of the mantle here oozes abundantly a deep purple liquor, with which the animal colours the sea for a considerable distance around when it perceives any danger. The eggs are deposited in long interlaced glairy filaments, delicate as packthread.

Cuvier instances as examples from the European seas, *A. fasciata* *A. punctata*, and *A. depilans*.

A. depilans. Blackish, with large cloudy grayish spots or blotches, or of different shades of brown tinged with blue or purple. It is found in European seas, where it adheres to rocks.

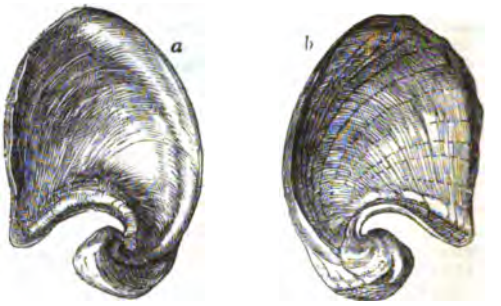


Aplysia depilans.

Dolabella.—Cuvier observes that this form only differs from the *Aplysiæ* in having the branchiæ and that which surrounds them at the posterior extremity of the body, which resembles a truncated cone. Their lateral crest, he adds, does not close on the branchial apparatus, leaving a narrow furrow, and their shell is calcareous.

The species are found in the East Indian seas and Mediterranean, where it has been found at a depth of six fathoms on sands.

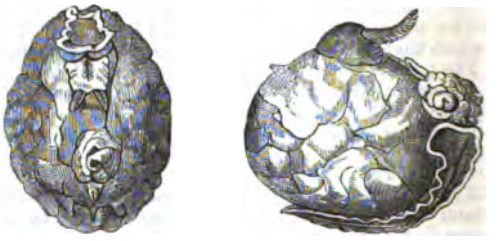
D. Rumphii may be given as an example.



Shell of *Dolabella Rumphii*. *a*, inside; *b*, outside.

Notarchus.—Animal furnished with a very small dorsal slit, which is sometimes oblique; foot elongated, and rather narrow; branchiæ often very long, and capable of being protruded out of the cavity operculum rudimentary or null; shell absent.

N. Cuvieri is an example.



Notarchus Cuvieri.

TE'CTONA, a genus of Plants belonging to the natural order *Verbenaceæ*. It is characterised by having a 5-6-toothed calyx, which becomes inflated over the growing pericarp; corolla 1-petalled, 5-6-cleft; stamens 5, but often 6; germ superior, 4-celled; cells 1-seeded, attachment central; drupe obtusely 4-sided, woolly, spongy, dry, hid in the calyx. Nut hard, 4-celled. Seed solitary; embryo erect, without perisperm.

The only species is the Teak-Tree, which grows to an immense size, and is remarkable for its very long leaves, which are from 12 to 24 inches long and from 8 to 16 inches broad, and are compared by oriental writers to the ears of the elephant. The best teak-timber for ship-building was supplied to Bombay from the mountains of the Malabar Ghauts, where the tree is found rather in detached clumps, of some extent however, than in extended forests. It is also found on the mountainous parts of the Coromandel coast, along the banks of the Godavery up to Poloonsha. It proceeds far into the interior of India, and may be seen in the mountains of Bundulcund, in the form however of only a moderate-sized shrub. Dr. Roxburgh introduced the Teak into the low grounds of the Circars as early as 1790, and

Lord Cornwallis and Colonel Kyd planted it in Bengal about the same time. The Calcutta Botanic Garden contains a number of these trees. From the Saharunpore Botanic Garden, in 30° 9′ N. lat. (where, its buds being covered with scales, it is enabled to resist cold, besides its leaves falling and giving it a season of rest), the tree has been spread along the Doab Canal; the whole of the intermediate country is suited to its cultivation, and the East India Company have ordered the Malabar forests to be preserved. The most extensive forests are however those extending along the banks of the Irrawady, especially in Pegu. [TEAK, in ARTS AND SC. DIV.]

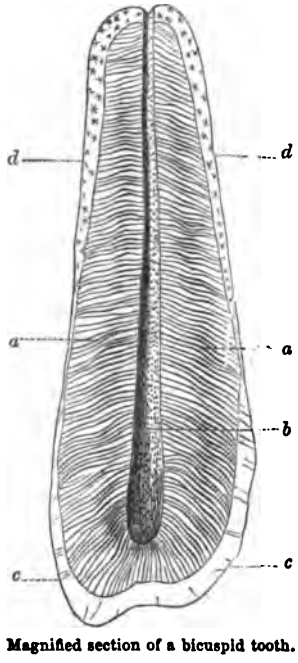
TECTURA, synonymous with *Patelloidea*. [PATELLOIDEA.]

TEESDA'LIA (named after Robert Teesdale), a genus of Plants belonging to the natural order *Cruciferæ*. It has a roundish notched pouch, boat-shaped valves, their backs keeled below, narrowly winged above; the seeds two in each cell; the petals either equal or the two outer ones larger. The species are small annual herbs. The flowers usually small and white.

T. nudicaulis is the *T. Iberis* of De Candolle. It has unequal petals and numerous leaves spreading on the ground; the stamens with remarkable scales within, the pouch emarginate. It is found in sandy and gravelly places in England, France, Germany, Denmark, and Sweden. It is the only British species. *T. lepidium* is a native of Europe, particularly of Spain. It differs but little in general characters from the former species; there are two varieties of it.

TEETH, in the Animal Kingdom, are those hard organs situated in the mouth, by which food is seized by many animals and masticated by others. In the Fishes and Reptiles the teeth are organs of prehension only, but in most of the *Mammalia* they serve both for prehension and mastication. The characters of the teeth of the various classes and families of animals are given with the descriptions of the animals in this work. We shall here only refer to the general structure of the human tooth, which may be regarded as the type of all dental structures.

Fig. 1.



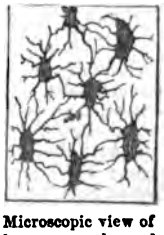
Magnified section of a bicuspid tooth.

The best method of preparing teeth for microscopic examination is to immerse them in dilute hydrochloric acid, till their earthy matter is so far dissolved that thin transparent slices may be cut from them with a knife; or, without softening them in acid, to make thin sections in the vertical and other directions with a fine saw, and to reduce these to the necessary thinness and transparency by filing them, and polishing them on a hard and smooth whetstone. For general examination, lenses magnifying about 50 diameters are sufficient.

In such a vertical section of a tooth three distinct substances are seen, namely, the dentine or ivory (*fig.* 1, *a a*), which forms the greater mass, and, as it were, the mould of the tooth, and which contains the pulp cavity (*b*); the enamel (*c c*), by which the crown or exposed part of the tooth is covered; and the bone, cement, or crusta petrosa (*d d*), which forms a thin layer around the fang, except at that part at which the vessels enter the pulp, and is continued in a finer and scarcely perceptible layer over the enamel.

The bone, or cement, has in each animal a minute structure similar to that of which the bones of its skeleton are composed. In man it consists of a basis of homogeneous substance, a compound of cartilage and earthy matter, in which there are minute cavities (*fig.* 2) with delicate branched canals leading from one to the other. On the walls of these canals and cells the earthy matter is deposited more thickly than in the intermediate spaces, so that when examined by transmitted light they appear black or dark gray. The cavities, or bone-corpuscles, in man are round and oval, and flattened; most of them are between $\frac{1}{2400}$th and $\frac{1}{1800}$th of an inch in length, and about one-third as much in breadth and one-sixth as much in thickness. They have somewhat jagged edges, from all parts of which there proceed the fine branching canals, to which the name of calcigerous has been given, and which traverse the homogeneous basis of the bone, and communicate irregularly with one another. The diameter of these canals at their largest parts is not more than $\frac{1}{12000}$th of an inch; that of their smaller branches is between $\frac{1}{20000}$th and $\frac{1}{30000}$th of an inch. Their general direction is towards the axis of the tooth, around which the corpuscles are arranged in concentric circles.

Fig. 2.



Microscopic view of bone-corpuscles and calcigerous canals.

The enamel is composed of solid prisms, or fibres (*fig.* 3, *a a*), about $\frac{1}{2500}$th of an inch thick, set side by side and upright upon the ivory of the crown of the tooth (*b*). One end of each prism is fixed in a little depression on the rough outer surface of the ivory; the other, which is somewhat larger, is turned towards the masticating surface of the tooth in the direction in which the chief external pressure is to be resisted. The course of the prisms is more or less wavy, their curves being for the most part parallel (*fig.* 4), but sometimes opposed. Most of them extend from the ivory to the surface of the tooth; and where they do not, small complemental prisms fill up like wedges the vacant spaces.

Fig. 3.

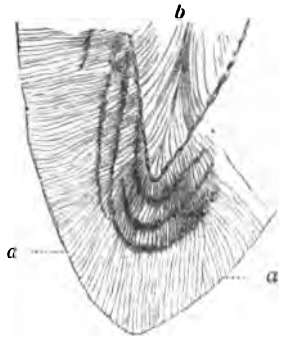
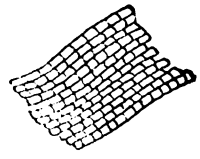


Fig. 4.

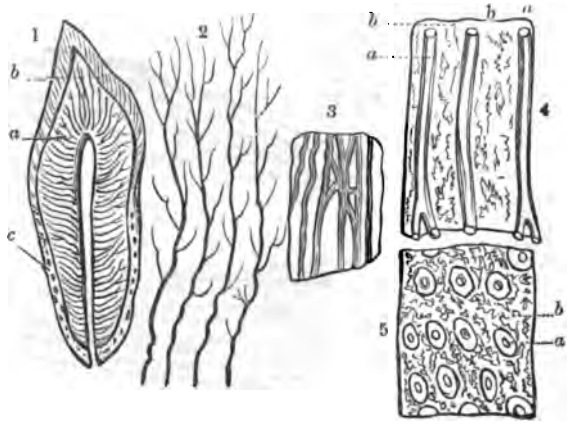


Small collection of enamel-fibres.

View of the arrangement of the enamel-fibres on the crown of an incisor tooth.

In the perfect state the enamel contains so small a quantity of animal matter, that it cannot be demonstrated to the sight, and the prisms are inseparably consolidated; but in young teeth it is soft, and may be broken up into its elementary parts. In the early state also it exhibits portions of a membranous animal substance, consisting of the cells in which each of its prisms was formed; for, as will be presently shown, the earthy matter is deposited in what might be called a set of moulds formed by the primary cells of the enamel membrane, and, as it accumulates, the membrane of the cell is so nearly removed, that in the perfect tooth no portion of it can be discerned. Its former existence however seems to be indicated by fine close-set transverse striæ upon each prism of the enamel.

Fig. 5.



1, longitudinal section of a canine tooth, showing the three tissues: *a*, the dentine or ivory; *b*, the enamel; *c*, the cement or dental bone.

2, dental tubes as seen by a low power.

3, a longitudinal section of dentine, showing a dentinal tube dilated, and sending off anastomosing branches.

4, longitudinal section of dentine, highly magnified: *a*, the dentinal tubes; *b*, granular intertubular structure.

5, transverse section of dentine: *a*, the tubes, showing their parietes and area; *b*, the intertubular tissue.

The dentine is made up of two distinct parts: first, dentinal tubes; secondly, intertubular tissue. The tubes have distinct parietes, equal in thickness to their calibre. In some instances they appear to contain a minute granular matter, but in many, perhaps in the majority of cases, they are perfectly free from solid contents. If a vertical section, passing through the pulp-cavity, be taken for examination, the dental tubes may be traced from their commencement on the surface of the pulp-

cavity, to their termination at the junction of the cement, and the dentine on the enamel of the latter, or they may be seen passing into these external structures. The tubuli commence at a right angle with the surface of the pulp-cavity, and proceed outwards towards the surface of the tooth, giving out in their way numerous small branches, which, meeting with other similar branches from neighbouring tubes, anastomose with them, or meeting with simple cells in the intertubular tissue, there terminate. Towards the surface of the dentine it is not uncommon to see a tube alter its course, and by joining another, form a loop. The tubes all commence in the pulp-cavity, and pass outwards towards the surface of the dentine. Their course, as regards each other, is divergent, so that the proportion of the intertubular tissue increases relatively as their distance from the pulp-cavity is greater or less. This preponderance of the intertubular over the tubular tissue near the periphery of the tooth is however in a considerable degree lessened by the more frequent branching of the tubes, and by the occurrence of cells near the surface of the dentine. If a single tube be traced through its whole extent, it will be found to make two undulations; and in addition to these, which are called the primary curves, a number of smaller undulations. In examining this structure a thin section may be taken from the fang, and, with the aid of the microscope, viewed by transmitted light. A tube will then appear as a very definite dark line pursuing its tortuous but definite course towards the surface, giving out numerous minute branches on its way, and at last dividing into two terminal branches, which end either by passing into a cell of the intertubular tissue, or by anastomosis with a collateral tube, or by passing into the cement. If a section of the dentine and enamel be taken, then the tubes will be seen to give out comparatively few branches till they come near to the latter, when they divide and anastomose freely, and some few terminal branches may be traced entering the enamel. It is by no means uncommon for a tube in its course to suddenly dilate and give out branches from the dilatation, then again contract, and pursue its original course. In such a case the dilatation forms a cell in every way similar to the bone-cell. The point of the greatest diameter of the dental tubes is at their commencement on the walls of the pulp-cavity, though in their course previous to the division of the trunk into two terminal branches they suffer but little loss in calibre. In tracing this structure in the teeth of various animals, we find every form of branching; sometimes the branches are few, in others extremely numerous; in some instances they are given out from one side of the tube only, in others from each side; but whatever the modification in the number or form of the branching given out, the primary tube always commences by an open extremity on the walls of the pulp-cavity, or upon the walls of a canal for a blood-vessel; and the direction taken by the tubes is invariably towards the periphery of the tooth, always anastomosing in their way by the numerous branches. In the temporary, and not unfrequently in the permanent teeth, the tubes, instead of presenting an uninterrupted line, present on their surface numerous indentations, just as though they were composed of a series of hollow beads, which were united and made to communicate with each other.

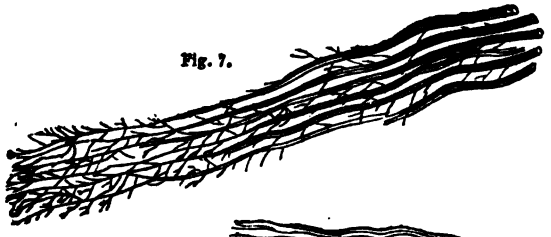


Fig. 7.

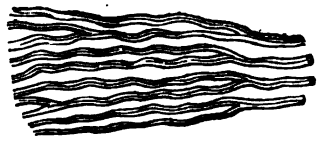


Fig. 8.

Views of the tubules of dentines.

The second part composing the dentine is the intertubular tissue, which occupies the spaces between the tubuli, everywhere surrounding and investing them, and thereby contributing greatly in rendering the whole dentine a solid dense mass, the area of the tubes and cells being the only hollow portion. In a favourable specimen of this tissue Mr. Tomes observed that it was composed of very minute granules, united to each other on all sides, thus forming a solid mass, of which, in character of formation, oolite would give a coarse illustration. The granularity is best seen near the external surfaces of perfect dentine, or in the tissue when developing. In the intertubular tissue, hemispherical or elliptical cells are found, especially near the surface of the dentine of the fang, where they form a layer joining the cement.

A separate organ is provided for the formation of each of these three constituent parts of the tooth, though, when they are perfected, they contain no vascular tissue but the pulp within the pulp-cavity; and it is doubtful whether, in the human subject, fresh material is ever formed from this after the tooth has once attained its complete development. The first appearance of the pulp of each tooth is in the form of a minute process or papilla rising from the bottom of a groove in the mucous membrane of the mouth behind the edge of the jaw. In course of time, as the borders of the groove grow around it, the papilla seems to sink into the mucous membrane; and it now appears as if rising from the base of a follicle, or of a flask-like depression, in the edge of the jaw. And lastly, processes of membrane, or operculs, grow from the sides of the mouth of the follicle, and as they approach each other and adhere by their mutually opposed edges, they gradually close it, and convert it into a capsule or sac, to the base of which the first-formed papilla is affixed. In the first-appearing tooth the papillary state may be seen in the human embryo an inch in length: the capsular stage is completed at about the fifteenth week of embryonic life.

These three stages of the formative organs of the tooth, namely, the papillary, the follicular, and the capsular, being completed, the substances of the tooth itself begin to be produced. The dentine is developed from the papilla, which gradually assumes the form and relations of the proper tooth-pulp; the enamel, from a special organ developed at that part of the capsule which is opposite to the papilla; and the bone probably from the interior of the capsule itself. The composition of the enamel and osseous portions of the teeth differs. The following analyses are given by Von Bibra:—

	Molar tooth of a woman aged 25 years.		Molar tooth of an adult male.	
	Enamel.	Osseous portion.	Enamel.	Osseous portion.
Phosphate of Lime, with a little Fuoride of Calcium	81·63	67·54	89·82	66·72
Carbonate of Lime	8·88	7·97	4·37	3·36
Phosphate of Magnesia	2·55	2·49	1·34	1·08
Soluble Salts	0·97	1·00	0·88	0·83
Cartilage	5·97	20·42	3·39	27·61
Fat	a trace	0·58	0·20	0·40

The osseous portion includes the dentine and cement.

TEETHING. [DENTITION.]

TEFFLUS. [CARABUS.]

TEIDÆ, a family of Saurian Reptiles. [SAURIA]. The following is a synopsis of the genera:—

I. Throat with two cross folds, with larger 6-sided scales between.

A. Ventral shields small, long, smooth. Tongue contractile.

1. *Teius.*—Toes 5-5. Femoral pores distinct. Two species.
2. *Callopistes.*—Femoral pores none. Toes 5-5. One species.

B. Ventral shields broad, smooth.

* Tongue elongate, sheathed at the base. Teeth compressed.

3. *Ameiva.*—Toes 5-5. Teeth 3-lobed. Six species.

** Tongue not sheathed, free at the base.

4. *Cnemidophorus.*—Teeth compressed longitudinally, 3 lobed. Toes 5-5. Six species.
5. *Dicrodon.*—Teeth compressed transversely, bifid. Toes 5-5. One species.
6. *Acrantus.*—Teeth compressed transversely, bifid. Toes 5-4. One species.

II. Throat with a collar of large shields.

a. Collar and ventral shields keeled. Tail round.

7. *Acanthopyga.*—Scales of back large, of sides granular. One species.
8. *Centropyx.*—Scales of back and sides moderate, in many series. One species.

b. Collar and ventral shields smooth, elongate. Tail round.

9. *Emminia.*—Scales of back rhombic, keeled, equal. One species.

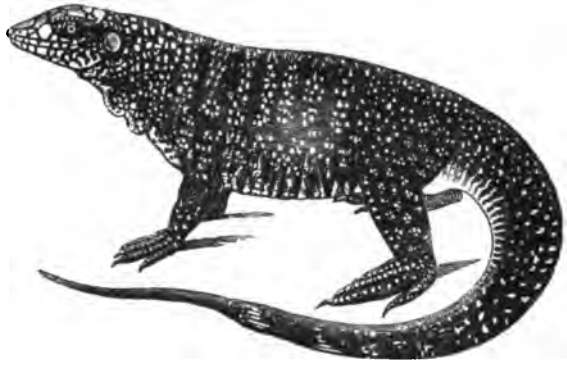
c. Collar and ventral shields smooth, elongate. Tail compressed.

10. *Crocodilurus.*—Scales of back equal, similar. One species.
11. *Custa.*—Scales of back unequal. Throat with a collar of large scales. One species.
12. *Ada.*—Scales of back unequal. Throat with two plaits. One species.

This family is well-illustrated by the *Teius Teguixin* of the British Museum Catalogue. It is the *Lacerta Teguixin*, Linn.; *Seps marmoratus*, Laurenti; *Lacerta Monitor*, Latr.; *Tupinambis Monitor*, Daud.; *Monitor Merianæ*, De Blainville, Van Hasselt and Kuhl, &c.; *Tejus Monitor*, Merr., &c.; *Monitor Teguixin*, Fitzing.; *Podinema Teguixin*, Wagl., Wiegm.; *Teguixin Monitor*, Gray; *Monitor Teguixin*, Eichw.; *Tejus Teguixin*, Schins.; Le Grand Sauvegarde d'Amerique, Cuv.; Variegated Lizard, Shaw; Great American Safeguard, Griffith's Cuvier.

The warm countries of America are the native places of the *Teidæ*, which arrive at a considerable size, often measuring as much as 4 or 5 feet in length. Messrs. Duméril and Bibron state that they ordinarily inhabit the fields and the borders of woods, although they never climb trees; but they also appear to frequent sandy, and consequently arid tracts, where they are said to excavate burrows, in

which they lay themselves up for the winter. When, in their flight to avoid pursuit, they come upon a lake, pond, or river, they plunge in, according to D'Azara, to escape from the danger which menaces them, and do not leave the water till all fear of danger is past. These Lizards, observe Messrs. Duméril and Bibron, have not, indeed, webbed feet; but their long and slightly compressed tail becomes, without doubt, under such circumstances, a sort of oar, of which they well avail themselves. D'Azara states that they feed on fruits and insects, and that they also eat serpents, toads, young chicks, and eggs. He also relates that they are fond of honey; and that in order to procure it without fear of the bees, they come forward at intervals, and, as they run away each time, give the hive a blow with their tail, till by repeated attacks they weary out the industrious insects, and drive them from their home.



Variegated Lizard (*Teius Teguixin*).

Head of Variegated Lizard.

TEIUS. [TEIDÆ.]
TELEOSA'URUS. [CROCODILIDÆ.]
TELESCO'PIUM. [ENTOMOSTOMATA.]
TELLI'NA. [CONCHACEA.]
TELLI'NIDÆ. [CONCHACEA.]
TELLUR-BISMUTH. [TELLURIUM.]

TELLU'RIUM, a Metal which was discovered in 1782 by Müller of Reichenstein, but its properties were more minutely examined by Klaproth sixteen years afterwards, and he gave it the name it now bears.

Native Tellurium is found crystallised and massive. Primary form a rhomboid, occurring in minute 6-sided prisms, the terminal edges of which are usually replaced. Cleavage parallel to the faces of the prism. Fracture indistinct. Hardness: scratches sulphate of lime, and is scratched by the carbonate. Easily frangible. Colour tin-white or steel-gray. Lustre metallic. Specific gravity 5·7 to 6·115. Before the blow-pipe it is very fusible, and burns with a greenish flame, and is volatilised in a white vapour. It is soluble in hydrochloric acid.

A massive variety is granular. Colour splendent, tin-white. Lustre metallic. Opaque. Specific gravity 6·115. It occurs in Transylvania, and, according to Klaproth's analysis, gives—

Tellurium	92·55
Iron	7·20
Gold	0·25
	——100

Graphic Tellurium—Auro-Argentiferous Tellurium—occurs crystallised. Primary form a right rhombic prism; occurs in attached flattened crystals, which are generally minute. Fracture uneven. Hardness: scratches talc, and is scratched by calcareous spar. It is brittle. Colour steel-gray. Lustre metallic. Opaque. Specific gravity 5·723. Before the blow-pipe it readily fuses into a globule, and is reduced to a metallic button of a bright yellow-colour. Soluble in nitric acid, except a yellow metallic residue. It is found accompanying gold in narrow veins traversing porphyry at Offenbanya, and also at Nagyag, in Transylvania. It consists of tellurium, gold, silver, and lead.

Berzelius found also a little sulphur, arsenic, antimony, iron, and copper.

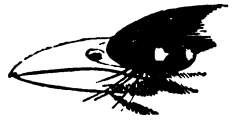
Yellow Tellurium occurs in imbedded crystalline laminæ. Primary form a right rhombic prism. Traces of cleavage. Fracture uneven. Hardness: scratches gypsum, and is scratched by calcareous spar. Rather brittle. Colour silvery-white, inclining to brass-yellow. Lustre metallic. Opaque. Specific gravity 10·678. By the blow-pipe it melts into a metallic globule. It is partly soluble in nitric acid. It is found at Nagyag in Transylvania, and in the Altaï Mountains in Siberia. According to Klaproth, it contains tellurium, gold, lead, silver, and sulphur.

Black Tellurium occurs crystallised, and in imbedded foliated masses. Primary form a square prism. Cleavage parallel to the terminal plane, in thin flexible laminæ. Fracture indistinct. Hardness: scratches talc, and is scratched by gypsum. Colour dark lead-gray. Lustre metallic. Opaque. Specific gravity 7·085. Before the blow-pipe is fusible on charcoal, and covers it with oxide of lead; reducible into a gray metallic globule, which eventually leaves a button of gold. It is found at Nagyag and Offenbanya in Transylvania, and contains, according to Klaproth—tellurium, lead, gold, silver, copper, and sulphur.

Bismuthic Tellurium—Tellur-Bismuth; Telluret of Bismuth—occurs crystallised in small 6-sided prisms. Cleavage parallel to the base of the prism. Fracture indistinct. Hardness: scratches calcareous spar, and is scratched by fluor-spar. Colour steel-gray or zinc-white. Lustre metallic. Specific gravity 7·82. It is fusible by the blow-pipe, and disengages the odour of selenium. Acted on by nitric acid, and the solution is precipitated by water. It is found in Norway, and contains—

Tellurium	34·6
Bismuth	60·0
Sulphur and traces of Selenium	4·8
	——99·4

TELOPHO'NUS (Swainson), a genus of Birds. [LANIADÆ.] The character of the bill is seen in the accompanying figure.



Bill of *Telephonus leucogrammicus.*

TE'MIA (Le Vaillant), a genus of Perching Birds, which, Cuvier observes, M. Vieillot has changed into *Crypsirina*, and Dr. Horsfield into *Phrenotrix*, whilst M. Temminck arranges them under *Glaucopis.*

Bill of *Crypsirina.* (Swainson.)

Mr. Swainson thus characterises *Crypsirina*:—Bill shorter than the head, much compressed; the culmen considerably arched, and curved from the base. Nostrils small, basal, concealed by incumbent feathers, which are either soft or setaceous. Wings short, much rounded; the primaries hardly longer than the secondaries. Tail feathers broad and obtuse. Feet moderate, arboreal. The middle toe and claw

Phrenotrix Temia. (Horsfield.)

short, but as long as the tarsus; lateral toes unequal; hind toe and claw shorter than the tarsus. It is a native of India.

C. vagabonda (*vagabunda*) and *C. Temia* are among the species given as examples.

The first of these is the *Pica vagabunda* of Gould ('Century of Birds from the Himalaya Mountains'), a representation of which we subjoin.

Pica vagabunda. (Gould.)

Dr. Horsfield, who gives *Corvus varians* as the synonym of his *Phrenotrix Temia* (the Chekitut, or Benteot, of the Javanese), states that although not a rare bird in Java, his *Phrenotrix* is by no means familiar, and never approaches the villages and habitations like many others. ('Zoological Researches in Java.') A figure of this bird is given in the preceding page.

TEMNOPLE'URUS. [ECHINODERMATA.]

TEMNU'RUS. [TROGONIDÆ.]

TEMPERATURE OF THE EARTH. [GEOLOGY.]

TEMPERATURE OF PLANTS. [HEAT, VEGETABLE.]

TENCH. [TINCA.]

TENDON, or Sinew, is the tough white and shining tissue by which muscles are attached to the bones or other parts which it is their office to move. The name of Tendons however is generally applied only to those which are thick and rounded, and which serve for the attachment of the long round muscles, such as those of the biceps muscle on the front of the upper arm: those which are broad and flat, and which serve for the attachment of the membranous muscles, are commonly called Aponeuroses. But whatever be the external form of a tendon, its intimate construction is the same, being chiefly composed of the same fibrous or tendinous tissue of which a large class of organs, including the ligaments, fasciæ, periosteum, and several others, consist. [AREOLAR TISSUE; MUSCLE.]

At that end of a tendon which is affixed to a muscle each primitive fibre or fasciculus of the latter terminates in an abruptly-rounded extremity, which is embraced by a fasciculus of the filaments of the tendon, expanding and inclosing it in a sheath, or in a manner which may be coarsely represented by placing the end of the fore finger of one hand within a circle formed by the ends of all the fingers of the other hand. The larger bundles of cellular and fibrous tissue in the tendon are also continuous with the cellular tissue which is placed between the secondary fasciculi of the muscle.

At their opposite extremities the tendons are usually affixed to bones. Their fibres are intermixed and firmly united with those of the periosteum, and often pass into the very substance of the bone.

Although the chief and proper office of Tendons is to serve as media for the action of muscles, yet many of them fulfil other purposes in the economy. Thus the Aponeuroses of the abdominal muscles form a great part of the walls of the abdomen, and, by their toughness, support and protect the organs within its cavity; the Tendons of the muscles of the fingers add strength to each joint over which they pass; and many, in other parts, are arranged so as to act like ligaments.

TENDRAC. [TENREC.]

TENDRILS, or *Cirrhi*, are those elongated and filamentous organs of Plants which possess a power of twisting in one direction or another, and by which the plants on which they grow are enabled to embrace other plants, and thus to elevate themselves. Tendrils are only found on those plants which are too weak in the stem to enable them to grow erect. In most cases the tendrils are only forms of the petiole; for although they may occur on the parts of flowers, yet the flowers must be regarded as metamorphoses of the leaf. Tendrils are distinguished according to the parts of the leaf from which they grow. When the tendril consists of the elongated petiole of a compound leaf, it is called a Cirrhus Petiolaris, as in the common pea. When, as in *Smilax horrida*, it branches off on each side at the base of the lamina into a twisting branch, it is called a Cirrhus Peduncularis. When it is extended from the point of a single leaf, as in the *Gloriosa superba*, it is a Cirrhus Foliaris; and when it occurs in the petals of a flower, as in *Strophanthus*, it is called Cirrhus Corollaris. Those tendrils which are in connection with the stem alone, as those of the Passion-Flowers and Vines, are called Capreoli. The type of these organs however is the same in all cases. (Bischoff, *Wörterbuch der beschreibenden Botanik.*)

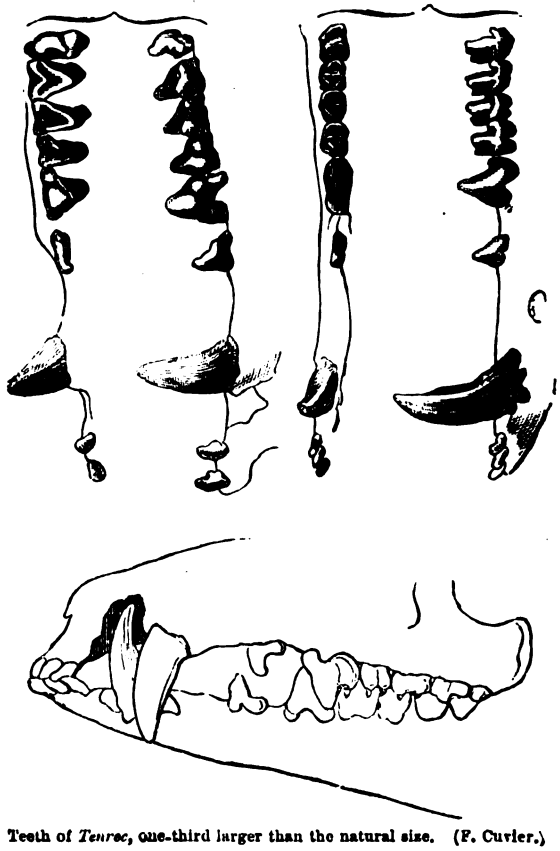
TENGYRA. [SCOLIADÆ.]

TENNANTITE, a variety of Gray Copper-Ore, so named in honour of Smithson Tennant, a distinguished chemist. It occurs in attached crystals, which are usually small. It is found only in Cornwall, and has there been found in several copper-mines.

TENORITE. [COPPER.]

TENREC, the common name of a species of *Centetes*, Ill.; *Centenes*, Desm.; *Setiger*, Geoff. The Tenrecs may be considered—indeed they have been considered by most zoologists—as Hedgehogs without the power of rolling themselves up into a ball. They were not included in the genus *Erinaceus* of Linnæus, as he left it, in his last edition of the 'Systema Naturæ' (the 12th), but in the 13th (Gmelin's) all the known species were included under that genus. They have no tail, are nocturnal for the most part in their habits, feed on insects, lie dormant during a considerable portion of the year, and that during the hot season, and have the skin beset with spines, or spine-like bristles.

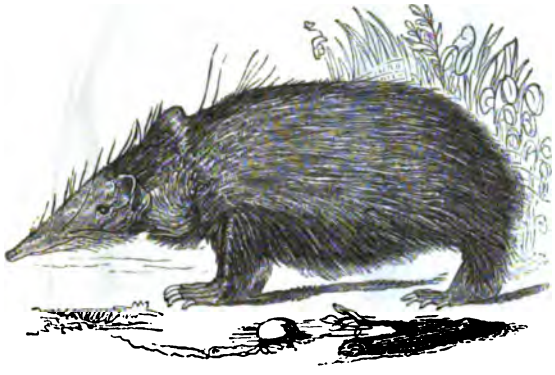
Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6} = 40$.



Teeth of *Tenrec*, one-third larger than the natural size. (F. Cuvier.)

The situation assigned by Cuvier to the Tenrecs is between the Hedgehogs (*Erinaceus*, Linn.) and *Cladobates*.

C. ecaudatus (Ill.) is the largest of the species, exceeding our Hedgehog in size. It is covered above with long flexible spines, except on the vertex and occiput, and has no coloured bands; the under part of the body is clothed with hairs or bristles only, which are yellowish, mixed with some longer black ones.



Centetes ecaudatus.

C. setosus, Ill. (the Tendrac of Buffon and Zimmerman), is less than the former, and the spines are short and rigid.

Tendrac (*Centetes setosus*).

C. semispinosus is still less, and hardly so large as a common mole. Its body is clothed with a mixture of spines and bristles, and is banded longitudinally with yellow and black.

Striped Tenrec (*Centetes semispinosus*).

TENTACULITES (Schlottheim), a genus of small annulated pointed shells, fossil in the Silurian strata.

TENTHRE'DO, a genus of Hymenopterous Insects, of the section *Terebrantia*. The genus *Tenthredo* of Linnæus is in modern systems regarded as constituting a family, to which the name *Securifera* has been applied by Latreille, and *Tenthredinidæ* by Leach.

Latreille restricts the generic term *Tenthredo* to those species which have nine joints to the antennæ, and in which these organs are not distinctly thickened at the apex. Their larvæ have from eighteen to twenty-two feet. The genus *Tenthredo* is however still further restricted by many other authors, and it is especially to Dr. Leach ('Zoological Miscellany,' vol. iii.) that we are indebted for pointing out distinguishing characters for the subdivisions of the very extensive Linnæan genus. By this author the *Tenthredinidæ* are divided chiefly according to the structure of the antennæ, and the cells inclosed by the nervures of the wings. The first section, according to Dr. Leach, contains those species which have the antennæ short and clubbed at the extremity and the third joint long; the superior wings with two marginal and three submarginal cells. It includes the genera *Cimbex*, *Trichiosoma*, *Clavellaria*, *Zarea*, *Abia*, &c.

The species of the second section have the antennæ of moderate length, filiform, and composed of three joints; the last joint long, slightly thickened at the extremity, and in the males ciliated, and sometimes forked. It contains the genera *Hylotoma* and *Schizocerus*. The characters of the third section are:—Antennæ short, with nine or ten joints, increasing in thickness in the middle, but ending in a point; the third joint longer than the fourth; body short and increasing in thickness towards the apex. Genera: *Messa*, *Selandria*, and *Fenusa*.

Section 4.—Antennæ composed of nine joints, moderately long; body moderately long; upper wings with two marginal cells. To this section belongs the genus *Tenthredo* as at present restricted; it is distinguished by the upper wings having four submarginal cells, and the antennæ with the third and fourth joints of equal length. The genus *Allantus* differs only from *Tenthredo* in having the third joint of the antennæ longer than the fourth. The *Allantus scrophulariæ* is a very common species in this country, and is found on the *Scrophulariæ*, on the leaves of which its larvæ feed. The perfect insect somewhat resembles a wasp, but is of a rather more slender form; it is black, and has the body adorned with yellow rings; the legs (with the exception of the thighs) and antennæ are also yellow. The larva, which is provided with twenty-two feet, is white and has black dots, and the head is black. When touched it rolls itself up in a spiral manner, as indeed do the larvæ of other *Tenthredinidæ*.

Section 5.—Superior wings with but one marginal cell; body short, narrower at the extremity in the males; antennæ simple, nine-jointed, slightly ciliated, increasing in thickness in the middle, and decreasing at the extremity. This section contains the genera *Cræsus*, *Nematus*, and *Cladius*, examples of each of which are found in this country.

Section 6.—Antenna with numerous joints; body rather depressed; wings with two marginal and four submarginal cells. British genera *Tarpa*, *Lyda*, and *Lophyrus*. The larvæ of the species of *Lophyrus* live in society, more particularly on the pines, and are said to be very injurious to the young plants. The species of this genus are very rare in England. The antennæ are serrated in females, and in the males they are provided with a double series of denticulations.

TENUI'PE'DES. [MALACOLOGY.]

TENUIROSTRES, a family of Birds belonging to the order *Insessores*. Cuvier makes the *Tenuirostres* the fourth family of his Passeraux, placing it between the *Conirostres* and the *Syndactyles*, and comprising under it the genera *Sitta*, Linn. (with the sub-genera *Xenops*, Ill.; *Anabates*, Temm.; and *Synallaxis*, Vieill.); *Certhia*, Linn. (with the sub-genera *Certhia*, Cuv.; *Dendrocolaptes*, Herm.; *Tichodroma*, Ill.; *Nectarinia*, Ill.; *Dicæum*, Cuv.; *Melithreptus*, Vieill.; *Cinnyris*, Cuv.; and *Arachnathera*, Temm.); *Trochilus*, Linn. (dividing the genus into the Humming-Birds properly so called, or *Colibris Trochilus*, Lacép.; and the Oiseaux Mouches, or Fly-Birds, *Orthorhynchus*, Lacép.); *Upupa*, Linn. (with the sub-genera *Fregilus*, Cuv.; the Hoopoes properly so called; *Upupa*; *Promerops*; and *Epimachus*).

Mr. Swainson includes the following families under this tribe:—*Meliphagidæ*; *Cinnyridæ*; *Trochilidæ* (Humming-Birds); *Promeropidæ* (Hoopoes); and *Paradisiadæ* [BIRDS OF PARADISE].

The *Tenuirostres* are placed by this author between the *Scansores* and the *Fissirostres*.

M. Lesson makes the tribe *Tenuirostres* (which he arranges between the *Latirostres* and the *Syndactyles*) consist of the following families and genera:—

1. *Promeropidæ.*

Genera:—*Upupa*; *Promerops.*

2. *Certhiadæ.*

Genera:—*Certhia*; *Tichodroma*; *Dendrocolaptes*; *Climacteris*; *Furnarius*; *Cœreba*; *Dicæum.*

3. *Philedonidæ.*

Genera:—*Drepanis*; *Cinnyris*; *Pomatorhinus*; *Prinia*; *Orthotomus*; *Mysomela*; *Myzantha*; *Anthochæra*; *Tropidorhynchus*; *Melliruga.*

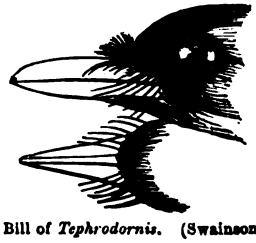
4. *Trochilidæ.*

Genera:—*Polytmus*, Briss.; *Ornismya*, Less.

In Mr. G. R. Gray's 'List of the Genera of Birds' (2nd edit., 1841), the *Tenuirostres* stand as the second tribe of *Insessores*, between the *Fissirostres* and the *Dentirostres*, and comprise the following families, sub-families, and genera:—

1. *Upupidæ*. 2. *Nectarinidæ*. [CINNYRIDÆ.] 3. *Trochilidæ*. 4. *Meliphagidæ*.

TEPHRODORNIS (Swainson), a genus of Drongo Shrikes, *Dicrurinæ*. [LANIADÆ.] The accompanying cut represents the bill in this genus.



Bill of *Tephrodornis*. (Swainson.)

TEPHROITE. [*See* SUPPLEMENT.]

TEPHRO'SIA (from τεφρός, ash-coloured), the name of a genus of Plants belonging to the Papilionaceous division of the order *Leguminosæ*. The genus consists of shrubs or herbs, with usually unequally pinnated leaves, and lanceolate or subulate stipules distinct from the petiole. The flowers are white or purplish, arranged in racemes which are mostly axillary; the calyx is without bracts, 5-toothed, nearly equal; vexillum of corolla large, silky outside, and reflexed in a spreading manner; wings adherent to the keel; stamens separate or united in one or two parcels; legume mostly sessile, linear, compressed, many-seeded, with the valves flat; seeds compressed. This genus at present includes 84 species, but it is probable that a more accurate investigation will result in making several genera of the present one. The American and Asiatic species are in some measure distinguished by their properties. In the former a narcotic poison is more frequently secreted; in the latter a colouring matter.

T. toxicaria, the Poison Tephrosia, is a half-shrubby erect plant, with 18 to 20 pairs of oblong-lanceolate obtuse leaflets, pubescent on the upper surface, silky beneath; legumes linear, velvety, mucronate. This plant is a native of the West Indies and of Guyana, and is said by Tussac to have been first brought from Africa. The whole plant affords a narcotic poison, and if the leaves are taken and pounded, and then thrown into water where there are fish, they become intoxicated, and losing all power over their muscles, they float about as if dead, and may be easily caught. If placed in fresh water, or the fresh water be allowed to come in contact with them as in a stream, the fish soon recover: it is however generally fatal to the smaller fish.

T. Virginiana is found in woods, on dry and sandy soils, in North America from Canada to Florida. It is considered in America a powerful vermifuge. Several other species of *Tephrosia* are found in North America.

T. emarginata, a native of South America, possesses the same properties as the *T. toxicaria*, and is also used for the purpose of poisoning fish.

T. tinctoria, the Ceylon Indigo, is a shrubby glabrous plant with 5 pairs of leaflets, silky and villous beneath; flowers purple or flesh-coloured, seated on axillary peduncles; straight pendulous legumes. This plant is a native of Ceylon, where it is called Anil. Its tissue yields a blue colouring-matter, which has the same properties as the indigo, and is used in Ceylon for the same purposes. There are other plants used in Ceylon for dyeing also called Anil.

T. piscatoria, the Fisher's Tephrosia, contains the narcotic principle of the genus, and is used in the East Indies for the same purposes as *T. toxicaria* is in the West Indies.

T. Apollinea is shrubby, and covered with a close pubescence; the leaflets are silky beneath, and in 2 or 3 pairs; the legume is 6- or 7-seeded, and rather pubescent. It is a native of Egypt, and yields a blue colouring-matter, which is used in dyeing.

T. Senna, Buga Senna, is a glabrous shrub, with leaves having 6 pairs of leaflets, and the legumes and calyxes covered with pubescence. It grows on the banks of the river Cauca, near Buga, in Popayan. Its leaves have a purgative quality like senna, and are used by the natives for the same purposes as that plant is used.

TERATI'CHTHYS, a Fossil Fish.

TEREBELLA. [ANNELIDA.]

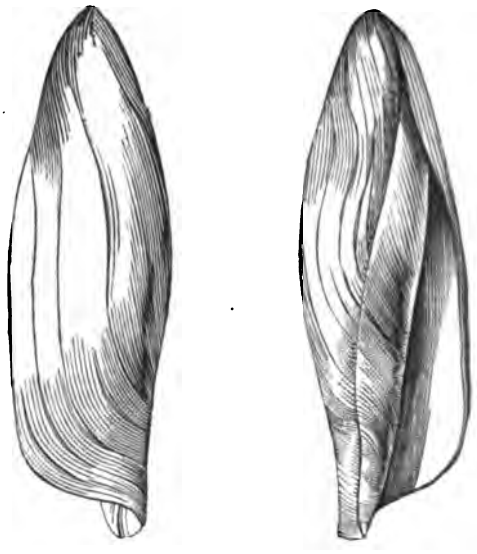
TEREBELLA'RIA, a genus of *Polypiaria*, included by De Blainville in the family of *Milleporæa*.

TEREBELLUM, a genus of *Mollusca*, placed by Cuvier among his Pectinibranchiate Gasteropods, between *Ovula* and *Voluta*; by De Blainville among his *Angyostomata*, between *Conus* and *Oliva*; and by Rang between *Mitra* and *Ancillaria*.

The fossil *Terebellum convolutum* is the type of Montfort's genus *Seraphs*.

T. subulatum, a native of the East Indies, may be taken as an example of the recent species, and *T. convolutum* of the fossil forms.

Terebellum subulatum.



Terebellum convolutum. (Genus *Seraphs* of Montfort.)

The fossil species appear to belong to the tertiary formation, Eocene period of Lyell (Grignon, &c.).

TEREBINTA'CEÆ, a natural order of Dicotyledonous Plants constituted by Jussieu, and adopted by De Candolle, Arnott, Don, and other writers on systematic botany. Brown has however divided it into five orders. [ANACARDIACEÆ; BURSERACEÆ; CONNARACEÆ; SPONDIACEÆ; AMYRIDACEÆ.]

TE'REBRA. [ENTOMOSTOMATA.]

TEREBRA'LIA, a sub-genus of *Cerithium*. [ENTOMOSTOMATA.]

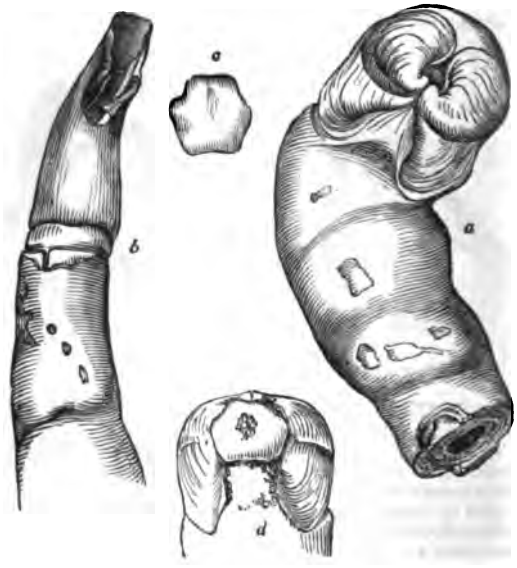
TEREBRA'TULA. [BRACHIOPODA.]

TEREDI'NA, a genus of *Mollusca* belonging to the family *Tubicolida* of Lamarck, and to the *Adesmacea* of De Blainville.

This genus is fossil only. Lamarck places it between *Septaria* and *Teredo*; Cuvier between *Fistulana* and *Clavagella*.

Mr. Swainson arranges it in his family *Pholadidæ*, and makes it a sub-genus of *Teredo*.

Dr. J. E. Gray places the *Terelina* among the *Pholadidæ*, between *Jouannetia* and *Teredo*. [FISTULANA; CLAVAGELLA.]



Terelina personata. (Courtagnon, &c.)

a, tube with valves; *b*, the other termination of the tube; *c*, accessory valve; *d*, valves with accessory valve in its place. (G. B. Sowerby.)

TEREDO. [PHOLADIDÆ.]

TE'RGIPES. [NUDIBRANCHIATA.]

TERMES. [TERMITINA.]

TERMINA'LIA (from 'terminus'), is the name of a genus of Plants belonging to the natural order *Combretaceæ*. The species of this genus consist of trees and shrubs, with alternate leaves, which are usually crowded together at the ends of the branches. The flowers are

destitute of petals, and are disposed in spikes, which are racemose and panicled; in the lower part of the spikes they contain both stamens and pistils, but in the upper part they contain only stamens; the limb of the calyx is campanulate, 5-cleft, with acute lobes; the stamens are 10 in number, arranged in two series, and are longer than the calyx; the ovary contains two ovules; the style is acute, and the fruit is drupaceous, containing only one seed. All the species are inhabitants of the tropical parts of Asia and America. They are numerous, and many of them are used in medicine and the arts.

T. angustifolia. The leaves are linear-lanceolate, very thin at both ends, pubescent beneath; the petioles are also pubescent, and have two glands at their apex. This tree is a native of the East Indies, and was formerly called *Terminalia Benzoin*, as it yields on tapping a gum-resin very similar to benzoin, and possessing the same properties.

T. vernix is a native of the Moluccas, and abounds in a resinous juice, which is collected by the inhabitants, and used in the natural state as a varnish. It is also used for the same purpose in China.

T. Catappa has obovate leaves, tapering to the base, pubescent beneath, and glands on the under sides of the midrib. It is originally a native of the East Indies, but has now become naturalised in the West India Islands. Some botanists have described the West India species as distinct from the Asiatic, but there is no good distinctive character. The drupaceous fruit of this tree is about 3 inches long, and contains a large seed, which is eaten, and also yields an oil, in the same manner as the almond. This tree, on account of its thick foliage, is much planted in the tropics for the purpose of forming avenues near houses. The bark and leaves yield a black pigment. Indian ink is manufactured from the juice of this tree.

T. glabrata very much resembles the last, but the leaves are glabrous beneath and small. It is a native of the Society and Friendly Islands.

T. Bellerica is a native of the East Indies, and the fruit is reputed to possess tonic, astringent, and attenuant properties.

T. Chebula is also an East Indian species. It is distinguished from the last by possessing opposite leaves which are pubescent beneath. The fruit of this species is more astringent than the last, and is used for the purposes of dyeing. A durable ink is made by mixing the salts of iron with an infusion of the outer rind of the fruit. Both this species and the last are subject to the attacks of insects producing gall-nuts. These galls possess the astringent principle in abundance, and are also used for dyeing. They are called Cadacay by the Tamuls.

TERMITI'NÆ, a section of Neuropterous Insects, in which Latreille includes the genera *Mantispa*, *Raphidia*, *Termes*, and *Psocus*. These genera however are usually regarded as constituting three distinct families, and will be here treated as such, commencing with the *Raphidiidæ* of Leach, which contains the two first-mentioned genera. The insects of this family have the antennæ slender and composed of more than 10 joints; the tarsi have from 3 to 5 joints; the wings are nearly equal in size and have numerous nervures inclosing small polygonal cells; the prothorax is long and slender.

Mantispa is at once distinguished by the peculiar structure of the anterior pair of legs, which are large, have the tibia broad and compressed, and provided beneath with spines; the joints of the tarsi are indistinct, and also furnished beneath with spines; the tarsi of the other four legs are distinctly 5-jointed. The antennæ are short, about equal to the head in length, and slender. The prothorax is elongated, slender, and broadest in front. The wings, when at rest, meet over the abdomen.

M. pagana, Fabricius, is rather less than three-quarters of an inch in length, and of a brownish-yellow colour; the wings are transparent, the superior pair have the upper margin yellow. It is found in France and Germany.

In Brazil are species closely allied to *Mantispa*, which differ in having the antennæ as long as the body; the wings are nearly horizontal; the body is depressed and terminated by two little appendices. They form the genus *Hoplophora* of Perty.

Raphidia.—The body is rather slender; the prothorax is long and almost cylindrical; the head broad and somewhat depressed; the eyes prominent; the antennæ are as long as the head and thorax, and composed of about 37 joints. The abdomen is terminated in the female by a long ovipositor. The legs are slender, of moderate length, and the tarsi are 4-jointed.

R. ophiopsis is not an uncommon insect in this country. It is rather more than one-third of an inch in length, and the expanded wings measure two-thirds of an inch; the head and body are black, the antennæ and legs are yellow, and the wings are transparent.

The larva of this insect lives in the bark of trees, and is said to prey upon other insects. It is exceedingly active in its motions, which are somewhat like those of a snake. The body is soft, long, and slender, of a brown colour, striped, and variegated with yellow; the head and prothorax are corneous, and of a black colour. In the pupa all the parts of a perfect insect are distinct, being enveloped in a thin membrane.

Termitidæ.—This family is distinguished by the following characters:—Wings with few transverse nervures, folding horizontally; tarsi 4-jointed; antennæ short and moniliform; body depressed.

Termes has the head large and rounded, and, besides the ordinary compound eyes, it has three ocelli, or simple eyes, situated on the upper surface; the antennæ are as long as the head and thorax, inserted in front of the eyes, and composed of about 18 joints. The abdomen is terminated by two small jointed appendages.

The Termites, or White Ants, as they are often called (though they have little affinity with the true Ants), are chiefly confined to the tropics; some few species however extend into the temperate regions. Like the Bees, Wasps, and Ants, which live in society, the Termites are composed of three kinds of individuals—males, females, and what are termed neuters or workers. Their ravages in the warmer parts of the globe are well known. They unite in societies composed each of an immense number of individuals, living in the ground and in trees, and often attacking the wood-work of houses, in which they form innumerable galleries, all of which lead to a central point. In forming these galleries they avoid piercing the surface of the wood-work, and hence it appears sound when the slightest touch is sometimes sufficient to cause it to fall to pieces.

The Termites sometimes erect their domiciles on the ground, in the form of pyramids or cones, sometimes with a roof, and these nests are often very numerous, and resemble the huts of savages.

The larvæ nearly resemble the perfect insect, excepting that they possess no wings. The pupæ have rudimentary wings. The neuters differ from the males and females in possessing no wings, in having the body stouter, the head much longer, and provided with long jaws crossing at the extremity. They are said to defend the nests, and, stationing themselves near the outer surface, they are the first to make their appearance when their habitation is disturbed. They will attack the party molesting them, and bite with considerable strength.

The negroes and Hottentots consider these insects a great delicacy. They are destroyed with quick-lime, or more readily with arsenic, which is thrown into their habitations.

The *Psocidæ* are very small insects, having soft and swollen bodies; the head is very large, nearly trigonal, and provided with three ocelli on the upper surface; the wings when folded meet at an angle above the abdomen, and are sparingly provided with nervures; the antennæ are setaceous, and composed of about 10 joints; the tarsi are short, and usually 2-jointed. They are very active in their motions, and live in the bark of old trees and in dwelling-houses. Nearly 40 species are said to be found in this country.

TERNS. [STERNIDÆ]

TERNSTRÖMIA'CEÆ, *Theads*, a natural order of Polypetalous Exogenous Plants. It consists of trees or shrubs with alternate coriaceous leaves, without stipules, mostly undivided, and sometimes with pellucid dots. The flowers are generally white in colour, sometimes pink or red, and are arranged in axillary or terminal peduncles, articulated at the base. The calyx is composed of 5 or 7 sepals, imbricated in æstivation, the innermost the largest; petals 5, 6, or 9, often combined at the base; stamens indefinite, with monadelphous or polyadelphous filaments, and versatile or adnate anthers; ovary superior; capsule 2-7-celled; seeds few, attached to a central axis, with little or no albumen, and a straight embryo, the cotyledons of which are very large, and often filled with oil. This order includes the *Theaceæ* of Mirbel and the *Camelliceæ* of De Candolle. Their closest affinity is with the order *Guttiferæ*, from which they differ in their alternate leaves; in the

3 4 1 2

Thea Bohea.

1, branch with flowers and leaves; 2, superior ovary with trifid stigma; 3, fruit entire; 4, capsule dehiscent.

parts of their flowers being 5 and its multiples; in the calyx being distinct from the corolla; in their twisted æstivation, and in their thin inadherent cotyledons. They have also relations with *Hypericaceæ* and *Marcgraaviaceæ*. The plants of this order are principally inhabitants of Asia and America; one species only is a native of Africa. [THEA; CAMELLIA; COCHLOSPERMUM.]

TERRAPE'NE, or TERAPIN. [CHELONIA.]

TERRICOLA. [ANNELIDA.]

TERRIER (*Canis familiaris Terrarius*), a variety of the Dog remarkable for the eagerness and courage with which it goes to earth, and attacks all those quadrupeds which come under the gamekeeper's denomination of Vermin, from the Fox to the Rat.

The breed of Terriers recommended in the old times when the huntsman went on foot, was from a Beagle and Mongrel Mastiff, or from any small thick-skinned dog that had courage. Thus the coat and courage were supposed to come from the Cur, and the giving tongue from the Beagle. The time for entering the young terriers at a fox or badger was when their age was ten or twelve months, with an old terrier to lead them on. When entered at a fox, and the old one was taken, the young terriers were set to attack the cubs unassisted, and when they killed them, both young and old terriers were rewarded with the blood and livers fried with cheese, with fox's or badger's grease: at the same time the dogs were shown the heads and skins to encourage them. There were other ceremonies recommended, too cruel to be repeated, and which could have been of little or no service. Honest Dandie Dinmont's mode of entering his Pepper and Mustard generations is as good as can be practised.

A cross of the Terrier with the Bull-Dog for the purposes of badger-baiting, &c., was at one time much in vogue. Of this breed was the celebrated dog Billy, famous for the destruction of rats. He was often turned into a room with 100 of those animals, and he frequently killed every one of them in less than seven minutes.

TERTIARY STRATA, the title given by almost universal consent of geologists to the uppermost great group of strata. Previous to the publication of the 'Essay on the Geology of the Basin of Paris,' by Messrs. Cuvier and Brongniart, in 1810, but little attention had been awakened to this great mass of deposits, though the familiar use of the terms primary and secondary, and the acknowledged dissimilitude between the latest of these strata and modern accumulations from water, in respect of mineral aggregation and organic exuviæ, seemed to be prophetic of the discovery of a newer type more in harmony with existing nature.

The extent to which, over great tracts in all quarters of the globe, this type has been found to prevail, is exceedingly great: most of the capital cities of Europe are built upon tertiary strata; many of the broadest plains and widest valleys in the New and the Old World are nothing but the dried beds of seas and lakes of the tertiary period: and some considerable mountain ranges bear on their high summits, and still more abundantly on their flanks, portions of the shelly tertiary strata which were uplifted from their original horizontality and subjected to the convulsive movements of which the mountain ranges are the result. In almost every part of the globe strata of this tertiary series prevail, and yield astonishing numbers of shells, corals, *Crustacea*, and other remains of marine, fresh-water, and terrestrial *Invertebrata*, and more locally abundant layers of fishes, and rich deposits of bones of *Mammalia*, &c. Possessing so many attractions, and affording such unusual facilities for study, the tertiary strata of Italy, France, England, Northern Europe, the eastern states of North America, the great tracts of Brazil, Patagonia, &c., have been the theatre of great and laborious investigations, which have brought forward our knowledge of these deposits to at least an equal advance with that of the older strata.

More than this can hardly be said with justice; for though, in consequence of the great similitude between the agencies concerned in producing modern accumulations of sediments and organic exuviæ, and those which produced the tertiary strata, the minute history of particular portions of these is almost completely known, their general history is imperfectly comprehended, because the original formation of those strata was performed under as great a variety of local conditions as the accumulations of sands and shells on the actual sea-bed, and because, since their production and elevation from seas or lakes to form dry land, they have, from their surface position and inferior induration, been more subject to superficial waste and destruction than the older, more sheltered, and more consolidated strata. The incompleteness of our knowledge of the general history of the tertiary strata is evident by the incompleteness of the classification which represents that history, and on this point, the only one which it appears necessary here to discuss, we shall offer a few remarks. Among the primary and secondary strata [GEOLOGY] subdivisions corresponding to successive times of production have been found practicable and definable, and traceable over immense areas by means of a combination of mineral, structural, and organic characters. Limestones of certain kinds, as chalk, oolite, magnesian-limestone, accompanied with green, brown, or red arenaceous and argillaceous beds, and holding *Spatangi*, *Apiocrinites*, or *Palæonisci*, mark and distinguish cretaceous, colitic, and magnesian formations and systems of secondary strata corresponding to the carboniferous and other older systems of rocks. This has not been found so practicable in regard to the tertiary strata, which, though presenting many different sorts of strata, offer in the manner of combination amongst these too many general analogies, and too much of local difference, to be conveniently ranged into formations or systems having more than a local value, by means of mineral and structural characters.

Some assistance towards the desired classification appeared to be furnished by the alternation of marine and fresh-water sediments, as in the Isle of Wight, and in the Basin of Paris, and hence the titles of Upper and Lower Marine, Upper and Lower Freshwater Deposits acquired a considerable application. But the most successful and probably best-founded classification of tertiary strata rests upon a study of their organic contents.

It has been long remarked that in those strata, wherever they occur, the forms of animal and vegetable life make a near approach, even specifically, to living types. By careful examination, a certain number of species have been found in tertiary strata actually identical with or undistinguishable from living objects. The proportion in which these still living species are mixed with now extinct (or believed to be extinct) forms varies, so that in Sicily tertiary beds occur with above 90 per cent. of still living species of shells, but in the basins of London and Paris others are found containing only about 5 per cent.

There are reasons independent of these proportions, which leave no doubt that the strata near London and Paris, which contain only 5 per cent. of living forms, are among the oldest of tertiary beds; while the Sicilian beds, which contain only about 5 per cent. of extinct species, are among the most recent.

Views of this kind generalised lead to a speculation which is strongly confirmed by the general current of geological discovery, that the relative antiquity of tertiary strata may be judged of by the relative proportion of extinct species of shells which are found in them. On this postulate M. Deshayes and Sir Charles Lyell have founded the most prevalent modern classification of tertiary strata, which may be thus briefly sketched:—

Recent Period.

Newer Pleiocene Period, the strata containing not above 10 extinct species in 100.

Older Pleiocene Period, the strata containing about 50 or 60 extinct species in 100.

Meiocene Period, the strata containing about 80 extinct species in 100.

Eocene Period, the strata containing about 95 extinct species in 100.

Secondary Period.

(These terms are taken from the Greek *καινός*, recent, combined with *πλεῖων*, more, *μείων*, less, and *ἠώς*, the dawn).

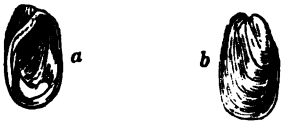
The principle of per centage employed by Sir Charles Lyell in this classification should not be strongly objected to on account of its rigorous numerical results being sometimes found locally inapplicable. It is impossible that this should be otherwise, for the numerical proportions of organic life must always vary in proportion to local conditions as well as to the general succession of physical influences: but that the great cause of the systematic variations of the forms of plants and animals in successive geological periods, whether primary, secondary, or tertiary, is the successive and systematic change of physical circumstances influential on organic life, appears amply proved. There appears no good reason to doubt that the variations of individual organisations, and the numerical proportions of their combinations, are in harmony with and indicative of the successive physical conditions when they lived, and consequently of the successive periods to which these physical conditions belonged. The comparison of individual fossil and living forms is merely one mode, and that not the most general or important, of manifesting the numerical constants of organic life of the several geological periods. By some other less obvious arithmetical processes, the relative analogies of ancient and modern nature may be made to appear numerically, independent of any such specific comparisons, and without limitation of geological age or geographical region. This has been attempted in regard to the Palæozoic fossils generally, and to the fossils of Devonshire specially, and the result affords remarkable encouragement to the application of rigorous calculations based on exact data representing the numbers of distinctly recognisable forms of different groups of organic remains, whether these be of living or extinct tribes.

We have only further to remark, that the tertiary strata are far more distinctly defined and separated from the uppermost secondary strata than from the recent deposits of water. In fact the most natural classification of tertiary volcanic products, tertiary strata, and tertiary organic remains, is with the living creation. In tertiary strata the phenomena of mineral accumulation seem to be such as are witnessed in daily operation: they contain marine, littoral, and pelagic deposits; æstuary and fluviatile sediments; lacustrine beds hardly distinguishable from such as are now in progress. In these sediments occur remains of a system of terrestrial and aquatic life as complete (if we except reasoning man) as that now in activity; and if the absence of man, and the animals which seem to be associated with him for his comfort and advantage in the actual creation, be thought a sufficient reason to remove from historic time the account of tertiary deposits, and to justify the adoption of a distinct quaternary or modern period

in geological classifications, it is not the less true that the geological date of the epoch of this period, the line of separation between it and the tertiary eras, is entirely unknown by direct and positive facts, and appears incapable of determination by reasoning on any collateral phenomena at present ascertained.

(Lyell, *Principles of Geology;* De la Beche, *Geological Manual;* Phillips, *Palæozoic Fossils of Devon.*)

TESTACELLUS, the name of a genus of Pulmoniferous *Mollusca*. *T. Maugei* may be given as an example. This form appears to have been first noticed by M. Dugué, in a garden at Dieppe in 1740: but it does not seem to have attracted much attention till M. Maugé, some years since, brought home specimens from the island of Teneriffe. It has also been found in several parts of France, and in Spain, and more recently in a garden at Bristol.



Shell of *Testacellus Maugei*. *a*, inside; *b*, outside.

Testacellus Maugei. *a*, shell in situ. (G. B. Sowerby.)

TESTUDINARIA, a genus of Dictyogenous Plants belonging to the natural order *Dioscoreaceæ*.

T. Elephantipes, the Elephant's-Foot Plant, is well known in our collections of plants from its curious truncate rootstock, looking like an elephant's foot. It is covered with a soft corky bark, which is split so as to give it a rough character. From the top of this thick mass a climbing stem is sent, which bears the leaves and flowers. Like the rest of Dictyogens this stem has not the regular division of the parts of the stem seen in most Exogenous Plants.

TESTUDINATA. [Chelonia.]

TESTU'DO. [Chelonia.]

TETE.' [Senna.]

TETHIUM. [Spongiadæ.]

TETHYS. [Nudibranchiata.]

TETRABRANCHIATA. [Belemnite; Bellerophon; Cephalapoda; Goniatites; Nautilidæ; Octopoda; Sepiadæ; Spirulidæ; Teuthidæ.]

TETRACAULODON. [Mastodon.]

TETRACERUS. [Antilopeæ.]

TETRACLITA. [Cirripedia.]

TETRADYMITE. [Bismuth.]

TETRADY'NAMOUS (from τέτταρες, four, and δύναμις, power), a botanical term employed by Linnæus to indicate the character of those flowers which, possessing six stamens, have two of them shorter than the other four. [Cruciferæ; System. Sexual.]

TETRAGONA. [Acalephæ.]

TETRAGONIA'CEÆ, *Aizoons*, a natural order of Exogenous Plants. It includes the genera *Tetragonia*, *Aizoon*, *Sesuvium*, and *Miltus*, which are generally placed in the order *Ficoideæ*, or *Mesembryaceæ*. The reason given by Dr. Lindley for this separation is the want of petals in these genera, as he considers that the tendency to produce petals in the *Mesembryaceæ* is of too powerful a nature to admit exception. The relation of these apetalous *Ficoideæ* to *Chenopodiaceæ* is so strong, that Dr. Lindley says "there is no character to distinguish them except their ovary being formed of several carpels."

Tetragonia expansa is a native of New Zealand and Japan, and is used by the natives of those countries as a remedy in those forms of cutaneous disease called scorbutic. The *Aizoon Canariense* and *A. Hispanicum* grow on the sea-coasts of the Canary Isles and Spain, and are amongst the plants which yield soda after burning.

TETRAGONO'LEPIS, a genus of Fossil Fishes. [Fish.]

TETRAGONO'LOBUS (from τέτταρες, four, γωνία, angle, and λόβος, lobe), a genus of Plants belonging to the natural order *Leguminosæ*. It contains herbs with broad leafy stipules, trifoliate leaves, winged petioles, alternate leaflets, and flowers seated on axillary peduncles, furnished with a bract. The calyx is tubular 5-cleft, the winge shorter than the vexillum; the stigma is funnel-shaped and beaked; the legume is cylindrical, furnished with four foliaceous wings, which give it a 4-cornered appearance.

T. purpureus, Purple-Winged Pea, is a pilose plant with decumbent stems, entire obovate leaflets, bracts longer than the calyx, and a glabrous legume, with globose seeds. It is a native of the south of Europe, and has dark purple flowers; a variety is however found with flowers of a dark-yellow colour.

There is also a variety called *T. p. minor*, in which the stem, leaves, and legumes, are much smaller. The unripe legumes are cooked and eaten in the same manner as we eat French beans.

There are four other species of *Tetragonolobus*, all of them inhabitants of Europe.

TETRA'NTHERA, a genus of Plants belonging to the natural order *Lauraceæ*. The flowers are dioecious, some hermaphrodite, involucrated. The calyx 6-parted, the segments nearly equal or wanting. The fertile stamens generally about 9, in the petaloid flower from 12 to 21. The leaves are variable, with pinnate veins.

T. Roxburghii is a variable plant, a native of the mountains of India and China. The fruit is globose, black, and about the size of a pea, yielding a kind of greasy exudation from which the Chinese manufacture candles of a bad quality, and which serves as a basis for salves. This fixed oil is supposed to constitute the principal part of the fruit of *Persea gratissima*, so much esteemed in the West Indies under the name of Avocado Pear.

TE'TRAO. [Tetraonidæ.]

TETRAODON. [Tetrodon.]

TETRAOGA'LLUS, a genus of Birds, placed by Mr. G. R. Gray in the sub-family *Lophophorinæ*, of the family *Phasianidæ*.

TETRAO'NIDÆ, a family of Rasorial Birds, to which the Common Grouse belongs.

Linnæus, in his last edition of the 'Systema Naturæ,' places the genus *Tetrao* at the end of his fifth order, *Gallinæ*, next to the genus *Numida*. The *Gallinæ* come between the *Grallæ* and the *Passeres;* the genus *Struthio* is the last of the order *Grallæ*, and the genus *Columba* the first of the order *Passeres*.

The Linnæan genus *Tetrao* is very extensive, comprising not only the true Grouse, but also the Francolins, Partridges, and Quails.

Cuvier, in his last edition of the 'Règne Animal,' arranges the Tétras (*Tetrao*, Linn.) under his fourth order, Gallinacés (*Gallinæ*, Linn.), placing them between the Pheasants (*Phasianus*, Linn.) and the Pigeons (*Columba*, Linn.).

This great genus in the arrangement of Cuvier is more comprehensive even than that of Linnæus, for it includes the following subgenera:—1, Les Coqs de Bruyère (*Tetrao*, Lath.); 2, the Lagopèdes, or Snow Partridges (Perdrix de Neige); 3, the Ganga, or Attagen (*Pterocles*, Temm.); 4, the Partridges (*Perdix*, Briss.), comprising the Francolins, the ordinary Partridges, the Quails, and the Colins, or Partridges and Quails of America; 5, the Tridactyls (Lacèp., *Hemipodius*, Temm.), including *Turnix*, (Bonap., *Ortygis*, Ill.), and *Syrrhaptes*, Ill.; 6, the Tinamous (*Tinamus*, Lath., *Crypturus*, Ill., *Ynambus*, D'Azara). Of this last sub-genus Cuvier remarks that some, the *Pezus* of Spix, have still a small tail hidden under the feathers of the rump; others, the *Tinamus* of Spix, have no tail at all, and their nostrils are placed a little farther backward; and he adds that one should distinguish *Rhynchotus* of Spix, which has the bill stronger, without any furrow, slightly arched and depressed, with the nostrils pierced towards its base.

Mr. Vigors places the *Tetraonidæ* among the *Rasores*, observing that the groups which form the family are chiefly distinguished in modern systems from those of the *Phasianidæ* by their more simple appearance; by the absence in fact of those ornaments to the plumage, and those naked or caruncular appendages to the cheeks and head, so conspicuous in the latter family, but which are reduced in the present to the mere space that encircles the eye.

Mr. Swainson thus defines the "*Tetraonidæ*, Partridges and Grouse:—Bill and tail very short; hallux elevated;" and he comprises under the family the following genera and sub-genera:—

Cryptonyx, Temm.; *Odontophorus*, Vieill.; *Ortygis*, Ill.; *Tetrao*, with the sub-genera *Tetrao*, Linn., *Lagopus*, Willughby, *Lyrurus*, Sw., *Pterocles*, Temm., and *Centrocercus*, Sw.; *Perdix*, Briss., with the sub-genera *Perdix*, *Chætopus*, Sw., *Coturnix*, Briss., *Ptilopachus*, Sw., and *Ortyx*, Steph.; *Crypturus*, Ill., with the sub-genera *Crypturus* and *Nothurus*, Wagl.

Prince Bonaparte makes the *Gallinæ* the third order of his second sub-class *Grallatores;* and this order comprises the families *Pteroclidæ*, *Phasianidæ*, *Tetraonidæ*, and *Crypturidæ*. The order next in succession to the *Gallinæ* is formed by the *Grallæ*.

Mr. G. R. Gray, in his 'List of the Genera of Birds,' arranges the *Tetraonidæ* between the *Phasianidæ* and the *Chionididæ*, with the following sub-families and genera:—

1. *Perdicinæ*.

Genera:—*Rhizothera*, G. R. Gray; *Ptilopachus*, Sw.; *Ithaginis*, Wagl.; *Lerwa*, Hodgs.; *Pternistes*, Wagl.; *Francolinus*, Briss.; *Chaccura*, Hodgs.; *Perdix*, Antiq.; *Arborophila*, Hodgs.; *Coturnix*, Antiq.; *Rollulus*, Bonn.; *Odontophorus*, Vieill.; *Ortyx*, Steph.; *Lophortyx*, Bonap.; *Callipepla*, Wagl.

2. *Tetraoninæ*.

Genera:—*Tetrao*, Linn.; *Lyrurus*, Sw.; *Bonasa*, Briss. (*Bonasia*, Bonap.); *Centrocercus*, Sw.; *Lagopus*, Briss.

3. *Pteroclinæ*.

Genera:—*Pterocles*, Temm.; *Syrrhaptes*, Ill.

The following species are European:—*Tetrao Urogallus*, the Capercail

zie, or Cock of the Wood; *T. hybridus*, Sparrm. (*T. medius*, Meyer), the Hybrid Grouse, generally considered by ornithologists to be a hybrid between the Capercailzie and the Black Cock; *T. Tetrix* (genus *Lyrurus*, Sw.), the Black Grouse, or Black Cock; *Bonasia Europæa*, the Hazel-Grouse, or Gelinotte; *Lagopus Scoticus*, the Red Grouse; *L. mutus*, the Common Ptarmigan; *L. terrestris*, the Rock Ptarmigan; *L. Salicetí*, the Willow-Ptarmigan; *L. brachydactylus*, the Short-Toed Ptarmigan; *Pterocles arenarius*, the Sand-Grouse; *P. setarius*, the Pin-Tailed Sand-Grouse.

Of these the Black Cock, the Red Grouse, and the Common Ptarmigan, are British; to which we may now add the Capercailzie, restored by the care of the Marquis of Breadalbane and others. [CAPERCAILL.]

Lagopus mutus, the Common Ptarmigan, may be taken as an example.

Common Ptarmigan (*Lagopus mutus*) in winter and summer plumage. (Gould.)

This bird is supposed by some, and with good reason, to be the *Lagopus* of Pliny ('Nat. Hist.,' lib. x., c. 48), who notices its excellent flavour, and states that its feet, with their 'hare-like hair,' gave the bird its name. It is the *Tetrao lagopus* of Linnæus; *Lagopus vulgaris* of Fleming; Pernice de Montagna, Pernice Alpestre, and Lagopo Bianco, of the Italians; Perdris Blanche and Gelinote Blanche of the French; Perdiz Blanca of the Spanish; Schneehuhn and Haasenfüssige Waldhuhn of the Germans; Rype of the Norwegians; Riupkarre (male), Riupa (female), of the Icelanders; Tarmachan of the Northern Gael; and Coriar yr Alban of the Welsh.

The winter plumage of the male is pure white; a black band proceeding from the angle of the bill and traversing the eyes; lateral tail-feathers black, terminated by a white border; feet and toes well covered with woolly feathers; above the eyes a naked space, which is terminated by a small dentilated membrane; these naked parts are red; claws hooked, subulate, and black; bill black; iris ash-coloured. Length about 15½ inches.

The winter plumage of the female differs from that of the male in having the naked space above the eye less, and no black eye-band. Smaller than the male; the length about 14½ inches.

It is found in the north of Europe: Lapland, Norway, Sweden, Russia. The alpine districts of the middle and south of Europe. North America: the islands lying in the south-west of Baffin's Bay (Sabine); high hills keeping near the snow-line; Churchill River (Franklin; Richardson.)

In the British Islands it was formerly found in the north of England, and, as its Welsh name indicates, in Wales; but it no longer occurs in those localities, nor is it to be met with in Ireland.

On all the elevated summits of the north of Scotland it is not uncommon; and on most of the Grampians, but especially the great granite and slaty masses from which issue the sources of the Dee, the Spey, and the Tay, it may be said to be even abundant. Great numbers are annually killed, but as the haunts of this Ptarmigan are not so easily accessible as those of the brown species (*Lagopus Scoticus*), it is not at all likely to be exterminated.

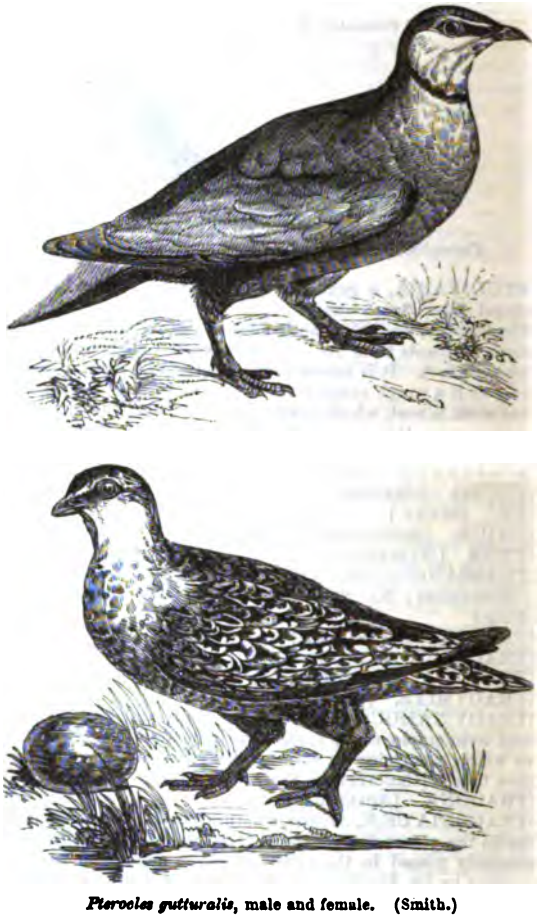
The summer food of the Ptarmigan consists principally of alpine berries, and in winter of the shoots of young heath.

This species has been reared in confinement without any great difficulty, and has bred in a tame state. (Selby.)

Large numbers of Ptarmigan are sent from Norway to London every winter. In Norway the peasants take them in snares. The captured birds are kept in a frozen state till the dealers come, and one of these dealers will sometimes buy and sell 50,000 ptarmigans in a season. According to the calculation of Sir Arthur de Capell Brooke, 60,000 of these birds were killed during one winter in a single parish, which was however large. Mr. Grant informed Mr. Yarrell that he was assured, when in Norway, that the number of ptarmigan killed in that country every winter was beyond belief: 2000 dozen, if Mr. Grant remembered right, was the quantity exported from Drammen in one ship for England in 1839; and great numbers, he adds, are sent to the Copenhagen market. Mr. Yarrell goes on to state that, besides those brought to this country from Drammen, great quantities are also received in London, during the months of February, March, April, and May, from Bergen, Drontheim, and other ports on the west coast of Norway, whence conveyance is obtained for them in the boats which bring constant supplies of lobsters to the London market. "On one occasion," says Mr. Yarrell, "late in the spring of 1839, one party shipped 6000 ptarmigan for London, 2000 for Hull, and 2000 for Liverpool; and at the end of February, or very early in March of the present year (1840), one salesman in Leadenhall market received 15,000 ptarmigan that had been consigned to him; and, during the same week, another salesman received 700 capercaillies and 560 black grouse."

Pterocles arenarius, Temm., Barbary and Senegal; *P. guttatus*, Licht., Egypt; *P. quadricinctus*, Temm., Senegal; *P. coronatus*, Licht., Nubia; *P. Lichtensteinii*, Temm., Nubia; *P. tricinctus*, Swain., Senegal; *P. exustus*, Temm., Egypt and Senegal; *P. tachypetes*, Temm., South Africa; *P. bicinctus*, Temm., South Africa; *P. simplex*, Roux., South Africa; *P. maculosus*, Burchell—are, according to Dr. Andrew Smith, all African species.

As an example of the African forms, we give a representation of *P. gutturalis*.



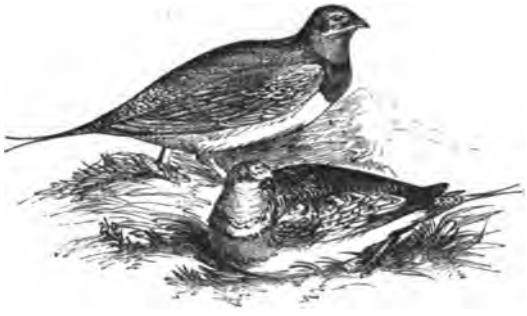
Pterocles gutturalis, male and female. (Smith.)

Dr. Smith states that this species was first discovered in 25° 40′ N. lat., about 80 miles to the eastward of Latakoo; and it was when he remarked its cry to differ from that uttered by *Pterocles tachypetes*, Temm., that he was led to suspect that it was distinct. He says that, in common with the other South African species of this genus, it repairs in large flocks at regular and fixed periods to localities where water is, and that at such times specimens are most readily procured; but he warns the sportsman to be quick in his movements, as they scarcely reach the water before they are again on the wing. As they approach and recede from such spots, they almost incessantly utter cries resembling 'twet weet, twet weet.'

P. setarius, the Pin-Tailed Sand-Grouse, Ganga Cata, is an example of the Grouse of Asia.

This bird is very numerous on the arid plains of Persia. Not very numerous in France, on the sterile Landes near the Pyrenees, and along the coasts of the Mediterranean; less common in Provence and Dauphiné, where they occasionally arrive; more common in Spain, Sicily, Naples, and throughout the Levant. Temminck, who gives these localities, states, in the fourth part of his 'Manuel,' second edition, that it is common in Provence, in the uncultivated plains of Crau, and says that it avoids cultured tracts, and only inhabits the sterile Landes of the south; but he adds that it is abundant in the

Pyrenees, and that it is to be found all the year round in the markets of Madrid. Mr. Gould states that the species is found in the north of Africa. It feeds on seeds, insects, and the young shoots of plants.



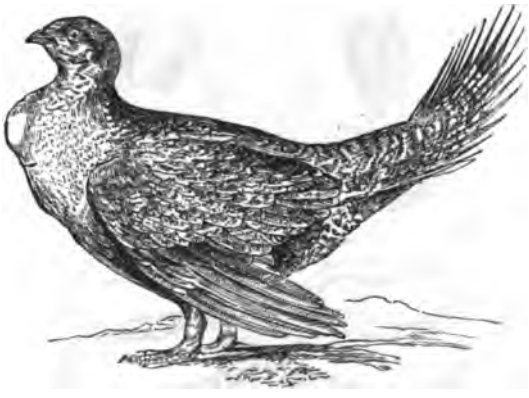
Pin-Tailed Sand-Grouse (*Pterocles setarius*), male and female. (Gould.)

America possesses several species of Grouse, consisting of the genera and sub-genera *Bonasia*, or *Bonasa*, *Tetrao*, *Lagopus*, and *Centrocercus*.

Centrocercus urophasianus, is the *Tetrao urophasianus* of Prince C. L. Bonaparte, the Cock of the Plains of Lewis and Clark, and the Pyàmis of the Kyuse Indians.

This grouse appears to have been first recorded by Lewis and Clark; and it has since become familiar to the fur-traders on the banks of the Columbia. Sir John Richardson gives an interesting account of its habits in the 'Fauna Boreali Americana.'

Nuttall says that the flesh is dark and less palatable than that of other species.



Cock of the Plains (*Centrocercus urophasianus*), male. (Swainson.)

Cryptonyx is a genus which has been variously placed, and by some amongst *Tetraonidæ*. It has the following characters:—Bill strong, stout, compressed, convex above, curved towards the point; nostrils

Cryptonyx cristatus. Male in the front; female behind.

longitudinal, placed in the middle of the bill, and covered by a naked membrane; orbits and lore naked; hind toe without any nail, not touching the ground. Wings short; third, fourth, and fifth quills longest.

C. cristatus (*C. coronatus*, Temm.), is the Rouloul de Malacca of Sonnerat. According to Mr. T. C. Eyton, the Malay native name is Bestum. ('Catalogue of a Collection of Birds from Malaya,' &c., in 'Zool. Proc.,' 1839.)

These beautiful birds haunt the great forests of Malaya, Sumatra, and Java. Wild and shy, they avoid the face of man, and are kept in captivity with great difficulty. [BLACK-COCK; CAPERCALI; BONASIA.]

TETRAONYX. [CHELONIA.]

TETRA'PTERUS, a genus of Fossil Fishes. [FISH.]

TETRAX. [STRUTHIONIDÆ.]

TE'TRODON, a genus of Fishes of the order *Plectognathi*. These fishes, instead of having distinct teeth as usual in the class, have the jaws provided with a substance resembling ivory, formed somewhat like the beak of a bird, and fitted for crushing crustaceous animals and *Fuci*, upon which they live. Both the Tetrodons and Diodons (*Diodon*, Linn.), a very closely allied genus, have the power of inflating the body with wind, or rather a membrane which extends along the under side of the abdomen, which causes them to float on the surface of the water, without the power, it is said, of directing their course; the membrane, when inflated, gives to the fish an almost spherical form, and is usually defended by spines and prickles. The pectoral fins are rather small; and besides these and the tail fin, they have one dorsal and a ventral fin. The Diodons have but one large tooth above and below, and are usually protected by large strong spines. The Tetrodons are distinguished by the possession of four large large teeth, the jaws being each divided by a central suture. These fishes are confined to the seas of warm climates: some of them are called Globe-Fishes.

TEU'CRIUM (from Teucer), a genus of plants belonging to the natural order *Lamiaceæ*, or *Labiatæ*. It has a tubular 5-toothed, nearly equal, or 2-lipped calyx. The tube of the corolla is shorter than the calyx, the upper lip is abbreviated and bipartite; the lower lip is longer, spreading, and trifid. The stamens are much exserted, and the cells of the anthers are confluent and spreading. The species are herbs and shrubs inhabiting most parts of the earth, and having a variable habit and inflorescence. Upwards 70 species are described. Of these comparatively few are known in this country. Some of them are cultivated in our gardens, and three are natives of the British Isles.

T. Scorodonia, Wood Germander, or Sage, has cordate downy petiolate-crenate leaves; the flowers are of a pale-yellow colour, with violaceous stamens, and are arranged in lateral and terminal 1-sided racemes; the stem is erect, hispid, pubescent, or nearly glabrous. It is a native of Europe in woody hilly situations, where the soil is dry and stony. It is not an uncommon plant in Great Britain. The smell and taste of this plant resemble very much the hop. In Jersey, where it is called Ambroise, the inhabitants use it as a substitute for hops in their beer; and by some persons the bitter given by the Germander is preferred to that of the hop.

T. Scordium, Water-Germander, has oblong-sessile downy serrated leaves; flowers purplish, arranged in axillary whorls, 2-6 flowers in each; the stem is procumbent and villous. It is a native of Europe and the temperate parts of Asia in boggy wet places. It is a rare plant in Britain. Its fresh leaves are very bitter and rather pungent, having a smell similar to garlic. It had once a great reputation in medicine, but is now seldom used; it might however be employed in cases where an aromatic bitter is desirable.

T. Chamædrys, Wall, or Common Germander, has ovate inciso-serrate leaves, tapering into a footstalk; the flowers are reddish-purple, and arranged in axillary whorls of three flowers; the stem is ascending, and most frequently villous. It is a native of Europe and some parts of Asia, on walls and rocks and dry places. It is only rarely found in Great Britain.

T. Marum, Cat-Thyme, has small ovate quite entire leaves, with 2-4-flowered whorls; stem erect, branched. It is a native of the region of the Mediterranean. Cats are very fond of it, and destroy it when they get near it.

T. polium, Mountain Poly, has cuneated-oblong or linear leaves with revolute edges; whorls few, condensed into globular terminal heads; stems procumbent, much branched. This plant is a native of Europe and Africa, on the shores of the Mediterranean.

TEU'THIDÆ. [SEPIADÆ.]

TEXTOR. [PLOCEINÆ.]

THALAMI'TA. [PORTUNIDÆ.]

THA'LAMUS (from θάλαμος, the bridal chamber), a botanical term which was applied by Linnæus to the calyx or outer whorl of floral envelopes. Tournefort applied the term to a receptacle that is not fleshy, but surrounded by an involucre. In this sense it is used in common with the terms Clinanthium and Phoranthium. By some writers, as De Candolle, the term is applied to the receptacle of all plants or that point of the rachis or stem around which the floral envelopes are seated. Thus those plants in which the petals and stamens are inserted into the receptacle constitute the first sub-class,

Thalamiflora, of the Exogens, in De Candolle's natural arrangement of plants.

THALARCTOS. [BEAR.]

THALA'SSEMA. [SIPUNCULOIDEA.]

THALASSEUS. [STERNIDÆ.]

THALASSIANS. [CHELONIA.]

THALASSIANTHUS, a genus of *Actinida*.

THALASSI'DROMA. [PROCELLARIDÆ.]

THALASSI'NA. [THALASSINIDÆ.]

THALASSINIDÆ, a family of Macrurous Decapodous *Crustacea*. The species of this small but interesting family resemble each other in appearance, and are remarkable for the extreme elongation of their abdomen, and the small degree of consistence of their integuments.

M. Milne-Edwards divides this family into two divisions :—

1. Cryptobranchida.

Under this group M. Milne-Edwards arranges all the *Thalassinidæ* which are without respiratory appendages suspended under the abdomen. Their branchiæ are in general composed of cylinders, united after the manner of a brush. All the species whose habits are known live in the sand, in which they burrow deeply.

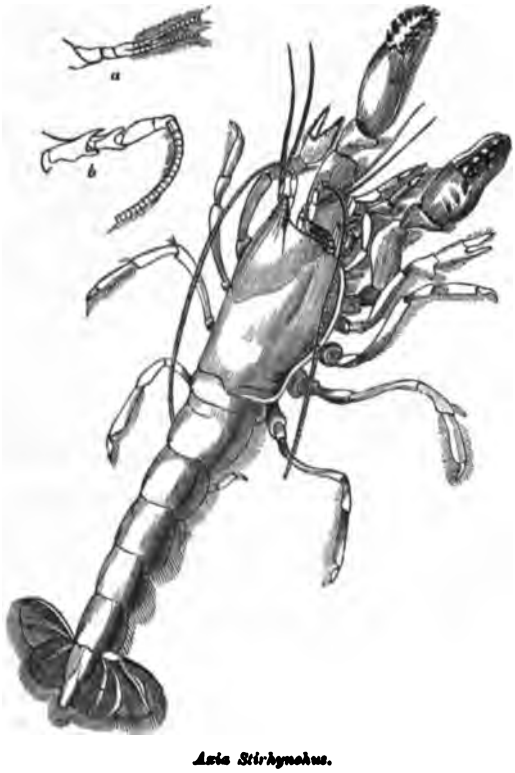
Glaucothöe, Edwards.—Carapace nearly ovoid, and without any rostriform prolongation; eyes projecting, large, and nearly pyriform; internal antennæ short, cylindrical, and bent; external antennæ inserted lower than the preceding, their peduncle bent, and presenting above a small scale, the vestige of a palp.

G. Peronii is the only species known. It appears to inhabit the seas of Asia.

Callianassa, Leach. [CALLIANASSA.]

Axia, Leach.—Carapace very much compressed, and terminated anteriorly by a small triangular rostrum; ocular peduncles very small, cylindrical, and terminated by a hemispherical cornea. Terminal filaments of the internal antennæ nearly of the length of the carapace.

A. Stirhynchus is the only known species. Its length is about three inches, and it inhabits the coasts of France and England.



Axia Stirhynchus.

a, intermediate antenna; *b*, external antenna.

Gebia (*Gebios* and *Thalassina*, Risso; *Gebia* and *Upogebia*, Leach).—Carapace terminating anteriorly by a triangular rostrum, and sufficiently large to cover the eyes almost entirely; on each side of its base is a tooth, which is continued with a crest, and forms the lateral border of the upper surface of the stomachal region. Internal antennæ very short, but nevertheless their terminal filaments are longer than their peduncle; external antennæ very slender, and presenting at their base no vestige of a moveable scale.

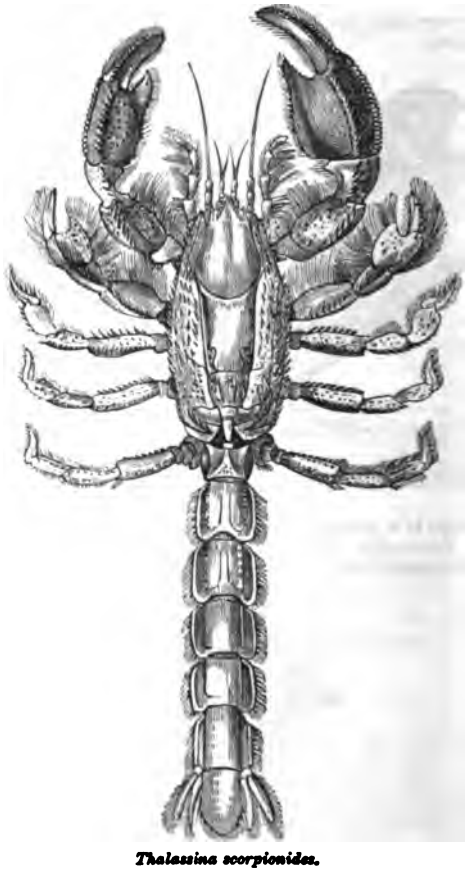
G. stellata. Length an inch and a half. It inhabits the coasts of England

Gebia stellata.

a, intermediate antenna; *b*, base of an external antenna.

Thalassina, Latreille.—Carapace short, narrow, and very much elevated. Stomachal region small, and limited backwards by a deep furrow. Cardial and intestinal regions equally separated from the branchial regions, and representing by their junction a triangle, the apex of which is directed backwards. Front armed with a small triangular rostrum. Eyes small and cylindrical. Internal antennæ inserted above those organs; their peduncle of moderate size, and their terminal filaments slender and unequal, the longest about thrice the length of the peduncle. External antennæ very small; their peduncle cylindrical, hardly reaching beyond the rostrum, and presenting above no vestige of appendages.

T. scorpionides. Length about 6 inches. Colour brownish. It is a native of the coasts of Chili.



Thalassina scorpionides.

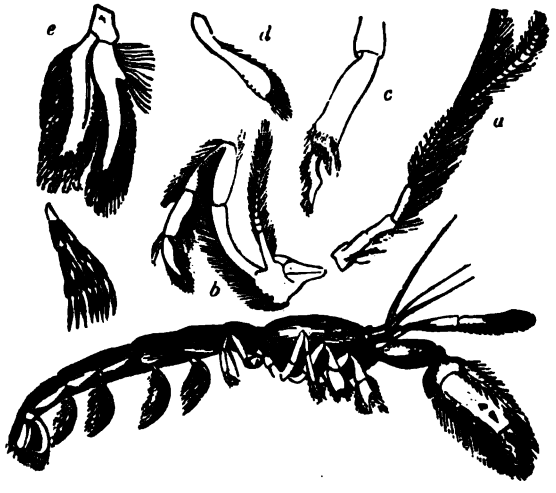
2. Gastrobranchida.

M. Milne-Edwards observes that this small division of the Thalassinians is very remarkable, for it establishes the passage between the *Callianassæ* and the *Squillæ*. In the general form of the body the Crustaceans forming this division differ, he remarks, but very little from the first, and the conformation of their thoracic branchiæ does not permit their separation from the Macrurous Decapods, nor their distant removal from the Thalassinians; but they have respiratory appendages fixed to their abdominal false feet, exhibiting the greatest analogy with the ramose branchiæ of the Stomapods.

Callianidea (Edwards).—Body very delicate, slender, and elongated; carapace hardly a third of the length of the abdomen, and not covering the last thoracic ring, compressed and rather elevated, its lower border applied exactly against the base of the four first pairs of feet. No

rostrum, and the anterior border of the carapace notched on each side of the median line for the reception of the base of the eyes, whose peduncles are very short, and formed as in the *Callianassæ*. Four antennæ, slender, and inserted nearly on the same transversal line; the first pair terminated by two filaments nearly equal in length, one of which however is the largest, and slightly convex towards the end.

C. typa. Length about 10 lines. It is a native of the coasts of New Ireland, where it was found by Messrs. Quoy and Gaimard.



Callianidea typa, magnified.

a, antenna of the first pair; *b*, external jaw-foot; *c*, extremity of one of the posterior feet; *d*, abdominal false feet, first pair; *e*, false feet of one of the four succeeding pairs; *f*, marginal fringe of those false feet.

THALASSIOPHYTES (literally 'sea-plants,' from θάλασσα and φύτον) is the name given by Lamouroux to designate the vegetable productions of the ocean and of its rocks and shores.

THALASSOPHRYNE. [*See* SUPPLEMENT.]

THALICTRUM (from the Greek θάλικτρον), a genus of Plants belonging to the natural order *Ranunculaceæ*. Its consists of herbs which have usually a fetid smell like rue, and hence are called Meadow Rues. The species have perennial roots with annual stems. The flowers are corymbose, panicled, and somewhat racemose, of a green, white, or yellow colour; they have no involucre and no petals; the calyx is composed of 4 or 5 petal-like sepals; carpels 4-15 in number. Upwards of 50 species are enumerated, which are mostly natives of the temperate and colder parts of the world.

T. aquilegifolium, Feather-Columbine, has ovate stipules, placed at the base of the ramifications of the petiole; and a corymbose panicle. It is a native of Europe, in woody districts of Germany, France, and Italy. The stems and stamens of this plant vary in colour, sometimes being greenish-white and sometimes purple. A variety is found in Austria with dark purple stems and stamens, and is called *T. a. atro-purpureum*. Another variety, *T. a. formosum*, has the stamens dilated at the apex; whilst another has the stems green and stamens quite white, and is named *T. a. album*.

T. minus, Lesser Meadow-Rue, has the stem round, mealy, the flowers panicled, drooping, leaflets smooth, roundish, toothed at apex, glaucous, pericarps acute, furrowed. It is a native throughout Europe. In Britain it is found in chalky pastures, and on the sea-coast where shell-sand abounds. The *T. majus*, Greater Meadow-Rue, is also a native of Great Britain, though rare.

T. flavum, Yellow Meadow-Rue, has an erect branched furrowed stem, fibrous roots, a somewhat corymbose panicle of cream-coloured flowers, with wedge-shaped trifid acute leaflets. It is a native of all districts in Europe. In Britain it occupies wet meadows, the banks of rivers and ditches. It has a root of a yellow colour, and is said to resemble, both in appearance and properties, rhubarb. It yields a yellow dye, which may be employed for dyeing wool, and was formerly used as a remedy in jaundice. Like many of the family to which it belongs, it is very acrid, and produces blisters upon the skin, when applied to it.

T. fœtidum, Fetid Meadow-Rue, has a simple stem, naked at the base, leafy in the middle, and panicled at top; the leaflets are obtuse, toothed, and covered with a clammy pubescence. It is a native of France, Switzerland, Russia, &c., and is found in valleys and on hill sides, and in the fissures of calcareous rocks. It smells more powerfully than any of the species—hence its specific name.

T. Cornuti has dicœcious or polygamous flowers, with club-shaped filaments, obovate roundish leaflets, glaucous beneath. This is a North American species, and is found on the banks of rivers and in woody districts throughout the whole continent.

THALLOGENS, a class of Plants proposed by Lindley for those Flowerless Plants which are distinguished by the absence of an axial stem. It includes all the *Cryptogamia*, with the exception of Ferns and Mosses. [ACROGENS.]

THALLUS is a botanical term used exclusively in cryptogamic botany, and is generally applied to the part of the plant which bears the reproductive organs, and constitutes the principal part of its vegetation.

THAMNOPHILI'NÆ. [LANIADÆ.]

THAMNO'PHILUS. [LANIADÆ.]

THA'PSIA, a genus of Plants belonging to the natural order *Umbelliferæ*. The species are perennial herbs, with doubly or trebly pinnate leaves, large compound umbels of many rays without involucre or involucella, and yellow flowers. The margin of the calyx is 5-toothed; petals elliptic, entire; fruit compressed from the back; mericarps with five primary filiform ribs, three of which are dorsal, and two lateral ones in the commissure, and with four secondary ribs, of which the two dorsal are filiform and the two lateral ones membranous and winged; vittæ in each furrow underneath the secondary ribs.

T. villosa, Velvety Deadly Carrot, has a square glabrous stem; tripinnate leaves, many-parted leaflets, villous on both surfaces, lower ones deflexed. This plant is found in Portugal, Spain, the south of France, in Italy, and the northern coasts of Africa.

T. silphium, Silphium Deadly Carrot, has a square glabrous furrowed stem; pinnate leaves, many-parted leaflets, all linear, hairy on both surfaces, with revolute margins. It is a native of the north of Africa, on the mountains of Cyrenaica, and is supposed to be the plant that produced the juice called Silphium, and which was held in such high repute by the ancients, that a district where it grew in abundance was called 'Silphifera.' [SILPHIUM.]

T. *Garganica*, Garganian or Greek Deadly Carrot, has a square glabrous stem; bi- or tri-pinnate shining leaves; segments linear, acute, elongated, quite entire along the margins; involucre with few leaves; fruit cordate at the base. This plant is a native of Calabria, Mauritania, Greece, Sicily, Sardinia, Spain, &c. Dr. Sibthorp found it common in Greece and the neighbouring islands, and concludes that it is the Θάψια of Dioscorides, with whose description it agrees better than any of the rest.

THASPIUM, a genus of umbelliferous plants.

THAUMA'NTIAS. [ACALEPHÆ.]

THEA, a genus of Plants belonging to the tribe *Camellieæ* and natural order *Ternströmiaceæ*, which has been so named from the slightly altered Chinese name of the dried herb which now forms the almost universal beverage of the British Isles. Though now so extensively employed, the introduction of tea into Europe is of comparatively recent origin.

Tea however must have been used in China from very early times. It is differently named in different parts of China, as Tcha, or Cha, also Tha, whence we have Tsia, The, and Tea. In Persian works in use in India, tea is called Cha-Khutai, or Tea of Cathay.

The genus *Thea* is characterised by having a calyx which is persistent, without bracts, 5-leaved, leaflets imbricated, the outer ones smaller; petals of the corolla 6 to 9, hypogynous, imbricated, the inner ones the largest, all adhering together at the base; stamens numerous, in several rows, adhering to the bottom of the petals; filaments filiform, anthers incumbent, 2-celled, oblong, with a thickish connectivum, cells opening longitudinally; ovary free, 3-celled; ovules 4 in each cell, inserted alternately into the central angle, the upper ones ascending, the lower pendulous; style trifid, stigmas 3, acute; capsule spheroidal, 2-3-lobed, 3- or by abortion 2-celled, with loculicidal dehiscence, or with the dissepiments formed from the turned-in edges of the valves; seeds solitary or rarely two, in cells, shell-like testa, marked with the ventral umbilicus; cotyledons thick, fleshy, oily; no albumen; radicle very short, very near the umbilicus, centripetal.

The genus *Camellia* is usually considered to be very distinct from *Thea*; indeed by Cambessedes the two are separated from each other by several intervening genera: they are however too closely allied to allow of this separation. Distinctions have been made in the fruit of the two genera. That of *Thea* is 3-lobed with obtuse corners and opening along the middle of the lobes, that is, having the dissepiments opposite to the valves, or, as expressed by modern botanists, having a loculicidal dehiscence. *Camellia*, on the contrary, is described as having its fruit obscurely triangular, without any tendency to become deeply 3-lobed, with the margins of the valves turned inwards and forming the dissepiments, which thus alternate with the valves, and have what is now called a septicidal dehiscence. Mr. Griffith, on the contrary, who is well qualified to form a correct opinion, states, from examination of the Assamese tea-plant and of two species of *Camellia* from the Khosiya Hills, that there is no difference between *Thea* and *Camellia*. The dehiscence in both, he says, is of the same nature, that is, loculicidal, and the only difference that does really exist is simply of specific value, consisting in the fruits of the tea-plant being 3-lobed, of the *Camellia* triangular.

The species of the genus *Thea* are few in number; some botanists are of opinion that even these are varieties of a single species.

T. viridis is a large, strong-growing, almost hardy plant, with spreading branches, its leaves three to five inches long, thin, almost membranous, very broadly lanceolate, light green and wavy, with large and irregular serratures, the flowers large, usually solitary, mostly confined to the upper axil, with 5 sepals and from 5 to 7 petals; fruit

nodding. This species is figured by Dr. Lettsom in his account of the tea-plant, t. 1, and by Sir W. J. Hooker, 'Bot. Mag.,' t. 3148, and in Loddiges' 'Bot. Cab.,' t. 227, all from plants which have flowered in this country. Kæmpfer supplies a very good figure, 'Amœn. Exot.,' p. 607, from a Japanese plant. This species is found both in China and Japan, and is supposed to be the species which yields the green tea of commerce. It has been long introduced into this country; having been first sent from Japan in 1687 to the Cape of Good Hope, and thence into Europe.

T. Bohea is a smaller plant than *T. viridis:* its branches are stiff and straight, its stem erect, the leaves not above half or two thirds of the size of the former species, elliptical oblong, perfectly flat, more coriaceous, of a dark green colour, with small and even serratures; they are numerous, and have in their axils two or three flowers, of 5 sepals and 5 petals, these are smaller and have a slight fragrance, and flower later in the season than *T. viridis.* The plant is much more tender than the green tea-plant, and unable to stand the cold of an English climate. It is supposed by some to yield the leaves which are converted into black tea, and, notwithstanding contrary statements, leaves similar to those of this plant may be recognised on infusing and spreading out the leaves of some of the black teas of commerce. [TERNSTRÖMIACEÆ.] A variety of this is sometimes called *T. stricta.* It is figured by Lettsom, ed. 2, p. 41, who considers it only a variety of the former. It is also figured by Loddiges, 'Bot. Cab.,' t. 226, who, as well as Sir W. J. Hooker and Dr. Royle, considers it to be a distinct species.

T. Assamensis, the Assam Tea-Plant, which some years ago attracted so much attention, seems to partake of the characters of both the foregoing. The Calcutta Tea Committee say, in 1835, "We are now enabled to state with certainty, that not only is it a genuine tea, but that no doubt can be entertained of its being the identical tea of China, which is the exclusive source of all the varieties and shades of the tea of commerce." To this it may be replied, that there are considerable doubts whether the teas of commerce are all derived from one species of plant. Mr. Griffith says, in the size both of the plant and of the leaves, as well as in the texture of these last, and in its stations, the Assamese plant approaches to the green tea-plant of China; in its geographical distribution, so far as latitude is concerned, it approaches to the black tea. The inflorescence of the Assamese plant varies, but perhaps its usual state is to have the flowers solitary in the axils of the leaves, but the number of flowers varies from one to five. The plants introduced into this country have their leaves much larger and thicker than those of the green tea-plant, and Messrs. Loddiges find that it requires a much greater degree of heat, in fact that of the hot-house, while the others are in the open air for a great part of the year.

Two other species, described by Loureiro, are little known, as *T. Cochinchinensis,* about eight feet high, having lanceolate leaves, flowers of three to five sepals and five petals, solitary, terminal; found wild in the north of Cochin-China, where it is also cultivated, being used medicinally by the natives as a diaphoretic. *T. oleosa* is also a shrub of eight feet high, found in the fields in the neighbourhood of Canton, and named from its seeds yielding a large quantity of oil, which is used for burning and as an article of diet. The leaves are lanceolate, the flowers of six sepals and six petals, peduncles 3-flowered, axillary; fruit stated to be indehiscent, rather a berry than a capsule. [TEA, in ARTS AND SC. DIV.]

THECA (in Anatomy) is a term commonly applied to the strong fibrous sheaths in which certain soft parts of the body are inclosed. Thus the *Theca vertebralis* is the sheath of dura mater in which the spinal cord is inclosed; and the canals through which many of the long tendons of the muscles of the hand and foot run are called thecæ.

The same term is employed in vegetable anatomy. It was applied by Grew to that part of the stamen which contains the reproductive granules, and which is now generally called the anther. [ANTHER.] It is also extensively employed in cryptogamic botany. Among the ferns, it is applied, in common with the terms capsule, conceptacle, and sporangium [SPORANGIUM], to those little granules which constitute the masses called Sori. In the *Equisetaceæ* it expresses the assemblage of cases which are attached to scales arranged in a conical manner.

The same term is used to indicate the kidney-shaped two-valved cases that contain the reproductive matter of *Lycopodiaceæ,* and also the urn-like organs that inclose the sporules of mosses. It is by some writers still further extended, and used to express the parts that contain the sporules in Lichens and *Fungi.*

THECADACTYLS. [GECKOTIDÆ.]

THECI'DEA, or THECI'DIUM. [BRACHIOPODA.]

THECODONTOSAU'RUS, a genus of extinct Saurian Reptiles referred by Professor Owen to his group of Thecodont Lacertians.

Professor Owen, in his 'Report on British Fossil Reptiles,' observes that among the inferior or squamate saurians there are two leading modifications in the mode of attachment of the teeth, the base of which may be either anchylosed to the summit of the alveolar ridge, or to the bottom of an alveolar groove, and supported by its lateral wall. These modifications are, he remarks, indicated respectively by the terms 'acrodont' and 'pleurodont.' A third mode of fixation is presented by some extinct saurians, which, in other parts of their organization, adhere to the squamate or lacertine division of the order, the teeth being implanted in sockets, either loosely or confluent with the bony walls of the cavity: these Professor Owen has, in his 'Odontography,' termed the Thecodont Lacertians, the most ancient of all saurians belonging to this group.

The *Thecodontosaurus* of Dr. Riley and Mr. Stutchbury, described by them in the 'Geological Transactions' of 1836, from remains found in the dolomitic conglomerate of Redland, near Bristol, the oldest or lowest division of the new red-sandstone series, is allied to the typical Varanian Monitors, but differs from them in having the teeth imbedded in distinct sockets. The *Varani,* among the squamate saurians, approach to this condition in the shallow cavities containing the base of their teeth along the bottom of the alveolar groove.

But, in the extinct genus now under consideration, the sockets are deeper, and the inner alveolar wall is nearly as high as the outer one; the teeth are arranged in a close-set series, slightly decreasing in size towards the posterior part of the jaw; each branch of the lower jaw is supposed to have contained 21 teeth, which are conical, rather slender, compressed and acutely pointed, with an anterior and posterior finely-serrated edge, the serratures being directed towards the apex of the tooth, as in G. Fischer's genus *Rhopalodon;* the outer surface is more convex than the inner one; the apex is slightly recurved; and the base of the crown contracts a little to form the subcylindrical fang. The pulp-cavity remains open in the base of the crown; and in their microscopic structure the teeth of the *Thecodontosaurus* closely correspond with those of *Varanus, Monitor,* and *Megalosaurus.*

The tooth of *Palæosaurus* is compressed, pointed, and with trenchant serrated margins; but its breadth, compared with its length, is much greater than in *Thecodontosaurus.* [PALÆOSAURUS; TELEOSAURUS.]

Professor Owen draws the following conclusions from the knowledge at present possessed of the osteology of *Thecodontosaurus* and *Palæosaurus,* whose antiquity the discoverers of these genera regard as being greater than that of any other vertebrated animals, excepting fishes:—

In their thecodont type of dentition, biconcave vertebræ, double jointed ribs, and proportionate size of the bones or the extremities, they are nearly allied to the *Teleosaurus;* but they combine a lacertian form of tooth and structure of the pectoral and probably pelvic arch with these crocodilian characters, having distinctive modifications, as the moniliform spinal canal, in which however the almost contemporary Rhynchosaur participates.

THECODONTS. [THECODONTOSAURUS.]

THECOSO'MATA (Gray), an order of Pteropodous *Mollusca,* it includes the following families and genera:—

Family 1. *Cleodoridæ.*

Genera:—*Hyalæa; Diacria; Cleodora; Balantium; Pleuropus; Vaginella; Cresceis; Brochus; Psyche; Eurybia.*

Family 2. *Limacinidæ.*

Genus, *Limacina.*

Family 3. *Cuvieridæ.*

Genera:—*Cuvieria; Tripteres.*

Family 4. *Cymbuliadæ.*

Genus, *Cymbulia.*

THELI'DOMUS, (Swainson), a genus of *Mollusca* placed in the family *Trochidæ,* and in the sub-family *Rotellinæ.* This so-called shell, which is twice figured and described as that of a mollusc in the 'Cabinet Cyclopædia,' is the case of an insect.

We notice the error, that a mistake in a useful book bearing the authority of a name so generally known and deservedly respected as Mr. Swainson's, may not mislead.

THE'LODUS, a genus of Fossil Fish. [FISH.]

THELPHU'SA. [THELPHUSIDÆ.]

THELPHU'SIDÆ, a tribe of Brachyurous *Crustacea* belonging to the family *Catometopes.* The carapace has but little or no convexity, and is wider than it is long: its anterior border is straight, and occupies about two-thirds of its transversal diameter: its lateral borders describe a regular curve. The front is remarkably wider than the buccal frame, and more or less curved downwards. The eyes have a stout and short peduncle, the length of which is never more than double the diameter, and its lower surface is occupied by the cornea for about half its length. The orbits are oval, and always present at their internal angle a narrow gap filled by the external antenna. The internal antennæ are horizontal, and, in general, nearly entirely hid by the front. The basilary joint of the external antennæ penetrates into the gap which occupies the internal angle of the orbit and separates this cavity from the antennary fossets; it is but little developed, and the moveable stem which springs from it in the same gap is very small.

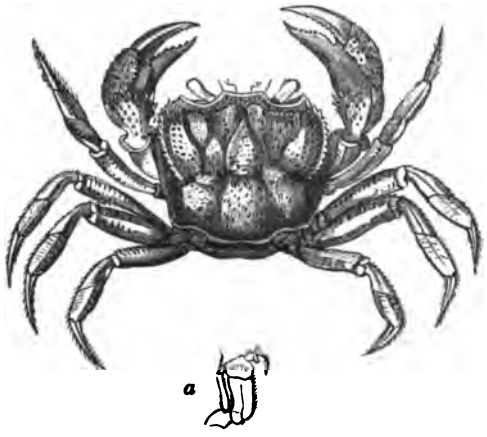
The habits of these animals are very remarkable. All the known species live in the earth near the banks of rivers or in humid forests; bearing a strong analogy to the Land-Crabs. (Milne-Edwards.)

M. Milne-Edwards divides the tribe into three sections:—

1. Third joint of the external jaw-feet nearly square, and giving insertion to the succeeding joint by a notch in its internal angle.

Ex. *Thelphusa fluviatilis.* Length 2½ inches. Colour yellowish. It is found in the south of Italy, Greece, Egypt, and Syria.

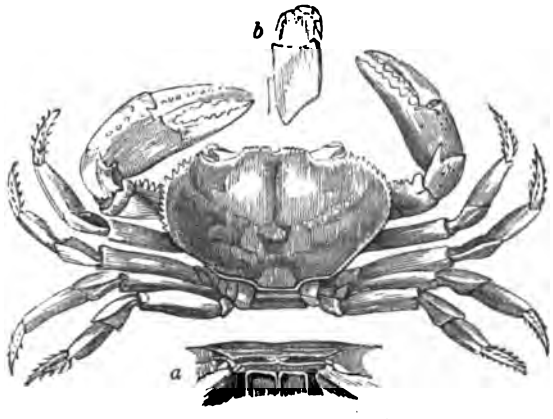
This species is generally considered to have been well-known to the ancients, and to be that noticed by Hippocrates and Aristotle: these *Thelphusæ* are supposed to be the Heracleotic Crabs (*οἱ Ἡρακλεωτικοὶ καρκίνοι*) of the latter ('Hist. Anim.,' iv. 2); and to be those represented on ancient medals. It burrows in the earth on the banks of rivers.



Thelphusa fluviatilis, reduced. *a*, external jaw-foot of same.

2. Third joint of external jaw-feet nearly square, and giving insertion to the succeeding joint towards the middle of its anterior border.

Ex. *Boscia dentata*. Length about 2 inches. It inhabits the Antilles and South America.



Boscia dentata, reduced one-third.
a, antennary region; *b*, external jaw-foot.

3. Third joint of the external jaw-feet having nearly the form of a reversed triangle, and giving insertion to the succeeding joint by its external angle.

Ex. *Trichodactylus quadratus*. Length about an inch. It is a native of Brazil.

THEMISTO (Guerin), a genus of Amphipodous *Crustacea*.

THENARDITE, *Anhydrous Sulphate of Soda*, a Mineral, occurring crystallised. Primary form a right rhombic prism. Cleavage parallel to the primary planes. Colour white or reddish. Transparent; translucent; opaque. Soluble in water; effloresces on the surface. Specific gravity 2·73.

It occurs in crystalline coatings at the bottom of some lakes, at a place called Las Salinas Espartinas, about five leagues from Madrid. It is used in the preparation of carbonate of soda. According to the analysis of Casaseca it is composed of—

Sulphate of Soda	99·78
Carbonate of Soda	0·22
	——100

THENUS. [Scyllaridæ.]

THEOBRO'MA (from *θεός* and *βρῶμα*, the food of gods), a genus of Plants belonging to the natural order *Sterculiaceæ*, the species of which yield the Cocoa of commerce. They are trees with large simple leaves and with the flowers in clusters. The calyx is composed of 5 sepals; the petals are 5, lengthened into a strap-like form at the apex; the stamens are 5, each with double anthers and a horn-like appendage between each filament; the style is filiform, with a 5-parted stigma; fruit a 5-celled capsule without valves; seeds imbedded in a soft pulp; no albumen, and thick oily wrinkled cotyledons.

T. Cacao, Common Cacao, or Chocolate Nut-Tree, has entire, elliptic, oblong, acuminate, quite smooth leaves, and oblong smooth fruit This tree is indigenous in South America, and is generally found at a height of 600 feet above the level of the sea. It is however extensively cultivated in the West Indies, and in the tropical parts of Asia and Africa. The Mexicans call the tree Chocolalt, hence our word Chocolate for the prepared seeds. The capsules of the fruit are large, and contain each about 25 seeds: the pulp in which these are enveloped has a sweet and not unpleasant taste, and is frequently eaten where the tree is grown. The trees are evergreens, and bear fruit and flowers all the year through, but the usual times for gathering the fruit are in June and December. The cotyledons of the seeds contain a large quantity of oily albumen, which has an agreeable flavour, and on this account they are not only used as a principal article of diet by the natives of the countries in which they grow, but are now used for the same purpose throughout the civilised world. The composition of these seeds, in which amylaceous matter is combined with oil, and a principle, called Theobromine, similar in its constitution to Thein and Caffein, is well adapted, when combined with sugar, to form a valuable article of diet. [Food.]

The oil contained in the seeds is sometimes obtained separately, and called cocoa-butter. It may be obtained easily by expression, especially if hot-water is added. It is said to be very nutritive, and to act as an anodyne. It is particularly recommended for making ointments. (Ersch and Gruber, 'Allgem. Encycl.,' art. Cacao.)

There are several other species of *Theobroma*, yielding seeds possessing the properties of the above, but they are not cultivated or employed to the same extent. They are all of them natives of South America, and used by the inhabitants where they grow as food. *T. Guazuma* of Linnæus, the Bastard Cedar, or Orme d'Amerique, now the *G. ulmifolia*, is a native of the West Indies, and is a handsome tree resembling the elm.

THEONEA. [Milleporidæ.]

THEONO'A, a genus of Fossil *Zoophyta*.

THEOPHRASTA, a genus of Plants dedicated to Theophrastus. It was originally called *Bresia* by Plumier, but afterwards altered by Linnæus. *T. Jussieui* belongs to the natural order *Myrsinaceæ*, and is a small tree with a simple unbranched stem, furnished with a tuft of long evergreen leaves at top, giving it a resemblance to a palm-tree. The flowers are of a white colour, and are arranged on terminal racemes, which are very short, and hidden amongst the leaves of the plant. The calyx is campanulate and cartilaginous. The corolla is also campanulate, with a short tube, and has a dilated throat, girded by an elevated angularly-lobed, fleshy, arched ring: the limb is spreading. The stamens are five, combined with the tube of the corolla; anthers horned. The fruit is a crustaceous spherical berry, about the size of a crab-apple, with the seeds half immersed in the placenta. The *T. Jussieui* is the only species. It is a native of the mountains of St. Domingo, and is much cultivated on account of its long handsome holly-like leaves. It may be propagated by cuttings, and grows well in a soil of peat, loam, and sand.

THERATES. [Ctenostoma.]

THERIS'TICUS, a genus of Birds.

THESPE'SIA (from *θεσπέσιος*), a genus of Plants belonging to the natural order *Malvaceæ*. The species are trees with large entire leaves. The calyx is truncate, and girded by a 3-leaved deciduous involucel; the fruit is a capsule with 5 cells, and each cell is semi-parted, with 4 seeds at the base.

T. populnea, Popular Thespesia, has roundish cordate pointed 5-7-veined leaves, with dot-like scales beneath, with the peduncles equal in length to the petioles. This plant is a native of the East Indies, Guinea, and the Society Islands; and is known, where it grows amongst British colonists, as the Umbrella-Tree. It attains a height of about 40 feet, and has large yellow flowers with a dark-red centre. In the tropics it has gained for itself a sacred regard, and is planted about monasteries and convents; hence the name Thespesia (divine). There are two species, natives of South America: they are all trees, with handsome showy flowers.

THETIS, a genus of Fossil Shells.

THIA, a genus of *Crustacea*. *T. polita* is a British species. It lives buried in the sand at a small distance from the shore. The colour is rosy. Length 10 lines.

Thia polita.

THINO'CORUS (Eschscholtz), a genus of Birds placed by Mr. G. R. Gray in his sub-family *Thinocorinæ*.

THIRST is the peculiar sensation which excites the desire to drink. Water is the proper object of this desire. [FOOD.]

THISANTHA. [*See* SUPPLEMENT.]

THISTLE, the common name of *Carduus*, a genus of Plants belonging to the large natural order *Compositæ*. From the time of Theophrastus down to that of Caspar Bauhin, all plants that possessed a spiny involucre were comprehended in the genus *Carduus*. The Artichoke (*Cynara*) and the Teasel (*Dipsacus*) were included in it by Tragus and Lobelius. Morison confined the genus to those plants that had spiny scales of the involucre and a crown of feathery down (pappus) surmounting the seed. Plants resembling them, but without a spiny involucre, he called *Cirsium*, and those without the feathery pappus *Carduus impropriè dictus*. Tournefort adopted these distinctions. Vaillant defined *Carduus* more accurately, giving it to plants with a globular involucre composed of spiny scales, with compound flowers, tubular florets, stamens united by the anthers, a hairy receptacle, and a hairy pappus on the seeds. If the pappus was feathery, he called the genus *Acama*; and when the receptacle was not hairy, but honeycombed, he used the term *Onopordon*, a name previously applied to Thistles by Pliny. When the scales and receptacles were fleshy, he named the genus *Cynara*. Linnæus adopted these genera, but changed Vaillant's *Acama* into *Cnicus*, a name which had been previously employed by Tournefort for another genus.

The genus *Carduus* consists of upwards of 30 species, most of which are inhabitants of Europe. None of them are found in the New World.

C. nutans, Musk-Thistle, has decurrent spiny leaves, with handsome drooping flowers; the scales of the involucre cottony, the outer ones spreading. It is a common plant on waste ground, in dry, stony, or chalky soils, in Great Britain. It gives out, especially in the evening in warm weather, a strong smell of musk.

C. marianus, Milk-Thistle, has spinous leaves embracing the stem; the scales of the involucre leaf-like, recurved and spinous at the margin. It is a native of England; scarce in Scotland. The leaves are distinguished by the milky-whiteness of their veins. This milkiness is said, according to an absurd story, to have been produced by a drop of the Virgin Mary's milk, just as the Milky-Way was supposed to arise from that of Juno. This plant is an esculent, and may be eaten young as a salad, or boiled and eaten as greens. The young stalks, when peeled and soaked in water, are also excellent.

The root may be prepared like salsify and skirret, and the receptacle may be cooked and eaten as the artichoke. When cultivated, the seeds should be sown in spring, and the plants kept at a foot and a half distance from each other, and the earth thrown up round them till they are etiolated.

The genus *Cnicus*, Plume-Thistle, is known by the feathered down that crowns the seeds. It is a large genus; nine of the species are inhabitants of Great Britain.

The Cotton-Thistle is the *Onopordon*, which is known by its honeycombed receptacle. The *O. Acanthium* is a British species. The leaves are ovate-oblong, sinuated, spinous, decurrent, and woolly on both sides. It attains a height of from four to six feet. It is cultivated in Scotland as the Scotch Thistle; but it is doubtful whether this national badge has any existing type, as the representations of the Scotch Thistle on ancient wood-carvings, coins, and armorial bearings, differ more from each other than any known species of thistles. The receptacle and stalks of the Cotton-Thistle are sometimes eaten in the same manner as the Artichoke and Cardoon. [CYNARA.]

The Carline Thistle forms the genus *Carlina*, which obtained that name from a tradition that the root of the Common Carline (*C. vulgaris*) was shown by an angel to Charlemagne as a remedy for the plague which prevailed in his army. The genus is known from the others by the inner scales of the involucre being spreading and membranous, and of a yellow colour. The Common Carline is a frequent plant in Great Britain on dry hilly pasture and in fields. It is about one foot high.

The Blessed Thistle is the *Centaurea benedicta*, the *Carduus benedictus* of old writers. The involucre of the genus *Centaurea* is not spiny, and the seeds have a very simple pappus, or none. The Blessed Thistle is a native of the Levant, and in the middle ages was held in extravagant estimation on account of its supposed virtues. It is still cultivated in some places on account of its medicinal properties.

Sow-Thistle is the name given to the species of *Sonchus*. [SONCHUS.]

THLASPI (from θλάω, to compress; seeds compressed), a genus of Plants belonging to the natural order *Cruciferæ*, and the sub-order *Angustiseptæ*. It has a roundish notched pouch, boat-shaped valves winged at the back; the seeds are numerous, the petals equal, the flowers white.

T. arvense, Penny-Cress, has oblong-toothed leaves and erect stems, an elongated fruit-bearing raceme, orbicular pouches with a longitudinal wing. It is a native throughout Europe and in England. The flowers are small and white, and the whole plant when bruised has a somewhat alliaceous odour.

T. perfoliatum has obcordate pouches, the stem-leaves cordate-oblong, the petals equal in length to the calyx. It is a native of Europe and is found in England on a chalky soil.

T. alpestre is found on limestone mountain pastures throughout Europe and England; the leaves are entire, the radical ones ovate, stalked, the cauline ones sagittate and stem-clasping; the petals nearly as long as the calyx, the pods obcordate, 8-12-seeded.

THOA (Linnæus), a genus of *Polypiaria*.

THOMSONITE. [COMPTONITE.]

THORA'CIC DUCT is the principal trunk of the lymphatic or absorbent system, and the canal through which the greater part of the chyle and lymph is conveyed into the blood. It commences, below, at what is called the receptaculum chyli, which receives all the principal absorbent vessels from the intestines and from the lower extremities, and lies at the posterior and middle part of the abdomen, on the upper lumbar vertebra and on the right side of the aorta. In man the diameter of the receptaculum is but little greater than that of the thoracic duct, which is continued from it; in most other animals it is considerably greater, and the duct seems in them to commence in a large pouch. From the receptaculum chyli the thoracic duct passes upwards, on the right side of the aorta, and behind it, from the abdomen into the chest, being joined in its course by the lymphatic vessels of the adjacent organs. Opposite the sixth dorsal vertebra it begins to bend to the left, and, after passing behind the arch of the aorta, it ascends to the level of the seventh cervical vertebra, curves forwards and downwards, and opens into the left subclavian vein, usually near its junction with the left jugular vein. At this orifice of the thoracic duct there are two valves, like those of the veins, which open to permit fluid to pass from the duct, but close when any is forced against them from the vein. Other valves in uncertain number are found in different parts of the duct, and have all the same direction as those of veins. [ABSORBENTS; CHYLE; DIGESTION.]

THORAX. [LUNGS.]

THORITE, a Mineral in which thorina was discovered to exist by Berzelius. It occurs massive and compact. Fracture uneven, very brittle, and full of cracks. Hardness about 5·0. Lustre resinous; vitreous; opaque. Colour black. Specific gravity 4·63 to 4·80. Before the blow-pipe, gives off water, and becomes yellow, but does not fuse It is found in Sienite, in Norway. It contains nearly 58 per cent. of thorina, mixed with 13 metallic and other bodies.

THO'RIUM, or THORI'NUM, a metallic body discovered by Berzelius in an earth to which he had given the name of Thorina. [THORITE.]

THORN. [CRATÆGUS.]

THORN-APPLE. [DATURA.]

THOROUGHWORT. [EUPATORIUM.]

THOROUGH-WAX. [EUPATORIUM.]

THRA'CIA (Leach), a genus of *Mollusca*.

THRASA'ETOS. [FALCONIDÆ.]

THRAULITE, *Hisingerite, Hydrated Silicate of Iron*, a Mineral occurring in roundish nodules. Fracture uneven or imperfect, conchoidal. Structure curved, foliated. Brittle. Splendent. Nearly opaque. Lustre vitreo-resinous. Colour brownish-black. Gives out water when heated in a glass tube; imperfectly fused by the blow-pipe, and is, after heating attracted by the magnet. It occurs at Riddarhyttan in Westmanland (1), and at Bodenmais in Bavaria (2), accompanying iron pyrites. Its analyses by Hisinger and Kobell are as follows:—

	(1) Hisinger.	(2) Kobell.
Silica	36·30	31·28
Peroxide of Iron	44·39	50·86
Water	20·70	19·12
	101·39	101.26

THRIFT, the common name of the *Statice Armeria*, Smith, now *Armeria maritima*. *Armeria* belongs to the natural order *Plumbaginaceæ*. It is distinguished by the flowers being in a head contained in an inverted cylindrical sheath, and the capsular fruit not bursting.

A. maritima, Thrift, is a common British plant, growing on muddy and rocky sea-shores and on the banks of salt-water estuaries. It bears transportation to gardens, where it is a favourite in forming the borders of flower-beds. It may be easily distinguished from other species by its linear 1-nerved leaves. It has rose-coloured flowers. Several varieties are described.

(Babington, *Manual of British Botany*.)

THRINCIA, a genus of Plants belonging to the natural order *Compositæ* and the sub-order *Cichoraceæ*. It has an oblong involucre in one row, with a few additional scales at the base; the receptacle is punctured; the fruit beaked; the pappus in two rows, the outer row setaceous, deciduous, the inner one longer, feathery, and dilated at the base; the marginal row of fruits enveloped in the scales of the involucre.

T. hirta, the only British species, has lanceolate leaves, sinuate, dentate, hispid or hairy; the leaves are all radical, sometimes nearly or quite entire, occasionally runcinate. It is found chiefly in gravelly soil.

(Babington, *Manual of British Botany*.)

THRI'OTHORUS. [TROGLODYTINÆ.]

THRIOTHU'RUS. [TROGLODYTINÆ.]

THROMBOLITE. [COPPER.]

THROSCUS. [ELATERIDÆ.]
THROSTLE. [MERULIDÆ.]
THRUSH. [MERULIDÆ.]
THRUSH-FUNGUS. [OIDIUM.]
THRUSHES. [MERULIDÆ.]

THUJA, or THUYA, a genus of Plants belonging to the natural order *Coniferæ*. This name is derived from *θύω*, as, on account of the pleasant odour given out by the wood in burning, it was used in ancient sacrifices. The species of this genus are more commonly known by the name of *Arbor Vitæ*. It belongs to the section of *Coniferæ* called *Cupressineæ* by Richard, in which *Cupressus*, *Callitris*, *Taxodium*, and *Juniperus* are also included. The pistils and stamens are in separate flowers on the same tree. The male catkins are terminal and solitary; the pollen of each flower is included in four cases that are attached to the inner face of the scale towards its base. The female catkin is terminal; the ovary is united to the bractea, forming together a kind of receptacle; each receptacle has two ovules; the receptacles are semipeltate, imbricated, and smooth, or, in some cases, have a recurved beak near the tip; the seeds in some are slightly winged. The leaves are scale-like, closely imbricated or compressed. The species are evergreen, either trees or shrubs, and are inhabitants of Asia, Africa, and North America.

T. occidentalis, Western or American Arbor Vitæ, has the branchlets 2-edged; the leaves imbricated in 4 rows, ovato-rhomboid, adpressed, and tuberculated; the cones are obovate, with the interior scales truncate and gibbous beneath the apex. This plant is a large shrub or small tree, and is a native of North America, from Canada to the mountains of Virginia and the Carolinas. It is not so frequent in the southern states, and is found there on the steep banks of mountain-torrents. In the northern states of America it is sometimes called the White Cedar, but more commonly Arbor Vitæ. It grows best in cool moist places, on the borders of rivers and lakes, and in swamps, some of which it covers to the extent of 50 to 100 acres. The stem of this tree seldom rises straight from the ground, but makes a short bend before it becomes straight.

T. orientalis, Oriental or Chinese Arbor Vitæ, has 2-edged branchlets; imbricated ovato-rhomboid adpressed leaves, furrowed in the middle and in 4 rows; the cones are elliptic, with the interior scales blunt, and mucronate beneath the apex. It is a native of rocky situations in Siberia and China, and on the mountains of Japan.

T. pendula, Pendulous or Weeping Arbor Vitæ, has opposite decussating spreading lanceolate mucronate keeled somewhat distant leaves; globose cones; convex smooth scales; filiform pendulous branches. It is a native of Tartary, and is an elegant shrub.

T. articulata of Desfontaines is now called *Callitris quadrivalvis*, Four-Valved Callitris. The genus *Callitris* differs from *Thuja* in having the scales of the female catkins, from 4 to 6 in number, opening like the valves of a regular pericarp, and the seeds at the base of these scales winged on the margin. The Four-Valved Callitris has flattened articulated leaves; the female catkin with 4 oval pointed valves, 2 of which have seeds. It is a native of Barbary, and attains a height of from 15 to 20 feet. It was first discovered by Desfontaines on Mount Atlas in 1796. [CALLITRIS.]

THULITE. [EPIDOTE.]
THUMERSTONE, or THUMITE. [AXINITE.]

THUNBERGIA (in honour of Thunberg the botanist), a genus of Plants belonging to the natural order *Acanthaceæ*. It has a double calyx, the outer one 2-leaved, the inner about 12-toothed. The corolla is campanulate; the capsule beaked and 2-celled. The species are handsome climbing plants with a fragrant odour.

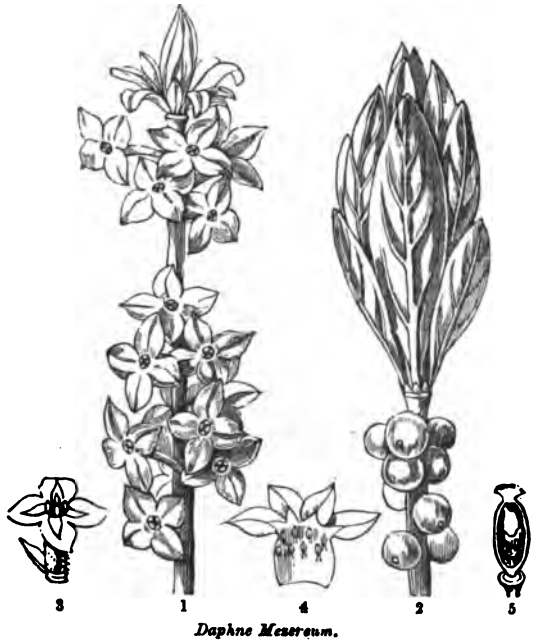
T. fragrans has a climbing stem, with cordate acuminate leaves somewhat angular at the base.

T. grandiflora has large flowers with no inner calyx; the leaves are angular cordate; the anthers bearded and spurred. This and the former species are natives of the East Indies.

THUREA. [BOSWELLIA.]
THURINGITE. [IRON.]
THUY'TES, a genus of Fossil Plants.
THYLA'CINUS. [MARSUPIATA.]
THYLACOTHERIUM. [MARSUPIATA.]
THYMALLUS. [SALMONIDÆ.]
THYME. [THYMUS.]

THYMELA'CEÆ, *Daphnads*, a natural order of Plants belonging to the tubiferous group of Incomplete Exogens. The name of this order is derived from *Thymelæa*, a plant spoken of by the ancients, and which some have supposed to be the *Daphne Gnidium*, a plant belonging to the present order. This order consists of shrubs or small trees, very rarely herbaceous, with non-articulate sometimes spiny branches having a very tenacious bark. The leaves are entire, simple, without stipules, and alternate or opposite. The flowers are capitate or spiked, terminal or axillary, occasionally solitary; the calyx is tubular, coloured, 4-cleft, with an imbricate æstivation; the stamens are 2, 4, or 8 in number, inserted into the tube with 2-celled anthers, dehiscing lengthwise in the middle; the ovary is solitary, with a solitary pendulous ovule. The fruit is hard and dry, or drupaceous. The seed has little or no albumen, a straight embryo, with a short radicle and entire cotyledons. This order is related to *Santalaceæ*, from which it differs in its inferior calyx. It is also allied to *Elæagnaceæ* and *Proteaceæ*, from both of which it is distinguished by its pendulous ovules. Lindley refers to this order Bartling's *Anthoboleæ*, on account of their superior fruit. The species are found in Europe, but are not common; they occur in greatest abundance in the cooler parts of India and South America, at the Cape of Good Hope, and in Australia.

The most prominent property of this order is their causticity, which resides in their bark. When applied to the skin it produces vesication, and pain in the mouth when chewed. The bark of several of the species is very tough, and may be manufactured into cordage. *Passerina tinctoria* yields a yellow dye, which is used in the south of Europe to colour wool. The various species of *Daphne* possess active properties; some are used for dyeing, some are poisonous, and the *Daphne Lagetta* is the Lace-Bark-Tree of Jamaica. [DAPHNE.]



Daphne Mezereum.

1, cutting with flowers; 2, ditto with fruit; 3, single flower; 4, calyx opened, showing the insertion of the stamens; 5, section of ovary, showing the single pendulous seed.

THYMUS (*θύμος*), the name of a genus of Plants belonging to the natural order *Lamiaceæ* or *Labiatæ*. It has an ovate bilabiate calyx with 13 ribs; the upper lip is trifid, the lower lip is bifid with ciliated subulate segments, and throat villous inside; the corolla with the upper lip erect, nearly plane, notched, lower patent and trifid; stamens straight, exserted; anthers 2-celled; styles bifid at apex. All the species are small under-shrubs with usually purplish flowers. Between 20 and 30 species have been described by botanists, most of them inhabitants of Europe, especially the region of the Mediterranean: one only is a native of the British Isles.

T. vulgaris, Common or Garden Thyme, is an erect plant, or sometimes procumbent at the base, or clothed with a hoary pubescence; the leaves are sessile, linear, or ovato-lanceolate, acute, with revolute edges, fascicled in the axils; the teeth of the upper lip of the calyx are lanceolate, but the segments of the lower lip are subulate and ciliated. This plant is a native of the south-west parts of Europe, in dry plains and on hills, and uncultivated places free from woods. It is very much branched, and has purplish flowers. This species is cultivated for culinary purposes, and many varieties of it are met with in gardens. It has a pungent aromatic odour and taste.

T. Chamædrys, Wild Thyme, or Mother-of-Thyme, is a suffruticose plant, with whorled or capitate flowers, branched decumbent stems, with plain ovate obtuse entire petiolate leaves, more or less ciliated at the base; upper lip of the corolla ovate, 4-angular; upper lip of the calyx with short ovato-lanceolate leaves, with subulate ciliated teeth. It is a native of Great Britain, on hills and in dry pastures, and throughout Europe and the north of Asia. This plant has the same sensible properties as the last. One of the varieties is known by the name of Lemon-Thyme, on account of its scent resembling the lemon.

T. Serpyllum, Linnæus, appears to be different from the above, having uniformly hairy prostrate creeping stems, distinct from the ascending capitate flower-stems. It is not a native of Great Britain.

T. mastichina, Mastich-Thyme, or Herb-Mastich, has ovate or oblong obtuse petiolate leaves, narrowed at the base and not ciliated; the calyx is villous, with feathery subulate teeth, which are longer than the tube. It is a native of dry sandy uncultivated places in Spain, Portugal, and Barbary. It exhales a scent resembling mastich. It is

the *Marum vulgare* of older botanists, and at one time had some reputation as an errhine.

THYMUS GLAND (which in the calf and lamb is called the Sweetbread), is an organ situated behind the sternum, in the anterior mediastinum, in front of the pericardium and the large vessels arising from the base of the heart. In the embryo and the infant it has, in proportion to the rest of the body, a very considerable size; in after-life it becomes comparatively smaller, and at last nearly disappears. It is of an elongated form, its greatest dimension being from above downwards, and is composed of two chief portions, which by careful dissection may be separated in the middle line. At each end it bears two processes, or horns, of which the upper are longer and more slender than the lower, and the right are usually longer than the left. It is supplied by several branches from the internal mammary, inferior thyroid, and mediastinal arteries, to which veins of considerable size correspond. Its absorbent vessels are numerous and large, but not more so than in other glands of equal vascularity.

The Thymus Gland is composed of a great number of similar small masses or lobules, which may be separated by dissection, and are held together by fine cellular tissue continued from that which invests the whole gland. The lobules vary in size from half a line to three lines in diameter, and have simple or complex cavities filled with a milky fluid. Sir Astley Cooper ('The Anatomy of the Thymus Gland') says that the lobules are arranged in spiral lines, so that the gland may be unravelled into a sort of knotted rope of lobules, which are wound around a central cavity or reservoir, with which the cavities of the lobules communicate. But the existence of such a central cavity is not generally admitted.

The fluid contained in the cells of the Thymus Gland is, in young and healthy animals, opaque and creamy. It has been particularly examined by Mr. Gulliver (Appendix to Gerber's 'General Anatomy'), who has found that both in its chemical composition, and in the abundance and structure of the globules which it contains, it closely resembles the fluid of the lymphatic glands.

Of the function of the Thymus Gland scarcely anything probable is known. Whatever it be, it is performed most actively during fœtal life and the first year of extra-uterine life; for during this time the Thymus Gland grows at the same rate as the rest of the body, its cells are full of fluid, and the fluid is thick and abundant in globules. From the end of the first to the end of the third year its size does not materially vary, but after this time it gradually diminishes, and after the twelfth or fourteenth year it is rare to meet with more than a slight trace of it.

THYNNUS. [Scombridæ.]

THYONES, or THYONIDÆ, a family of *Echinodermata*, belonging to the order *Holothuriadæ*. They are characterised by the pyriform shape of their bodies whilst resting, and a cylindrical form whilst moving; they are contractile, and covered all over with numerous papillose suckers; they have 10 branching tentacles. From their elongated character, and their body being covered with suckers, they resemble some forms of *Cactus*, and have hence been called Sea-Cactuses. The genus *Holothuria* is often included in this family. It is distinguished from *Thyone* by possessing 20 tentacles, which are not branched as in *Thyone*.

Thyone is thus characterised:—Body nearly regular, covered with scattered wart-like suckers; tentacles 10; teeth long and thread-like. There are three British species of this genus.

T. papillosa, the Common Thyone, has an elongate-ovate body of a brownish-white colour, with the tentacula much pinnated. It was first found by Dr. Johnston, and has since been taken several times on the British coasts.

T. Portlockii and *T. Raphanus* are the remaining British species.

THYROID GLAND is an organ situated in the middle and fore part of the neck, in front and by the sides of the thyroid cartilage of the larynx (from which it has its name), and of the cricoid cartilage and the upper part of the trachea [Larynx], to which it is closely fixed by cellular tissue. It is composed of two chief lateral portions or lobes, and a smaller portion or isthmus connecting them. A fourth portion, which is long and slender, and is named the middle column or horn, usually passes upwards from the isthmus in front of the larynx. The lateral lobes are of a somewhat pyramidal form, about two inches long, and an inch wide at their bases. The whole gland is proportionally larger in the embryo than in the adult, and in women than in men.

Of the function of this gland but little is known. It is subject to enlargement in scrofulous states of the system, and this disease is known by the names of Bronchocele and Goitre.

THYSANODACTYLUS. [Iguanidæ.]

THYSANOPODA. [Stomapoda.]

THYSANU'RA, Apterous Insects, with six legs and peculiar organs of motion on their sides, or at the extremity of the abdomen. They undergo no metamorphosis. They have been grouped by Latreille under two families, of which *Lepisma* and *Podura*, two Linnæan genera, are the respective types. In the first we have a number of brilliant silvery little insects, covered with small scales, which are used as tests for the powers of microscope glasses. They have long setaceous many-pointed antennæ, distinct palpi to the mouth, and moveable false feet on the sides of the abdomen; the body is terminated by articulated setæ, three of which are especially conspicuous. The *Podurellæ* have 4-pointed antennæ, indistinct palpi, an abdomen terminated by a forked tail, which is folded under the belly when the animal is at rest, and serves to aid it in leaping. They are little, long, soft insects. The *Lepismenæ* and *Podurellæ* live chiefly among wood or under stones.

TIARA, synonymous with *Mitra*. [Volutidæ.]

TIARIS. [Draconina.]

TIARIS, a genus of *Fringillidæ*.

TIBIA. [Skeleton.]

TIBIANA, a genus of *Polypiaria*.

TICHODROMA. [Certhiadæ.]

TICKS. [Acaridæ; Trachearia.]

TICO'REA, a genus of Plants belonging to the natural order *Rutaceæ*. It has a small 5-toothed calyx, a monopetalous funnel-shaped corolla with a long tube, and a 5-cleft limb, either equal or unequal. The stamens are from five to eight, of which from two to six are often sterile. The disc is cup-shaped, surrounding the ovary; the stigma 5-lobed.

T. jasminiflora is a shrub from 7 to 8 feet high, a native of Rio Janeiro. The leaves are ternate and stalked; the leaflets lanceolate, from 1 to 6 inches long, tapering to the base, acuminate, obtuse, deep green with pellucid dots. The calyx is rather downy, the corolla white, downy, glandular, with pellucid dots. A decoction of the leaves is drunk by the Brasilians as a cure for framboesia.

T. febrifuga differs but little in its character from the last species, but in its stem being generally arborescent, its panicles contracted, its flowers not more than half the size, the bracts more numerous and foliaceous, and the style more protruded. The bark is intensely bitter, astringent, and is regarded as a febrifuge.

(Lindley, *Flora Medica*.)

TIGA. [Picidæ.]

TIGER. [Felidæ.]

TIGER-BITTERN. [Tigrisoma.]

TIGER-CAT. [Felidæ.]

TIGLIUM. [Croton.]

TIGRIS. [Felidæ.]

TIGRISOMA, Mr. Swainson's name for the Tiger-Bitterns. The species have the bill as in *Ardea*; face, and sometimes the chin, naked; legs almost feathered to the knees; inner toe rather shorter than the outer; claws short, stout, regularly curved; anterior scales reticulate or hexagonal. Mr. Swainson considers this to be the rasorial type, and he arranges it as a sub-genus of the family *Ardeadæ*, between *Buteo* (Antiq.) and *Nyctiardea*.

TILESIA. [Milleporidæ.]

TILGATE BEDS. A portion of the great series of strata in the Weald of Kent and Sussex, interposed between the green-sands and the Portland oolite, is thus named by Dr. Mantell, who has described the numerous and interesting organic remains which it contains. (Mantell, *Fossils of the British Museum*.)

TI'LIA, a genus of Plants belonging to the natural order *Tiliaceæ*. The trees in England are called Lime-Trees, in Swedish Linn, and in German and Dutch Linden. They are characterised by possessing a 5-parted deciduous calyx; 5 petals; numerous free or somewhat polyadelphous stamens; a globose, villous, 1-styled, 5-celled ovary. All the species are handsome trees, with alternate, heart-shaped, acute, serrated, deciduous leaves, and fragrant yellowish panicled flowers. The wood is light, smooth, and white, and the sap possesses a considerable quantity of sugar. They are principally natives of Europe and America.

T. Europæa, the European or Common Lime-Tree, has petals without scales, and cordate acuminate serrated leaves, which are smooth, with the exception of a tuft of hair at the origin of the veins beneath, and are twice the length of the petioles; the cymes are many-flowered, and the fruit is coriaceous and downy. This tree is abundant in the middle and north of Europe. It is very common in Great Britain, although some doubts have been expressed as to its being truly indigenous. It is however admitted into all British Floras; and there can be no doubt, from its wide diffusion, that it is truly naturalised in this country. It was well known to the ancients, and is spoken of by both Theophrastus and Pliny. It is a very general favourite in Europe, and is planted in public places, parks, and approaches to residences, in France, Germany, Holland, and Great Britain. For this purpose its large size, handsome appearance, and profusion of sweet flowers well adapt it. The wood is in considerable request. The Russian mats used by gardeners and upholsterers are made from its bark. The flowers secrete a large quantity of nectar, and exhale a delicious scent. The seed of the lime possesses a large quantity of albumen, which is nutritious and perfectly innocuous.

The Lime-Tree attains a great age; and many specimens, celebrated for their age and size, exist. The principal street of Berlin is called Unter den Linden, from the lime-trees which are planted on each side.

Many varieties of this tree are described; and, as is usual in these cases, some authors have elevated them to the rank and importance of species.

T. microphylla, the Small-Leaved Lime, has its petals without nectaries or scales; cordate, roundish, acuminated, serrated leaves, smooth above and glaucous beneath, with scattered as well as axillary hairy blotches, and compound many-flowered umbels. This is identical

with the *T. parvifolia* of Ehrhart and other writers. It is a native of subalpine districts in the north of Europe. In Great Britain it is common in the woods of Essex and Lincolnshire; and Mr. E. Forster thinks it probable that this is the only true British species.

T. rubra, the Red Lime, is a native of Taurida, and some few specimens are growing in England.

T. platyphylla, the Broad-Leaved Lime-Tree, is the *T. grandifolia* of Ehrhart and other botanists. It is more common than the other species in Switzerland and the south of Europe.

All the foregoing species are distinguished by not having nectaries or scales at the base of their petals. There are six other species characterised by possessing nectaries.

T. alba, the White or Silvery Lime; *T. glabra*, the Black or Black American Lime-Tree; *T. laxiflora*, Loose-Flowered American Lime; *T. pubescens*, the Pubescent American Lime; *T. heterophylla*, the White American Lime, are natives of North America; and numerous specimens of them are found growing in our forests and shrubberies.

TILIACEÆ, *Lindenblooms*, a natural order of Plants belonging to the syncarpous group of Polypetalous Dicotyledons. This order consists of trees or shrubs, seldom of herbaceous plants, with simple, toothed, alternate leaves, furnished with stipules. The flowers are axillary. The calyx consists of 4 or 5 sepals, which are valvular in æstivation; the petals 4 or 5, with mostly a little pit at their base; the stamens are hypogynous, mostly indefinite, with oval or roundish 2-celled anthers bursting lengthwise; the disc is formed of glands, which are equal in number to the petals and opposite to them; the ovary is single, composed of from 4 to 10 carpels, with a single style and stigma divided into lobes according to the number of the carpels; seeds numerous, with erect embryo, and abundant albumen. This order is nearly allied to *Sterculiaceæ* and *Malvaceæ*, from which it differs in its glandular disc, distinct stamens, and 2-celled anthers. The species, of which there are about 250, are arranged in 32 genera, and are generally diffused throughout the tropical and temperate parts of the globe.

Tiliaceæ possess no active properties; they abound in a mucilaginous wholesome juice. The fibres of the inner bark are very tough, and are used for a variety of economical purposes. [Tilia.] The wood is generally white, light, and tough; that of *Grewia elastica* is used for making bows in India. The Trincomalee-Wood used at Madras for making the Massoola boats is the produce of *Berrya Ammonilla*. The *Corchorus olitorius* is cultivated in Egypt for use as a pot-herb.

Tilia alba.

a, cutting, with flowers and leaf; 2, section of ovary, showing the cells; 3, single flower; 4, stamens.

TI'LIQUA. [Scincidæ.]

TILL. [Boulder-Formation.]

TILLÆA, a genus of Plants belonging to the natural order *Crassulaceæ*. It has a 3- or 4-parted calyx; petals 3 or 4, oblong acuminated; scales none, or very small; carpels 3 or 4, somewhat constricted in the middle; 2-seeded. The species are small glabrous annual herbs, inhabitants of exposed subhumid places. The leaves are opposite. Flowers small, white, for the most part axillary.

T. muscosa is a native of Europe in many places, in dry, barren, sandy, and gravelly soil; plentiful in Britain on the most barren sandy heaths, and frequent in Norfolk and Suffolk. It has a stem branched and decumbent at the base; flowers axillary, sessile, and trifid. The plant is very minute, and of a reddish colour. The leaves are opposite, oblong, obtuse, concave above, connate; sepals ovate or lanceolate acute, bristle-pointed. Petals nearly subulate, white, tipped with red. There are several other species, natives of North and South America and Australia.

TILLA'NDSIA, a genus of Plants belonging to the natural order *Bromeliaceæ*. Linnæus says of the plants belonging to this genus, "Tillandsiæ cannot bear water, and therefore I have given this name to the genus from a professor at Abo, who in his youth having an unpropitious passage from Stockholm to that place, no sooner set his foot on shore than he vowed never again to venture himself upon the sea. He changed his original name to Tillands, which means on or by land; and when he had subsequently occasion to return to Sweden he preferred a circuitous journey of 200 Swedish miles through Lapland to avoid going eight miles by sea."

The genus *Tillandsia* comprehends the plants described by Sloane as *Viscum caryophylloides*, and by Plumier as *Caragata;* and is characterised by possessing a persistent calyx divided into three oblong, lanceolate-pointed segments; a corolla tubular, longer than the calyx, with the limb divided into three segments; six stamens not so long as the corolla, and inserted into it, and the anthers sagittate; the ovary superior, surmounted by a style with a trifid obtuse stigma; the fruit, a trilocular capsule containing several seeds, each of which is supported on a long stalk of aggregate fibres, which in the end constitutes a feathery wing. The species are most of them parasitical, and are natives of South America.

T. utriculata, the Wild Pine of the colonists of Jamaica, has linear, channelled, recurved, dilated leaves, inflated at the base; stem closely panicled. It is found growing on old and decaying trees in the forests of Jamaica. The stem is 3 or 4 feet high, and the leaves are a yard long, and placed within one another in such a way that the water which runs down them is retained in their expanded bases. The bases then swell out and form a reservoir or bottle, which, being contracted at the neck, prevents the heat of the sun from evaporating the water. These reservoirs will each hold about a quart of water, and during the dry season they are the resort of all kinds of animals for the sake of the water, and travellers are often able to obtain a supply of water from this source when all others fail.

T. usneoides, the Long-Moss Tillandsia, or Barbe de Vieillard of the French, the *Viscum caryophylloides* of Sloane, has a twisted, thread-shaped, scaly stem, much branched, with channelled leaves. This plant is a native of the forests of North America, from Virginia to Florida, also of the West India Islands and the Brazils. In medicine this plant has been recommended as a remedy in hæmorrhoids, also as an effectual diaphoretic.

T. monostachya, Single-Spiked Tillandsia, has the radicle leaves linear, channelled, recurved, broad, and sheathing at the base; the stem simple, clothed with imbricated scales; the spikes simple; the bracteas ovato-concave. This plant is a native of the West Indies. The leaves of this as well as most of the other species serve as reservoirs for water. About 30 species have been enumerated.

TIMA'LIA (Horsfield), a genus of Birds thus characterised:—Bill strong, compressed, deep (altum). Nostrils subrounded. Wings short, rounded. Tail elongated and graduated. Feet strong; hind-claw twice as large as the middle anterior claw.

T. pileata. Body ovate, rather stout. General colour above, brown with an olivaceous tint; underneath, testaceous inclining to gray. Head capped with saturated chestnut. Throat and cheeks white. Breast white inclining to gray, marked with intensely black stripes by the shafts of the plumes. Bill black and shining. Feet brown. (Horsfield.)

Timalia pileata. (Horsfield.)

Dr. Horsfield observes that the species is not unfrequent in the groves and small woods which abound throughout Java. It often,

he says, approaches villages and plantations, constructing its nest in the hedges; and he speaks of it as one of the social birds that delight to dwell in the vicinity of cultivation. In large forests he did not notice it. He describes its flight as low and interrupted, and adds that wherever it resides it is a welcome neighbour, in consequence of the peculiarity and pleasantness of its note, which consists of a slow repetition of the five tones of the diatonic scale (C, D, E, F, G), which it chants with perfect regularity, several times in succession, and at small intervals of time. Dr. Horsfield further remarked that the sixth tone was sometimes added; but as this required apparently an extraordinary effort, it was by no means so agreeable to a musical ear as the simple repetition of the five notes, which appeared to be the natural compass of the bird's organs. ('Zoological Researches in Java.')

TIMALI'NÆ, a sub-family of Birds belonging to the *Turdidæ*. [TIMALIA.]

TIMOTHY GRASS, the common name for the *Phleum pratense*. [PHLEUM.]

TIN. This metal is one of those which were earliest known, though it occurs in comparatively few countries. The acquaintance of the ancients with this metal, though it does not occur in the native state, is accounted for by the circumstances that the ore is found frequently near the surface, and is easily reduced by charcoal and a moderate degree of heat to the state of metal.

According to Berzelius Tin is found in England, Saxony, Bohemia, Hungary, the Isle of Banca, the Peninsula of Malacca, in Chili, and Mexico. Malacca furnishes the purest tin, and Cornwall the largest quantity.

Tin occurs in two states of combination, the peroxide and double sulphuret of tin and copper: this last is rather a rare substance, and it is from the former that the metal is almost entirely obtained.

The Peroxide of Tin is found in Cornwall in two forms:—1. In veins in primitive countries, where it is intimately mixed with several other metals, as arsenic, copper, zinc, and tungsten: this is common *Tinstone*. 2. In loose rounded masses, grains, or sand in alluvial soil, in which state it is called *Stream-Tin*. The former, when reduced to the metallic state, yields *Block-Tin*; while the latter yields *Grain-Tin*, which is the purer of the two.

Oxide of Tin—Tinstone—occurs in attached and imbedded crystals, and massive. Primary form a square prism, which is commonly terminated by four-sided pyramids. Cleavage parallel to the lateral planes and both diagonals. Fracture uneven or imperfectly conchoidal. Hardness 6 to 7: gives sparks with steel, and is brittle. Colour white, yellow of various shades, red, brown, and black. Streak paler. Lustre adamantine, vitreous. Transparent, translucent, opaque. Specific gravity 6·96. Insoluble in acids. Before the blow-pipe, in powder on charcoal, it is reduced to the metallic state. Fine crystals of this substance occur, more especially in Cornwall and Saxony.

The analysis of the Oxide of Tin of Cornwall by Klaproth gives—

Tin	77·50
Oxygen	21·50
Iron	0·25
Silica	0·75
	——100

The Massive Varieties of Oxide of Tin are called Stream-Tin. What is termed *Wood-Tin* is found in reniform and botryoidal masses, or in wedge-shaped pieces, which have arisen from their partial destruction: the surfaces are generally water-worn. Wood-Tin exhibits various shades of brown, which sometimes appear in concentric bands, giving it a ligneous appearance, whence its name.

Stream-Tin has evidently been derived from the destruction of tin veins or lodes, the lighter portions of stony matter having been carried away by the water, which has rounded the fragments of the ore.

At Finbo in Sweden Oxide of Tin has been met with containing nearly 2·5 per cent. of Oxide of Columbium.

Tin Pyrites—Sulphuret of Tin, a double Sulphuret of Tin and Copper—is a rare substance, having been found only in Cornwall at Huel Rock, in the parish of St. Agnes.

It occurs crystallised and massive. Primary form of the crystal a cube. Cleavage parallel to the faces of the primary form. Fracture uneven, with a metallic lustre. Hardness: readily scratched and reduced to powder; brittle. Colour steel-gray, mixed with yellow. Specific gravity 4·35.

Massive Variety.—Fracture granular and uneven, with a metallic lustre. Hardness 4. Brittle. Opaque. Specific gravity 4·35 to 4·76.

The following analysis by Klaproth gives—

Tin	34
Copper	36
Iron	12
Sulphur	25
	——97

TIN PYRI'TES. [TIN.]

TINACTOR. [MERULIDÆ.]

TI'NAMOU, a genus of Birds belonging to the family *Tetraonidæ*. *T. Tataupa*, is a native of South America.

Tinamus Tataupa, var. (Swainson.)

Mr. Darwin, in his graphic description of the country around Maldonado, gives the following account of this bird:—"The country wore the same aspect, till at last the fine green turf became more wearisome than a dusty turnpike-road. We everywhere saw great numbers of partridges (*Tinamus rufescens*). These birds do not go in coveys, nor do they conceal themselves like the English kind. It appears a very silly bird. A man on horseback, by riding round and round in a circle, or rather in a spire, so as to approach closer each time, may knock on the head as many as he pleases. The more common method is to catch them with a running noose or little lazo, made of the stem of an ostrich's feather, fastened to the end of a long stick. A boy on a quiet old horse will frequently thus catch 30 or 40 in a day. The flesh of this bird, when cooked, is delicately white." ('Journal of Researches in the Countries visited by H. M. S. Beagle.')

TINCA, a genus of Fishes founded by Cuvier, and which has for type the Common Tench (*Cyprinus Tinca*, Linn.).

T. vulgaris, Cuv., the Tench, belongs to the Carp family (*Cyprinidæ*), and is separated generically on account of the small size of the scales with which the body is covered, combined with the small antero-posterior extent of the dorsal and anal fins, both of which are destitute of the anterior bony spine or any such as are observable in some allied fishes—as in the dorsal fin of the Barbel for instance. The barbules to the mouth are very small.

The Tench, observes Mr. Yarrell, inhabits most of the lakes of the European continent. In this country, though frequent in ornamental water and ponds, it is but sparingly found in the generality of our rivers. There is some doubt whether, like the carp, its origin be not foreign, and whether those rivers that can now boast of it are not indebted for it to the accidental escape of fish from the preserved waters of neighbouring gentlemen. The rivers it is mostly in are those which are slow and deep, and in such situations it does not appear to be so prolific as in ponds. Cuvier observes that the tench inhabits by preference stagnant waters. This is in accordance with the observations of Mr. Yarrell, and rivers being an unnatural habitat for the fish, will account for their being less prolific in such situations.

It is very tenacious of life. "A piece of water which had been ordered to be filled up, and into which wood and rubbish had been thrown for years, was directed to be cleared out. Persons were accordingly employed; and, almost choked up by weeds and mud, so little water remained, that no person expected to see any fish, excepting a few eels, yet nearly 200 brace of tench of all sizes, and as many perch, were found. After the pond was thought to be quite free, under some roots there seemed to be an animal which was conjectured to be an otter; the place was surrounded, and on opening an entrance among the roots, a tench was found of most singular form, having literally assumed the shape of the hole, in which he had of course for many years been confined. His length from eye to fork was 33 inches; his circumference, almost to the tail, was 27 inches; his weight 11 lbs. 9½ ounces; the colour was also singular, his belly being that of a char, or vermilion. This extraordinary fish, after having been inspected by many gentlemen, was carefully put into a pond, and at the time the account was written, twelve months afterwards, was alive and well." (Yarrell.)

Experiments have shown that a tench is able to breathe when the quantity of oxygen is reduced to a five-thousandth part of the bulk of the water: ordinary river water generally containing one per cent. of oxygen.

The general colour of the tench is greenish-brown, or olive having a golden hue, which latter tint is most conspicuous on the under parts of the fish. From the carp it is readily distinguished by the small

size of its scales, and also the small extent of the dorsal fin: its form is rather less deep in proportion to the length. It spawns usually about the middle of June, and deposits its ova on weeds.

TINCAL, a name for borax. [BORON.]

TINEIDÆ, a family of small Moths, which are remarkable for depositing their eggs among animal substances, on which their larvæ afterwards feed. They are thus constantly found upon clothing made of hair or fur, and are called Clothes-Moths. The family is thus defined:—Antennæ moderate, slender, simple, pubescent beneath in the males; proboscis short; thorax rarely crested; body long and slender; wings entire, often narrow, mostly convoluted in repose. The caterpillars live in portable cases formed of various materials.

These moths are often ornamented with very brilliant colours, the upper wings having gold or silver spots. The caterpillars make their cases of the substances on which they feed. The *Adelæ* make their nests of bits of leaves. The true *Tineæ* clothe themselves with the hair of the skins of animals and bits of silk. When too small, they slit their cases and make them larger. Many of them burrow into skins, silk garments, &c., making cases as they proceed. The genera and species are very numerous.

(Westwood, *Entomologist's Textbook.*)

TINNU'NCULUS, a genus of Birds belonging to the family *Falconidæ*.

T. alaudarius, the Kestrel, may be taken as the type of this genus. This is, there can be little or no doubt, the Κερχνὶς of Aristotle ('Hist. Anim.,' ii. 17; vi. 1; vi. 2; viii. 3), and so most zoologists are disposed to consider it, as well as that it is the *Tinnunculus* of the Romans. (Pliny, 'Nat. Hist.,' x. 37.) It is the Foutivento, Canibello, Tristunculo, Acertello Falchetto di Torre, Gheppio, and Gavinello, of the Italians; Cercerelle, Quercerelle, Cresserelle, and Epervier des Alouettes, of the French; Turmfalke, Röthel-Geyer, Mausefalke, Windwachl, Rittlweyer, and Wannen-Weher, of the Germans; Kyrko-Falk of the Swedes; Kestrel, Stannel, Stonegall, and Windhover, of the English; and Cudyll Coch of the Welsh.

This bird is found in Europe generally, but not habitually beyond the regions of the arctic circle, where its place is occupied by the Merlin. England, Scotland, and Ireland. Smyrna, in winter at least (Strickl.). Africa, from the north to the south, according to Temminck. Senegal, according to the same authority. The Zoological Society have received it from the Cape of Good Hope; Asia, India (Selby); banks of the Ganges (Yarrell); Java (Horsf.); Japan (Siebold and Bürger). Mr. Yarrell states that figures of it occur in drawings from China.

Kestrel (*Tinnunculus alaudarius*), male and female. (Gould.)

The provincial name Windhover well expresses the most striking characteristic of this hawk. With its head to windward, whence Mr. Mudie suggests that one of its designations should be written 'Standgale,' not 'Stonegall,' it remains with outspread tail and winnowing wings suspended high in air, so that its piercing eye may include a considerable area, in which no field-mouse is safe: when the bird sees one, it drops unerringly on the surprised prey. When thus poised above the fields, it sometimes is within the range of a gun, and we have heard farmers exult in bringing one down, little thinking that the bird was then on the watch for one of their greatest enemies.

If a Kestrel can find the nest of a crow or a magpie as a receptacle for its eggs, it will not take the trouble to make one; indeed, it probably never does build: sometimes it lays upon the bare ledges of rocks and in old ruined towers. The number of eggs is four or five, and their ground-colour reddish-white, which is mottled closely with dark reddish-brown and sometimes blotched with reddish-brown. The young come forth from the egg towards the end of April or beginning of May, and are covered with a yellowish-white down.

In the 'Portraits d'Oyseaux,' the following quatrain sums up the qualities of the Kestrel:—

> "Mulots, Lezars, Rats, et autre vermine,
> Sont la viande à nostre Cresserelle.
> Elle est amye avec la Colombelle,
> Qu'elle deffend des oyseaux de rapine."

The allusion here made to the friendship of the Kestrel for the Dove, is probably taken from the passage in Pliny to which we have above referred.

TINSTONE. [TIN.]

TIPHIA. [SCOLIADÆ.]

TIPULA. [TIPULIDÆ.]

TIPULIDÆ, a family of Dipterous Insects belonging to the tribe *Nemocera*. They have the antennæ longer than the head, simple, not plumose, rarely pectinated; eyes entire, ocelli obsolete; front of head beaked; proboscis short, ending in two large fleshy lips; body elongated; wings long, nervures numerous; legs long.

The types of this family are the species of *Ctenophora*, *Pedicia*, and the species of *Tipulæ* which are usually known by the name of Daddy-Long-Legs.

Latreille divides this family into five smaller groups—Culiciformes, Gallicoles, Terricoles, Fungivores, and Florales.

The Culiciformes (*Chironomides*, Macquaart) include those forms the pupæ of which mostly dwell in the water, respiring by means of external tubes or filaments situated in front of the body. They have also the power of swimming. Many of them are transparent, and form exceedingly beautiful objects for the microscope. The larvæ of *Chironomus plumosus* are vermiform, and of a blood-red colour, whence they are called Blood-Worms. [CHIRONOMUS.]

The Gallicoles (*Cecidomyides*) include those species which form galls by depositing their eggs upon plants. [CECIDOMYIA.]

The Fungivores (*Mycetophilides*, Macquaart) embrace an extremely active group of these insects, which are capable of leaping by means of their hind legs. They are found in damp situations amongst various plants. They enter houses, and are found upon window-panes. They are also very partial to *Fungi*, hence their name; and they are generally found in the interior of *Boleti* and *Fungi*.

The Terricoles (*Tipulides*, Macquaart) are the true Crane-Flies. The species of the genus *Tipula* are found in damp meadows in great numbers, especially in the autumn. The larvæ are found in the soil and feed upon the roots of grass, &c., and occasionally they do much harm. Mr. Westwood remarks that the male Daddy-Long-Legs is very quarrelsome, and often fights with his brethren of the same species.

The Florales (*Bibionides*, Macquaart) are distinguished by having the body and legs shorter and more robust than the other forms. The species are small, and their flight is slow and heavy.

(Westwood, *Families of Insects.*)

TISSUES, ANIMAL. The ultimate parts of the organs of animals and plants, of which their bulk is composed, are called Textures, or Tissues. These parts are found to originate in cells, and to have their characters principally given to them by the growth and development of these ultimate constituents of all organised beings. An account of the Tissues thus formed will be found under the articles ANATOMY; AREOLAR TISSUE; ADIPOSE TISSUE; BONE; BLOOD; CELLS; CARTILAGE; GLANDS; MUSCLE; NERVOUS SYSTEM; INTESTINES; SKIN; TEETH.

TISSUES, VEGETABLE. The tissues or textures of plants are formed out of cells which have grown together in various ways. [CELLS.] Although the most general form of the cell is that of a sphere, by pressure and growth in various directions it assumes a variety of shapes, when several together enter into the composition of a tissue. This is more remarkably the case in the animal than in the plant.

In many parts of plants the cells are perfectly spherical, arising from the absence of pressure. It more frequently happens however that cells press each other regularly in all directions, when they assume a polyedral or many-sided form. (*Fig.* 1, *a*, *b*.) When the pressure is perfectly regular the figure assumed is that of a dodecahedron, and when cut through each section presents six sides. All kinds of departures from this normal form are constantly seen. In these cases the nutrition is regular in every part of the cell. In the cells of

exogenous and endogenous plants there is a constant tendency to the nutrition of the cells at either end, so that an elongated cell is thus formed. These cells are sometimes called vessels, and constitute the basis of what is called Vascular Tissue. Several cells may join together, and the intermediate parts of their walls being absorbed, they form a long tube or vessel. This is the way in which the longer and larger forms of vascular tissue are probably formed. (*Fig.* 4, *d*, *e*, *f*, *g*, *h*, *i*.) Sometimes this nutrition manifests itself in more than two directions; we then have what are called Stellate Cells. These cells are seen beautifully in the common rush, and all sorts of modifications of them are seen in water-plants, where the interstices between the projecting and united parts of the stellate or irregular cells are filled with air.

Cells grow or develop in two ways. First, by taking up the nutritive matters into the cell-wall, which thus becomes enlarged; second, by the deposit of new materials in the inside of the cell-wall. In the cases above referred to the forms produced are the result of growth by intus-susception, but in a large number of cases the cells and vessels of the tissues become curiously ornamented by deposits in their interior. The most frequent form which these deposits take is that of a spiral fibre (*fig.* 1, *d*), which is found in the interior of the cells or vessels. This deposit may be so regular as to form a fibre, which may be separated from the walls of the cell; but more frequently it happens that these deposits assume the form of rings, dots, bars, or even pores. (*Figs.* 2 and 4.) They have thus given names to various kinds of tissue.

In all these cases the interior protoplasm, endoplast, or primordial utricle, seems to be the seat of nutritive activity. Our knowledge of the movement of the contents of the cells of plants is no longer confined to a few isolated cases, but has been observed in so large a number of cases as to lead to the inference that it is universal. It is also known that many of the currents observed assume a spiral direction, and it has been inferred that the spiral deposits are the result of such currents acting in the cells. The recent observations of Branson and Wenham have also shown that these currents are due to the active molecular movements that occur in the primordial utricle of the cell in which the movements have been observed.

One of the most interesting forms of nutrition is the case in which the active endoplast of protein projects beyond the cell-wall, and forms upon its surface a moveable hair-like projection, to which the name Cilium has been given. These cilia are the causes of the active locomotion observed in many of the spores of the *Algæ*, and of such compound unicellular plants as *Volvox globator*. [Cilia; Volvocineæ.]

The tissues of plants formed in the manner above referred to assume a variety of appearances, and vegetable physiologists have accumulated a large number of terms to express them. The following sketch will however give an idea of the general forms they assume:—

I. Cellular.

Tissue composed of membrane in the form of cells whose length does not greatly exceed their breadth.

- *A.* Parenchyma.
  Tissue composed of cells.
  1. Incomplete.
  2. Complete.
- *B.* Intercellular System.
  Tissue in which cells are absent.
  1. Original cavities.
  2. Cavities subsequently formed.
- *C.* Epidermal System.
  Tissue on the surface of plants.
  1. Epidermis.
  2. Appendicular Organs.
     - *a.* Papillæ.
     - *b.* Hairs.
     - *c.* Setæ.
     - *d.* Stings.
     - *e.* Prickles.
     - *f.* Warts.

II. Fibro-Cellular.

Tissue composed of cells, in the inside of which fibres are generated.

- *a.* Genuine.
  1. Fibrous cells.
- *b.* Spurious.
  2. Porous cells.
  3. Dotted cells.

III. Vascular.

Tissue composed of cylindrical tubes of membrane, continuous, or overlying each other at their ends.

1. *Pleurenchyma*, with the sides of the tubes thickened and tapering to each end.
2. *Cinenchyma*, the sides of the tubes of which anastomose, and convey a peculiar fluid.

IV. Fibro-Vascular.

Tissue composed of tubes, in the inside of which one or more spiral fibres are more or less perfectly developed.

- *a.* Genuine.
  1. Spiral vessels.
  2. Annular vessels.
  3. Moniliform vessels.
- *b.* Spurious.
  4. Scalariform vessels.
  5. Porous vessels.
     (*Bothrenchyma.*)
  6. Dotted vessels.

We shall now proceed to give a short description of the principal forms these tissues assume.

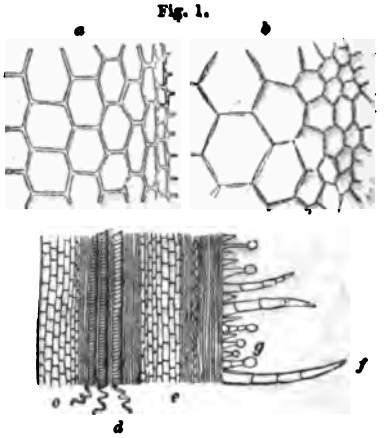
Cellular Tissue; also called Utricular and Vesicular Tissue; the Parenchyma of Lindley and Morren, and others, Tela Cellulosa of Link, and Contextus and Complexus Cellulosus of older writers; Zellgewebe, German; Tissu Cellulaire, French.—This tissue consists of cells or cavities, which are closed on all sides, and are formed of a delicate mostly transparent membrane. It is present in the whole vegetable kingdom; and all the lower forms of plants, constituting the class *Thallogens* (Lindley), are composed entirely of it, and have hence been called *Cellulares*. In the higher plants it is most abundant in fruits and succulent leaves. It exists in larger quantity in herbs than trees, and the younger the plant is the more it abounds, and constitutes the entire structure of the embryo.

The normal form of the cells is spheroidal, and when they exist in this or in an elliptical form, and only touch each other at a few points without exerting pressure, they constitute the tissue called by Meyen Merenchyma. The cells in this case may form a regular or irregular layer, a distinction which may be of some importance. Such tissue is found in many parts of plants, especially those which are delicate and easily torn, as in the pulp of fruits like the strawberry, in the petals of the white lily, in the stem of *Cactus pendulus*, where they are spheroidal, and in the leaf of the *Agave Americana*, where they are elliptical. The cells also which constitute the entire of many of the lower plants belong to this division of cellular tissue. They are seen separate or loosely adhering to each other in the *Protococcus nivalis*, the plant of the Red-Snow [Snow, Red], in many of the smuts and brands, as *Ustilago* and *Uredo*. *Chroolepus*, and many of the lower forms of *Algæ* and *Fungi*, consist of filaments which are entirely composed of spheroidal cells arranged one upon another.

In the higher forms of plants the vegetative force is greater, and a greater number of cells being generated in a given space, they press on each other on all sides, assuming a variety of forms, and constituting the tissue called by Meyen Parenchyma. The principal varieties of Parenchyma distinguished by Meyen are:—

1. The Cubical, which exists in the cuticle of some leaves, and is not unfrequently met with in bark and pith, as in the pith of *Viscum album*. (*Fig.* 1, *c*.)

Fig. 1.



2. The Columnar, of which there are two varieties: the Cylindrical (Cylindrenchyma of Morren), examples of which may be seen in *Chara* and in *Agaricus muscarius*; the Prismatical (Prismenchyma), frequently seen in the pith and the bark of plants, and when compressed it becomes the muriform tissue (*fig.* 1, *e*), which is constantly found in the medullary rays, and has its name from the cells being arranged as bricks in a wall.

3. The Dodecahedral: the natural form of parenchyma when the cells are of equal size and exert on each other equal pressure, and when cut present a hexagonal form. (*Fig.* 4, *a*, *c*.)

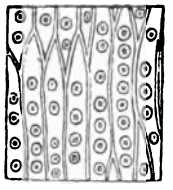
4. The Stellated (Actinenchyma), in which the cells, from the irregularity of their walls, assume a star-like form, seen in *Musa*.

5. The Tabulated, seen in the epiphlæum of many plants: other forms, as Conical (Conenchyma), Oval (Ovenchyma), Fusiform

(Atractenchyma), Sinuous (Colpenchyma), Branched (Cladenchyma), Entangled (Dædalenchyma), have been described by Morren.

Prosenchyma differs from Parenchyma in the cells always having an elliptical form which taper to their extremities, where they overlie each other. This form of tissue is found only in the bark and wood, and is a transition from cellular to what is called woody tissue. Meyen applies this term especially to the tissue forming the wood of *Coniferæ* and *Cycadaceæ*. In these families this tissue is marked with dots, which are surrounded by a circle (*fig.* 2). These dots were formerly supposed to be glands, and to secrete the resinous matter which abounds in them, and hence it was called 'glandular woody tissue.' The researches of Mohl and others have however shown that these dots are the result of the development of fibre within the walls of the cells, and in this view the Prosenchyma not only constitutes a transition from cellular to vascular tissue, but also a transition from fibro-cellular to fibro-vascular tissue.

Fig. 2.



It is mostly in the interior of the cells of cellular tissue that those crystalline bodies called Raphides are found. They occur singly or in bundles, and have an acicular form, and are long or short according to circumstances. In length they measure from 1-40th to 1-1000th part of an inch. These crystals were first observed in the proper juices of plants, and have been subsequently found in all parts of plants where cellular tissue exists. They were formerly supposed to exist between the cells, but later observers have seen them in cells, and they probably exist in both situations. The form of these bodies is not satisfactorily determined. Mohl describes them as right-angled four-sided prisms vanishing into points. Quekett, who is one of the latest observers on this point, says they are decidedly four-sided prisms, but not always right-angled. Those which are conglomerated are called crystal-glands (krystal-drüsen) by Meyen. They seldom present more than the pyramid of each little crystal composing them. The proportion in which they exist in plants is sometimes very great. In some species of *Cactaceæ*, according to Quekett, the crystals equal the weight of the dried tissue. One hundred grains of Turkey rhubarb-root yield between 30 and 40 grains of Raphides; the same quantity of tissue of *Scilla maritima* yielded 10 grains. In most plants these crystals are composed of either oxalate or phosphate of lime. Raspail says the crystals of the oxalate of lime are four-sided prisms with pyramids of the same base; those of the phosphate, six-sided prisms. In *Chara* crystals of carbonate of lime occur in great abundance on the outside of the tissue, and we have observed them in the intercellular passages immediately under the epidermis, but they do not occur in the interior parts of the plant. Schübler found that the crystal-glands of *Hydrurus crystallophorus* consisted of carbonate of lime, and Saigey and De la Fosse found silica in the crystals of the *Mirabilis Jalapa*. Silica is a very prominent constituent of the *Graminaceæ*, but is seldom found crystallised. It gives the hardness to the epidermis of the Dutch Rush, and is secreted in large quantities in the joints of the stem of the Bamboo, and is used as an article of commerce under the name of Tabasheer. From the variable form of the crystals in plants it may be inferred that other salts form them besides the above. These bodies do not appear to be necessary parts of the tissues in which they occur, and they have been compared by Link to Calculi and other concretions in the animal kingdom. This view is rendered very probable by the fact that they are always composed of those elements which the plants take up from the soil as necessary nutriment. Meyen has pointed out the fact that plants growing near the sea will throw off the superabundance of chloride of sodium in their tissues in the form of crystals; and we have found crystals of carbonate of lime most abundant in *Chara flexilis*, where the water in which it grew contained most of that substance. Phosphate of lime is necessary to the nutrition of many plants, and the elements of oxalic acid exist in the sap of all plants; and when these are in greater abundance than the vital energies of the plant can appropriate, the laws of chemical affinity come into play, and crystallisation is the result.

The Intercellular System.—The walls of the loose spheroidal cells in Merenchyma consist of a single membrane, but the walls of the more closely-pressed cells of Parenchyma consist of two membranes, originally distinct, but fused into one by growth. It frequently happens that the walls of the cells are not accurately applied to each other, and consequently spaces of various kinds occur between the cells. These are called Intercellular Passages. They occur in the greatest abundance in the loose Merenchymatous Tissue. When these passages exist between the walls of two cells whose sides are united in their middle and recede towards their margins, they are called by Link Meatus Intercellulares. These are most frequently met with in the epidermis of plants. Where the passages are formed of three or more cells the sides of whose walls do not touch, they are called Ductus Intercellulares. These are very well seen in the parenchyma of the stem of the Iris and Hyacinth, and *Heracleum*. These passages have been supposed by De Candolle and others to convey the sap; but this has probably arisen from an error in observation, as they are easily filled with sap when cut through.

Another kind of Intercellular Formation are the Air Cells (the Lacunæ Intercellulares of Link), which are large cavities formed in the tissue of plants, and whose walls are entirely formed of cellular tissue. They may be very distinctly divided into two kinds, the regular and the irregular. The regular exist under the epidermis of many plants, and vary in size, but have in all cases a regularity of structure, their sides being formed of equal-sized cells of cellular tissue. They may be seen in the leaf-stalk of *Calla Æthiopica*, the stem of *Œnanthe Phellandrium*, and the petioles of *Nymphæa*. They are very common in water-plants. They are always filled with air in these plants, and serve as a means of buoying them up in the water. The irregular air-cells (Lacunæ of Link), are found in old plants; they arise from the growth of the plant tearing asunder the cellular tissue, or from a deficient development or even the absorption of this tissue in particular directions. They may be seen in the stem of the fronds of the *Aspidium Filix Mas*, of *Hippuris*, and *Equisetum*, and in nearly the whole of the family *Umbelliferæ*.

All plants are covered with a layer of external cells, which are separated from the adjoining tissue and may be often peeled off in a layer. This is called Epidermis, and consists mostly of one row, but sometimes of two rows of cells, which are generally smaller and denser than those of the surrounding tissues. It is in these cells that the openings occur which are called Stomates. [Stomates.]

Schleiden divides the epidermis into three forms, which he calls Epithelium, Epiblæma, and true Epidermis. The epithelium is that form of epidermis which is continued into the interior of the organs of plants, as in the inside of the fruit. Epiblæma is applied to that modification of the tissue which is found on the surface of the leaves and other parts of aquatic plants. The true epidermis is found on the outside of the stem, branches, leaves, and other organs of plants.

The epidermal cells are often elevated above the surface. When three or four, or more, form a small projection, it is called a Papilla; when it is longer it is a Hair [Hairs]; when it becomes harder it is a Setum, and when hard and pointed a Prickle. Warts are still larger excrescences of the epidermis.

Fibro-Cellular Tissue, or Inenchyma, consists of cells formed of membrane, in the inside of which fibre is developed. This tissue may be divided into two kinds, genuine and spurious; the genuine being that in which the fibre is distinctly marked on the inside of the cell, and the spurious that in which the fibre, either by absorption or the union of its various parts, forms rings, bars, dots, and other appearances on the sides of the cell. The genuine fibro-cellular tissue is mostly found in parenchymatous and prosenchymatous cells. It has been known for a long time amongst botanists, and was first described by Hedwig, who was followed by Moldenhawer and others. It is abundant in the external parchment-like layers of the aërial roots of *Orchidaceæ*, and has been described in *Oncidium altissimum*, *Acropera Loddigesii*, *Brassavola cordata*, &c. It occurs in the hairs of the pericarp of many of the *Compositæ*, as in *Perdicium taraxaci*, *Senecio flaccidus*, and *Trichocline humilis*. Horkel has described it in the epidermis of many *Labiatæ*, as *Ziziphora*, *Ocymum*, and many *Salviæ*. The seed-coats of many plants possess it, as *Gilia Ipomopsis*, *Polemonium Cantua*, and *Caldaria;* and Kippist has demonstrated its presence in many of the species of *Acanthaceæ*. In some of these cases, and many others might be mentioned, the fibre appears to constitute the whole of the cell, and this has led to the supposition that it is found independent of the cell-wall or cell-contents.

The fibre in these cells varies in its position and form. In the cells of the leaf of *Oncidium altissimum* they are very distinct, and occasionally branched. In the testa of the seed of *Maurandya Barcleyana*, where they were first pointed out by Lindley, the fibres run in different directions over each other, forming a network. In the endothecium of *Calla Æthiopica* they are parallel, and in this form are very common in the same organ of other plants. In the endothecium of *Nymphæa alba* the fibres form regular arches arising from a plane base. In the elaters of *Jungermannia* and in the testa of *Acanthodium* the cells are greatly elongated, with a single spiral fibre in their interior.

The spurious fibro-cellular tissue includes the Porous and Dotted Cells of many authors, the Cellulæ Porosæ et Punctatæ of Link. If a portion of the parenchyma of *Viscum album* be examined, the inside of the cells will be found to possess a number of bright spots. They were first discovered by Treviranus in *Cycas revoluta*, and supposed by him to be granules. They were thought by other observers to be pores; hence their name Porous Cells. These spots however are not pores, but depressions, produced by the breaking up of the spiral deposits in the interior of the cell.

A transition from porous cells to porous tubes is seen in the tissue which has been called Bothrenchyma. In this tissue, which can be well seen in *Phytocrene*, as well as *Cycas*, a number of truncated porous cells are placed one on the other so as to form a cylinder, which becomes a tube by the absorption or removal of the cellular partitions. Porous vascular tissue is referred to this form by Lindley under the name of Continuous Bothrenchyma, as the partitions or union of the cells are not visible. Where the points of union of the cells are evident, he calls it Articulated Bothrenchyma.

Dotted Cells have their walls marked with dark spots. These cells have been observed in the pith of *Calycanthus floridus* and in the stem of *Dracæna terminalis*. They appear only to differ from the porous

cells in the matter from which they are formed having greater opacity, and not transmitting the light so freely.

Vascular, or Tubular Tissue, consists of continuous tubes of simple membrane, and comprehends the woody and the laticiferous tissues. On the one hand they are distinguished by their length from the forms of cellular tissue, and on the other hand by their plane membrane from those tissues of which fibre forms a constituent element.

Pleurenchyma, or Woody Tissue (Vasa Fibrosa of Link, and Fasergefässe, German), is found abundantly in the wood, and especially the liber, of all plants. It is composed of very long, thin, tough, transparent, membranous tubes. No bars or dots are seen in their walls, although when they cross each other the points at which they touch may be taken for such markings. They taper acutely to each end, and do not appear to have any communication one with the other, although they are occasionally seen with open extremities, which Slack supposes to arise from the breaking off of one fibre where it was united to another. In the wood and bark of Dicotyledonous Plants they are frequently mixed with Prosenchyma, and in Monocotyledonous Plants with Parenchyma. They grow by increasing in length both above and below. Their diameter varies from 1-150th to 1-3000th of an inch. The walls increase in thickness by the deposition of cellulose. Their form is mostly cylindrical, but in *Cycas revoluta* Link has observed them assumiug a prismatic form.

The tubes of woody tissue are very tough, and will resist considerable force without breaking. It is on this account that they are used extensively in the manufacture of cloths of various kinds. The plants used most commonly for this purpose are the hemp and flax. The fibres of *Tilia*, *Daphne*, *Lagetta*, and of many of the plants of the order of *Malvaceæ*, are used for making mats, cordage, whips, &c. The following is a comparative statement of the relative strength of silk and some woody fibre :—

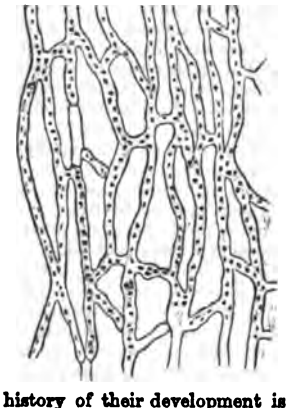
Silk supported a weight equal to	34
New Zealand Flax	23½
Hemp	16½
Flax	11¾
Pita Flax (*Agave Americana*)	7

Woody tissue gives firmness and tenacity to the plant, and assists in conveying the sap from the roots to the leaves.

Vascular Tissue occurs in bundles, that is, several tubes lie close together in a bundle, and are surrounded by cellular tissue. Schleiden describes three kinds of bundles :—1. Simultaneous, in which all the fibres are developed at the same time, as seen in the Ferns. The next are successive, in which the centre fibres are first developed, and those in the circumference after. These are divided into—2. Definite, in which the bundles, after having grown, are closed around by cellular tissue, as are seen in Monocotyledons. 3. Indefinite, in which the bundles do not cease to develop in the direction of their growth, as occurs in the bundles of woody tissue found in the stems of Dicotyledonous or Exogenous Plants. The mode of growth of these two last forms of vascular tissue seems to determine the forms of Monocotyledonous and Dicotyledonous stems.

Cinenchyma, or Laticiferous Tissue, consists of tubes which are mostly branched and anastomosing; their walls are exceedingly delicate in young plants, and thicker in old ones; and they are characterised by conveying a fluid called the latex, which differs from the sap in other parts of the plant. The older botanists, Spigelius, Malpighi, and Grew, described them, but they were generally confounded with woody tissue, till they were investigated by Schultz. In older writers they are called Vasa Propria or Peculiaria; by Link, Vasa Opophora.

Fig. 3.



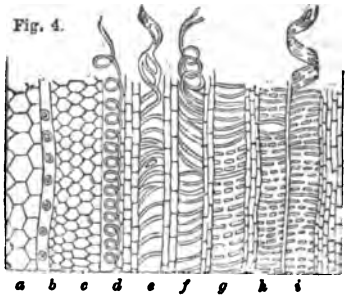
They are regarded by many observers as intercellular passages, in the course of which organic matters have been deposited, giving them the character of vessels with walls. The phenomena described by Schultz are most easily seen in plants containing a milky juice, as the *Euphorbiaceæ*. Their most remarkable character is the possession of branches communicating with each other, thus giving them the appearance of the capillaries in animals. (*Fig.* 3). The history of their development is not yet sufficiently made out to give them a claim to be considered as a genuine form of vegetable tissue.

Fibro-Vascular Tissue, or Trachenchyma (Vasa Spiroïdea of Link), consists of tubes, in the inside of which spiral fibres are generated. The fibres of this tissue are subject to metamorphosis, the consequence of which is, the tubes present the appearances of rings, bars, and bright and dark spots.

The tubes consist of a very delicate membrane, which is mostly cylindrical; it may however assume a prismatical form when the tubes are in bundles and closely pressed together, as in Ferns and many Monocotyledonous Plants. The fibres generated in this tissue are mostly compressed, and wind up the sides of the tube in a spiral form. When the membrane is broken, the fibre in most cases may be unrolled. It is in the younger tubes that this is most easily effected; as in the older tubes those changes go on which connect the membrane and the fibre firmly together, and convert the latter into bars, dots, &c. The number of fibres included in a tube varies; it is frequently single, but in some instances as many as 22 have been counted. They have no fixed direction; some pass from right to left, others from left to right. Some difference of opinion has existed as to whether the fibres are tubular or not. Schleiden says in most instances they are solid, but where they are formed from large globules of jelly they appear to be tubular in both vascular and cellular tissue.

Link divides fibro-vascular tissue into genuine and spurious; the former includes all those vessels which possess perfect fibres. The principal forms of these are the spiral, annular, and moniliform vessels. The spiral vessel consists of a tube, in which one or more fibres run continuously along its sides from one end to the other (*fig.* 4, *d*, *e*, *f*.) When the fibres are single, they are called simple; when there is more than one, compound. The spiral vessels are most abundant in young plants, as their character becomes changed by age. When the fibres adhere to the sides of the membrane, they are said to be closed. The spiral vessel was at one time considered a very important tissue, performing especial vital functions. From the circumstance of air being frequently found in them, and this air containing a larger quantity of oxygen than the atmosphere, they were supposed to carry on the function of respiration.

Fig. 4.



a *b* *c* *d* *e* *f* *g* *h* *i*

Annular Vessels or Ducts consist of tubes with perfect rings of fibre on their sides. (*Fig.* 4, *g*.) These are evidently formed from the interruption of the spires, and the union of the broken ends, as they are frequently found present with a spiral fibre in the same tube. They are mostly larger than the spiral vessels, and the fibre is also thicker : they are very abundant in Monocotyledonous Plants; amongst Dicotyledons they are found chiefly in quick-growing plants, as *Cucurbitaceæ*.

Moniliform Vessels have successive dilatations and contractions of the tube, and a perfect spiral fibre in their inside. It has been proved by Slack that these vessels derive their peculiar form from accidental compression. They are found in the knots of trees where branches are given off: in roots and other parts where they meet with obstacles to their longitudinal development.

Spurious Fibro-Vascular Tissue includes Scalariform, Porous, and Dotted Vessels. The spurious vessels are not found in the tissues of young plants, and are either developed after the appearance of the genuine spiroids, or are formed from them.

Scalariform Vessels consist of tubes mostly prismatical, with spots on their walls resembling bars or straps. These bars are placed one above another in a ladder-like form; hence their name. They are abundant in ferns, where the prismatic form of the spiroid is most frequently seen.

Porous Vessels are tubes with bright spots upon their walls (*fig.* 4, *h*, *i*); they constitute the Continuous Bothrenchyma of Lindley. They are found in greatest abundance in the old wood of *Coniferæ*, in the same positions where spiral vessels are found, in the young wood, and also in the roots of plants.

Dotted Vessels constitute the tissue which has been called Glandular Woody Tissue, and to which Meyen applies peculiarly the term Prosenchyma. (*Fig.* 3; *fig.* 4, *b*.) The dotted vessel, like the dotted cell, has dark spots on the inside of its membranous walls; but in addition to the dot there is also a circle. This dot does not appear to be formed by the remains of a partly-absorbed fibre, or the crossing of the fibres, as in some of the forms of porous cells and vessels, but from the sinuous flexures of one or more fibres uniting together, and forming between them a little cavity or depression: this is attended with depression of the external membrane, which gives the appearance of the larger circle surrounding the depression. (*Fig.* 2; *fig.* 4, *b*.) These phenomena make their appearance very early in the tissues of Coniferous plants; but if buds and very young plants are examined, the sinuous spiral vessels, called by Link Vasa Spiroida Fibrosa, may be easily seen.

For information on the functions of these tissues, see the articles CELLS; SAP; REPRODUCTION IN PLANTS AND ANIMALS.

(Mohl, *On the Vegetable Cell*, translated by Henfrey; Schleiden, *Principles of Scientific Botany*, translated by Lankester; Link, *Elementa Philosophiæ Botanicæ*; Meyer, *Pflanzen Physiologie*; Unger, *Botanical Letters*, translated by Paul; Braun, *Rejuvenescence in Nature*, translated for the Ray Society.)

TITA'NIUM. This metal was first recognised by Mr. Gregor, in 1791, as a distinct substance. He detected it in a black sand found in the bed of a rivulet near Menaccan in Cornwall. In 1795 Klaproth discovered it in some other minerals, and he gave it the name it now

bears. The properties of titanium were not however satisfactorily determined until 1822, when Dr. Wollaston examined and described it as it occurred in its perfect metallic and crystallised state, in the slag of an iron-furnace at Merthyr Tydfil in South Wales. The form of the crystals is the cube; their colour resembles that of bright copper; they are sufficiently hard to scratch rock-crystal, and their specific gravity is 5·3.

Titanium enters into a great many minerals, some of which are described under their names; the remainder will be described here.

Anatase, Octaedrite, or *Oisanite.*—This is protoxide of titanium nearly pure. It occurs in attached and imbedded acute octahedral crystals. Primary form a square prism. Cleavage parallel to the terminal planes and to those of the octahedron. Fracture conchoidal, indistinct. Hardness: scratches phosphate of lime, and is scratched by quartz. By friction it becomes negatively electrical, and when heated gives out a reddish-yellow phosphorescent light. Colour various shades of brown, more or less dark, sometimes indigo-blue. Streak white. Lustre adamantine. Translucent, transparent. Specific gravity 3·826. It is found in Cornwall, in Dauphiny, at Bourg-d'Oisans, in Spain, Switzerland, and some other places. It consists almost entirely of oxide of titanium, probably the protoxide.

Rutile, or *Titanite; Peroxide of Titanium,* or *Titanic Acid.*—It occurs crystallised and in crystalline masses. Primary form a square prism. Cleavage parallel to the lateral planes. Crystals frequently geniculated. Fracture uneven. Hardness: scratches glass, and sometimes quartz. Colour red, reddish-brown, and occasionally yellowish. Streak very pale brown. Lustre adamantine. Translucent, transparent, opaque. Specific gravity 4·249 to 4·4. It occurs not unfrequently inclosed in quartz, in fine red filamentous crystals. Rutile is found in Perthshire, Bohemia, Switzerland, especially at St.-Gothard, and in various other parts of Europe; and also in Brazil and North America. According to H. Rose, it consists of—oxygen, 33·95; titanium, 66·05. It is frequently more or less mixed with oxide of iron and of manganese, and sometimes with oxide of chromium.

The minerals which are next described are the titanates of iron: they vary greatly both in form and composition, some being crystallised and others granular; the latter are frequently termed titaniferous iron-sand.

Kibdelophan—Axotomous Iron.—It occurs in imbedded crystals. Primary form a rhomboid. Cleavage perpendicular to the axis, distinct. Fracture conchoidal. Hardness 5·0 to 5·5. Brittle. Colour dark iron-black. Streak black. Lustre imperfect metallic. Opaque. Specific gravity 4·661. It is found at Gastein in Salzburg, in Sweden, and Siberia. The following is an analysis of a specimen from Gastein, by Kobell:—

Titanic Acid	59·00
Protoxide of Iron	36·00
Peroxide of Iron	4·25
Protoxide of Manganese	1·65
	—100·9

Ilmenite.—It occurs in imbedded crystals. Primary form a right rhombic prism. No cleavage observed. Fracture uneven to conchoidal, with a vitreous lustre. Hardness 5·0; scratches glass slightly. Colour black. Opaque. Specific gravity 5·48. It is found near Lake Ilmen in Siberia. The analysis by Mosander gives—

Titanic Acid	46·92
Protoxide of Iron	37·86
Peroxide of Iron	10·74
Protoxide of Manganese	2·73
Magnesia	1·14
	—99·39

Orichtonite.—It occurs in attached crystals. Cleavage parallel to the axis. Fracture conchoidal, splendent. Hardness: scratches fluor-spar, but not glass. Brittle. Does not obey the magnet. Colour shining black. Streak black. Lustre imperfect metallic. Opaque. Specific gravity 4. It has not been completely analysed; but, according to Berzelius, it consists of titanic acid and oxide of iron.

Granular Titanate of Iron and Titaniferous Iron-Sand present the following varieties:—

Nigrin.—It occurs in flat rounded grains of about the size of a pea, with occasional indications of a crystalline form. Structure foliated. Very hard. Brittle. Colour grayish-black. Lustre metallic. Specific gravity 4·445. It is found in Transylvania. Its analysis by Klaproth gives—

Titanic Acid	84
Protoxide of Iron	14
Protoxide of Manganese	2
	—100

Menaccanite occurs in small angular grains. Structure imperfectly lamellar. Fracture fine-grained, uneven. Hardness: yields to the knife. Colour grayish-black. Lustre glistening. Opaque. Specific gravity 4·427. It occurs in rivulets in the parish of St. Keverne, Cornwall; and has also been found in New South Wales. The picked grains, analysed by Dr. Colquhoun, gives—

Titanic Acid	57·187
Protoxide of Iron	39·780
Protoxide of Manganese	2·175
	—99·142

Iserine occurs in very small flattish angular grains, which have a rough glimmering surface. Structure lamellar. Cross fracture conchoidal. Very hard. Slightly attracted by the magnet. Opaque. Lustre semi-metallic. Specific gravity about 4·5. It is found on the Riesengebirge, near the origin of the river Iser in Silesia; in Bohemia; in the river Don in Scotland, and that of the Mersey opposite Liverpool. By the analysis of H. Rose it consists of—

Titanic Acid	50·12
Protoxide of Iron	49·88
	—100

It is probably a variety of Menaccanite.

Sphène—Spinthère—Silico-Titanate of Lime—occurs in attached and imbedded crystals, and massive. Primary form an oblique rhombic prism. Cleavage indistinct. Fracture even, slightly conchoidal. Hardness: scratches phosphate of lime, but is scratched by felspar. Colour various shades of gray, green, yellow, and brown. Streak white or grayish-white. Lustre adamantine, resinous. Transparent, translucent, opaque. Specific gravity 3·468 to 3·6. Sphène is found interspersed in primary rocks, as in granite and gneiss, and more particularly in syenite, in Norway, Germany, Switzerland, and also in America. The results of the analysis of sphène vary considerably; the following is by Klaproth:—

Titanic Acid	33
Silicic Acid	35
Lime	33
	—101

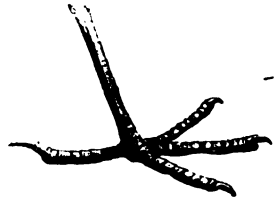
Æschynite—Titanate of Zirconia and Cerium, &c.—occurs crystallised. Primary form a right rhombic prism. Cleavage difficult, and only parallel to the bases of the primary form. Fracture conchoidal. Hardness: scratches phosphate of lime, and is scratched by felspar. Colour black; streak grayish-black. Lustre resinous. Opaque. Specific gravity 5·14. It is found at Miask, in the Uralian Mountains Siberia. The analysis by Hartwall gives—

Titanic Acid	56·0
Zirconia	20·0
Oxide of Cerium	15·0
Lime	3·8
Oxide of Iron	2·6
Oxide of Zinc	0·5
	—97·9

[BROOKITE; MOHSITE; GREENOVITE; PEROVSKITE; PYRRHITE; WARWICKITE; PYROCHLORE; ENCELADITE; POLYMIGNITE.]

TITLARKS, the common name for the species of *Anthus,* a genus of Birds belonging to the family *Alaudinæ.* [ANTHUS.] The species are also called Pipits. The following are British species:—

Anthus trivialis, the Tree-Pipit; *A. pratensis,* the Meadow-Pipit; *A. obscurus,* the Rock-Pipit (*A. petrosus,* Flem., Jen.; *A. aquaticus,* Selby, Gould; *Alauda obscura,* Auct.); and *Anthus Ricardi,* Richard's Pipit.



Foot of Tree-Pipit. (Yarrell.)

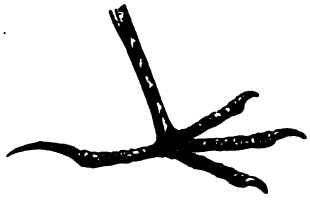
Tree-Pipit (*Anthus trivialis*). (Gould.)

The Titlark of Pennant is the Meadow-Pipit of the above list; and Mr. Yarrell well observes that scarcely any two British birds have been

so frequently confounded together as the Tree- and the Meadow-Pipits; but when the two species are examined in hand obvious and constant distinctions appear; and there are, he adds, besides, differences in the habits of these birds, as well as in the localities they each frequent. "The Tree-Pipit is rather the larger bird of the two; the beak is stouter and stronger; the spots on the breast longer and fewer in number; the claw of the hind toe is not so long as the toe itself; the tertial feathers of the wings are rather longer in proportion to the primaries; the white on the outer tail-feather on each side is neither so pure in colour nor is it spread over so large a portion of the feather; and, as far as my own observation goes, it does not appear to be so numerous as a species as the Meadow-Pipit."

We give illustrations of these two common British species.

The Tree-Pipit is a migratory bird; but the Meadow-Pipit remains with us throughout the year, and is the smallest and most common species, its total length being 6 inches only.



Foot of Meadow-Pipit. (Yarrell.)

Meadow-Pipit (*Anthus pratensis*), male and female. (Gould.)

TITMOUSE. [PARIDÆ.]

TIT-WARBLERS, Mr. Swainson's name for a sub-genus of his sub-family *Parianæ*, and considered by him as the second or typical division of the whole group.

Sylvicola minuta is an example of these birds. Its colour is blue-gray, beneath golden-yellow; back olive; wing-coverts tipped with white. It is a native of Brasil.

Gray-Backed Warbler (*Sylvicola minuta*). (Swainson.)

TOAD. [AMPHIBIA; BUFO.]

TOAD-FLAX. [LINARIA.]

TOBACCO. [NICOTIANA.]

TODDA'LIA, a genus of Plants belonging to the natural order *Rutaceæ* tribe *Xanthoxyleæ*, which is itself sometimes made into a distinct order. The name *Toddalia* is derived from Toddali, the Malabar name of one of the species. The genus is distinguished by having unisexual flowers, the calyx 5-toothed; petals 5; stamens 5, longer than the petals; stigma almost sessile, peltate; fruit fleshy, 5-furrowed, 5-celled, cells 1-seeded; seed kidney-shaped; embryo arched.

T. aculeata has prickly stems and branches, and extends to 30° N. lat., along the jungly base of the Himalayan Mountains. The bark and root of this species are said to be used as a cure for the remittent fever of such situations; and as many of the allied plants are possessed of bitter with aromatic properties, it is probable that this plant also may be useful for such purposes.

TODIRA'MPHUS. [HALCYONIDÆ.]

TODUS. [MUSCICAPIDÆ.]

TOES. [SKELETON.]

TOFIELDIA, a genus of Plants belonging to the natural order *Colchicaceæ*. It has a 6-parted perianth, the anthers bursting longitudinally; the 3 capsules, connected to above the middle, are 1-celled and many-seeded.

T. palustris is the only British species.

TOLU, BALSAM OF. [MYROSPERMUM.]

TOMATO. [SOLANUM.]

TONGA or TONQUIN BEAN. [COUMAROUNA.]

TONGUE. The human tongue has a very complex structure, in correspondence with the variety of its offices as an organ both of sensation and of voluntary motion. The sensations which are perceived by means of the tongue are of two kinds, namely, that of taste and that of touch or tact; its motions are chiefly subservient to speech and to the prehension and swallowing of food. The sensitive apparatus of the tongue is contained in the membrane which covers it; its motor apparatus forms its interior.

The form and other external characters of the tongue may be easily observed by the aid of a mirror. Its surface is covered by a membrane continuous at the sides and lower part with that which lines the mouth and cheeks, and covered by a fine cuticle which is constantly kept moist by the saliva and by the secretion from the tongue itself. The membrane on the inferior surface of the tongue is thin, smooth, and transparent; at the middle line it forms a vertical fold which extends nearly to the tip of the tongue, and is named the Frænum Linguæ. The membrane on the sides and upper part of the tongue is thicker and more vascular, and bears the Papillæ, the most sensitive parts, which are thickly set over its whole surface.

The papillæ of the tongue are of three different kinds:—1. The Papillæ Vallatæ, or Magnæ, are usually seven or nine in number, but sometimes are as many as twenty or as few as three. They are situated at the back part of the tongue, in two rows forming an angle, like the letter V, with its apex directed backwards. Each of them has the form of a truncated cone, and consists of a number of fine cylindrical processes closely held together. They are set in rather deep depressions of the membrane, so that they seem to be surrounded by fosse which are bounded by elevated rings. 2. The Fungiform or Lenticular Papillæ are smaller, but much more numerous than the preceding, and are scattered at irregular distances from each other over the whole of the upper surface and sides of the tongue. They vary in form, some being hemispherical, some nearly cylindrical, and some having narrow stems which support larger summits, so as to have somewhat the shape of mushrooms. These also, like the preceding kind, are composed of numerous delicate filaments closely united. 3. The Conical and Filiform Papillæ cover all the remaining parts of the upper surface and sides of the tongue.

All these papillæ are very vascular, and receive filaments of the sensitive nerves of the tongue. Their structure is similar to that of the sensitive papillæ of the skin.

The interior of the tongue is composed entirely of muscles, and of the fat and cellular tissue which lie between their fibres. These muscles are named, after the parts to which they are attached, the Hyo-Glossi, Stylo-Glossi, Genio-Hyo-Glossi, and Linguales.

But besides these muscles, and variously intermingled with their fibres, the tongue contains numerous other irregular fasciculi, of which no description can be given. It is also variously influenced by the muscles which move the soft palate and its arches and the hyoid bone.

For its movements and its double sensibility the tongue is supplied with three different pairs of nerves:—1, The Hypoglossal, or Lingual, or ninth pair of nerves [BRAIN; NERVOUS SYSTEM], are distributed almost exclusively in the muscles of the tongue: they are its motor nerves; and when they are paralysed, compressed, or divided, the tongue is rendered immoveable, but its sensations are unimpaired. 2, The Lingual (or, as they are sometimes called, the gustatory) branches of the fifth pair of nerves are those on which the sensibility of the tongue to all common impressions of touch, heat, cold, &c. depends. They are distributed most abundantly in the papillæ at and near the tip of the tongue, and they endow it with a sensibility more acute than that possessed by any part of the skin. 3, The Gustatory, Glosso-Pharyngeal, or eighth pair of nerves, of which a considerable part is distributed in the tongue, are probably those on which the peculiar sense of taste depends.

The quality by which substances are capable of exciting the sen-

tion of taste is altogether unknown, nor has even a probable hypothesis been formed. The best examples of merely sapid substances are the various alkaline and metallic salts, and the inodorous bitters. By experiments with these the sense of taste is found to be subject to many of the same rules as the other senses, and to be especially analogous to that of smell. [SMELL.] A certain force of application of the stimulus heightens the perception of it. Men instinctively press the tongue against the roof of the mouth and 'smack' it, to obtain a clear sense of taste, as they inspire quickly in the act of smelling. Contrast of tastes also commonly makes that which is last perceived more obvious, as the eye passing from one colour to another, or the nose from one odour to another, perceives each in succession the more acutely; and there are subjective sensations of taste, as there are of sight and hearing. Such are those produced by the contact of two different metals with each other and with the tongue, and those which are perceived in various diseases; but the circumstances on which they depend are as yet unknown.

TONQUIN or TONGA BEAN. [COUMAROUNA.]

TONSILS. The Tonsils are two complex glands, one of which lies on each side of the fauces, between the arches of the soft palate. They are of an elongated oval form, and each is composed of a number of smaller glands aggregated together in one mass, and usually opening by several orifices on the surface of the mucous membrane. They form a continuous layer with a great number of similar glands, which are contained in the substance of the palate, in the root of the tongue, and in the space between the tongue and the epiglottis; and with these the tonsils form a complete ring of glandular tissue around the aperture leading from the mouth to the pharynx. The nature of the fluid secreted by them is not certainly known. It bears a general resemblance to saliva, and probably serves chiefly to lubricate the food for its passage from the mouth to the stomach.

TOON-WOOD. [CEDRELA.]

TOPAZ, a Mineral. It occurs massive, in imbedded and rounded crystals. Primary form a right rhombic prism. Cleavage easy, parallel to the base of the primary form, more difficult in the direction of its lateral faces. Structure lamellar at right angles to the axis of the prism. Fracture uneven, slightly conchoidal. Hardness: scratches quartz. Electricity: positive by friction; those crystals which possess different faces of crystallisation at opposite ends acquire different kinds of electricity at the two extremities when heated. Colour white, yellow, bluish, and greenish. Lustre vitreous, transparent, translucent. Specific gravity 3·499. Fragments exposed to heat emit a blue, green, or yellowish phosphoric light. By the blowpipe on charcoal it does not fuse, but with borax it melts into a transparent glass. Topazes occur generally in primitive rocks, and in many parts of the world, as Cornwall, Scotland, Saxony, Siberia, Brazil, &c.

The following analyses have been given of this mineral: (1) Saxon topaz by Klaproth; (2) Brazilian topaz by Klaproth; (3) Saxon topaz by Berzelius; (4) Brazilian topaz by Berzelius:—

	(1)	(2)	(3)	(4)
Silica	35	44·5	34·24	34·01
Alumina	59	47·5	57·45	58·38
Fluoric Acid	5	7·0	7·75	7·79
Oxide of Iron	—	0·5	—	—
	99	99·5	99·44	100·18

The ancient *Topasion* was found on an island in the Red Sea, which was often surrounded with fog, and therefore difficult to find. It was hence named from 'topazo,' to seek. This name, like most of the mineralogical terms of the ancients, was applied to several distinct species. Pliny describes a statue of Arsinoe, wife of Ptolemy Philadelphus, four cubits high, which was made of topasion, or topaz, but evidently not the topaz of the present day, nor chrysolite, which has been supposed to be the ancient topaz. It has been conjectured that it was a jasper or agate; others have imagined it to be prase, or chrysoprase.

Topaz is employed in jewellery, and for this purpose its colour is often altered by heat. The variety from Brazil assumes a pink or red hue, so nearly resembling the Balas ruby, that it can only be distinguished by the facility with which it becomes electric by friction. The finest crystals for the lapidary are brought from Minas Novas, in Brazil. From their peculiar limpidity, topaz-pebbles are sometimes denominated Gouttes d'Eau. When cut with facets and set in rings, they are readily mistaken, if viewed by daylight, for diamonds. The coarse varieties of topaz may be employed as a substitute for emery in grinding and polishing hard substances.

Topaz is cut on a leaden wheel, and is polished on a copper wheel with rotten stone. It is usually cut in the form of the brilliant or table, and is set either with gold foil or 'or à jour.' The white and rose-red are most esteemed.

(Dana, *Manual of Mineralogy.*)

TOPAZOLITE. [GARNET.]

TORDY'LIUM (*Τορδύλιον* of Dioscorides), a genus of Plants belonging to the natural order *Umbelliferæ*. The calyx consists of 5 awl-shaped teeth; the petals obcordate, with an inflexed lobe, the outer ones radiant. The fruit has a thick wrinkled margin; the pericarps with very slender ribs; the 3 dorsal ribs at equal distances, the 2 lateral ones contiguous to the thickened margin or covered by it. The species are herbs, with pinnate leaves and ovate leaflets deeply toothed. The flowers are white.

T. maximum, Great Hart-Wort, has a scabrous or hispid stem, pinnate leaves, and lanceolate leaflets deeply notched and clothed with fine bristly hairs. It is a native of England.

T. officinale, Officinal Hart-Wort, has a branched furrowed stem, clothed with soft deflexed hairs; the leaves are pinnate, rough, and hairy; the leaflets ovate, cut, and crenate. The 2 outer petals are radiant, each with 2 very unequal lobes, which are sometimes reddish. It is the *Σέσελι* of Hippocrates ('Vict. Acut.,' 387) and of Theophrastus ('Hist. Plant.,' 9, 18); the Seseli of Pliny (25, 8).

TORENIA, a small genus of Plants of the natural family of *Scrophulariaceæ*, found in India, the tropical parts of Australia, and in South America. *T. Asiatica*, a species found in almost every part of India, is described by Rheede as having the juice of its leaves employed as a cure for gonorrhœa on the coast of Malabar.

TORILIS, a genus of Plants belonging to the natural order *Umbelliferæ*. The calyx has 5 teeth; the petals are obovate, emarginate, the outer ones radiant and bifid; the fruit slightly and laterally compressed; the carpel with bristly primary ridges, the secondary hidden by the numerous prickles which occupy the interstices; the flowers white, those in the disc of the umbellules male and sterile.

T. anthriscus has bipinnate leaves, the leaflets ovate, lanceolate, inciso-serrate; the umbels on long peduncles, the leaves of the involucre awl-shaped, the fruit covered with bristles; the flowers are small, reddish or white. It is a native of Europe and the Caucasus, and is plentiful in Britain.

T. infesta has an erect much-branched stem, the leaves bipinnate, the leaflets deeply cut, ovate, lanceolate. The fruit is densely prickly, the flowers small and reddish. It is found on fields and waste places in Europe and Great Britain.

T. nodosa has nearly sessile dense umbels, the outer carpels with hooked bristles, the inner often covered with dense whitish shining granulations; the lower leaves are bipinnate, the upper ones pinnate; the leaflets deeply, narrowly, and uniformly pinnated. It is a native of Europe and the Levant, and is plentiful in Britain.

TORMENTILLA. [POTENTILLA.]

TORPEDINIDÆ, the Torpedoes, a family of Fishes belonging to the order *Plagiostomi*, and the sub-order *Raiinæ*. [RAIIDÆ.]

Torpedo, the principal genus, was founded by Duméril upon the *Raia Torpedo* of Linnæus, and some other species, distinguished by their having the tail short and moderately thick, and the disc of the body nearly circular, the anterior margin being formed by two produced portions from the head, which, inclining sideways, join the pectorals: the space between the head, the pectoral fins, and the branchiæ is occupied by small vertical hexagonal tubes, which are filled with mucous matter, and largely provided with nerves from the eighth pair. The situation of these honeycomb-like cells, which constitute the electrical apparatus, is indicated on the upper surface by a slight convexity on each side of the head. [ELECTRICITY OF ORGANIC BEINGS.]

Cuvier and Risso consider that several species have been confounded under a common name, and the latter of these authors has characterised four species of *Torpedo* in his 'Histoire Naturelle de l'Europe Méridionale.' They are—

1. *Torpedo Narke*, which he describes as being yellowish-red above, and having five ocellated spots.

2. *Torpedo unimaculata*. This species has the body above fulvous, spotted with whitish spots, and one oblong ocellated spot in the middle of the back. The tail is more elongated and slender. It is said to have the electrical apparatus scarcely visible, and to give but very slight shocks.

3. *Torpedo marmorata*. Body flesh-coloured, and having brown spots and sinuous markings, producing a marbled appearance: tail thick, above rounded.

4. *Torpedo Galvani*. Body fulvous, immaculate, but margined with black.

Fleming refers the British Torpedo to the third of these species *Torpedo marmorata*.

TORPEDO. [TORPEDINIDÆ.]

TORS. By the natural weathering of rocks exposed to atmospheric vicissitudes, the perishable parts are removed and the more resisting portions remain. In rocks which manifest peculiar arrangements of joints or natural divisions, the blocks and masses defined by their intersections often appear in cubical, subcolumnar, and other characteristic shapes. To masses more or less characteristic in figure, left by the decay of surrounding parts in prominent situations, the name of 'Tor' is applied in the granitic tracts of Devon and Cornwall.

TORSK. [BROSMIUS.]

TORTOISES. [CHELONIA.]

TORTRIX, a genus of Serpents. [BOIDÆ; OPHIDIA.]

TORULA. [MOULDINESS.]

TOTANUS. [SCOLOPACIDÆ.]

TOTIPALMES, Cuvier's name for a group of Birds whose hind toe is united together with the others in a continuous membrane. The Pelicans, the Cormorants, the Frigate Birds, the Boobies, the Anhingas, and the Tropic Birds belong to this group.

TOUCANS. [RAMPHASTIDÆ.]

TOUCH. The sense of touch belongs to the outward integument of the body—the skin, and is shared, in a minor and modified degree, by parts of the mucous membranes, which, at the various orifices of the body, are continuous prolongations of the same structure. By it we have the faculty of determining our immediate relations to material objects, in regard of contact, temperature, and electrical excitement.

The nervous influence, or endowment, on which this sense depends, appears in no essential particular to be distinguished from that which gives common sensibility to the various deeper organs of the body. The nerves which convey the specific impressions of touch, are associated at their origin, or in their course, with others not reaching to the surface of the body, under the common name of sensitive; so that if we trace such a one from the centre outwards, we find it (previously to its termination in the skin, where it ministers to the special sense of touch) supplying parts which have merely that common feeling, or sensibility to pain, necessary to their own preservation.

In order to that high development of the sense of touch, which we notice in the human hand, or in the proboscis of the elephant, certain anatomical peculiarities are required:—

1. An exposure of the largest possible number of points, each endowed with sensibility, and capable of being recognised in the sensorium, as distinct and individual. Such a structure is eminently illustrated in the papillary surface of the skin; which presents a vast number of minute evolutions, or papillæ, every one furnished with its own fibrillary nervous loop, and a minute inosculation of blood-vessels. It is certain that each terminal loop is represented by a definite point in the brain, that no two nervous fibrillæ become blended or confused, and hence that each papilla may originate a single and particular sensation. Perhaps the strongest familiar evidence that can be adduced for this fact, is furnished in the tingling sensation (called 'pins and needles') which we produce in numbing the nerve of a part by pressure; the impression here made on the trunk of a nerve being referred, according to a well-known physiological law, to its cutaneous extremities; so that when, for example, we strike the funny-bone, or otherwise press the ulnar nerve which lies there, the peculiar tingling is felt in the skin, at the tips of the last two fingers: if this sensation be analysed, we find it to consist in a pricking of innumerable minute points, as though there were falling on the part a quick dense shower of the finest needles: the minute points, so made sensible to us, are single papillæ of the skin. This instance of subjective sensation is probably the only mode in which the sensitive faculty of the skin can be made known to us; for obvious reasons prove it impossible to apply to the organs of touch the same precise admeasurements as we may use in ascertaining the power of the eye or of the ear. It appears however that the tactile power of the skin varies for different parts in a very much greater degree than can be accounted for by differences in nervous supply. Professor Weber has measured the power of distinguishing distances in different parts of the skin, with the view of affording means to compare their relative degrees of endowment. He conducted his experiments by touching the surface with the points of a pair of compasses (blunted with pieces of cork), and observing how close their arms might be brought together, and still be felt each distinctly. He found that the point of the tongue could distinguish them, as two impressions, when distant only half a line from each other; and that in the middle of the back a separation of thirty lines was necessary to the distinction. Thus, while the tactile endowment of a part is in proportion to the minuteness and density of its papillation, it is evident that the applicability and development of this property will depend on habit and attention and practice, by which we acquire the power of appreciating minute differences of impression.

2. In addition to the anatomical arrangement just described, the sense of touch requires for its perception that a muscular apparatus should be connected with the sentient surface, by means of which this may adapt itself to the superficies of bodies, in order to explore their outline, span their dimensions, or probe their texture. And we find accordingly in those organs which are most tactile,—the hand, the tongue, the lips of the human subject, the snout, proboscis, or tentacles of lower animals,—that complicated muscular motions belong to the part, and render it a more available instrument of exploration. The importance of this addition becomes manifest, if we apply a foreign object to any plane surface of the body (to the front of the fore arm, for instance), and hold it there without pressure or motion. The only sensation so conveyed is one of indefinite contact: without pressure we know not its consistence; without successive and exploring movement we cannot ascertain its outline or level.

(Kirkes, *Handbook of Physiology*; Valentin, *Textbook of Physiology*.

TOUCH-ME-NOT. [IMPATIENS.]

TOUCHSTONE. [FLINTY SLATE.]

TOURACOS. [MUSOPHAGIDÆ.]

TOURMALINE (*Schorl*), a Mineral occurring crystallised. Primary form a rhomboid; secondary forms, prisms with from 3 to 12 sides, terminated by very irregular summits. Cleavage parallel to the faces of the primary form. Fracture uneven, conchoidal. Hardness: scratches glass easily. Electricity: according to Hauy the transparent varieties when heated become electric; the termination of the prism which presents the greater number of faces becoming positive, while the other end becomes negative. Colour white, brown, blue, yellow, green, red, and black. The blue variety is called *Indicolite*, and the red *Rubellite*. *Schorl* is a name formerly given to black tourmaline. Lustre vitreous. Transparent, translucent, opaque. Specific gravity 3·069 to 3·076. Before the blow-pipe all the varieties fuse readily with borax, producing at first slight effervescence.

Tourmaline occurs most commonly in primary rocks, especially in granite, gneiss, and mica slate. The red variety, or rubellite, is found in Siberia; the blue, or indicolite, at Uto; the green in Brazil; the black in Devonshire and many other places. The composition of tourmaline is extremely various. That of the red appears, from the analysis of Vauquelin, to be the simplest, consisting of—

Silica	42
Alumina	40
Soda	10
Oxide of Manganese	7
	—99

Some varieties contain also potash, lithia, lime, magnesia, oxide of iron, and boracic acid. The proportions of these constituents are extremely variable, and no one variety contains all the enumerated substances. The black tourmaline from Devonshire yields nearly 19 per cent. of oxide of iron, and that of Eibenstock nearly 24 per cent. of the same oxide.

The word Tourmaline is a corruption of the name in Ceylon, whence it was first brought to Europe. *Lyncurium* is supposed to be the ancient name for common tourmaline; and the red variety was probably called *Hyacinth*.

The red tourmalines, when transparent and free from cracks, are of great value, and afford gems of remarkable beauty. They have all the richness of colour and lustre belonging to the ruby, though measuring an inch across. A Siberian specimen of this variety, now in the British Museum, is valued at 500*l*. The yellow tourmaline, from Ceylon, is but little inferior to the real Topaz, and is often sold for that gem. The green specimens, when clear and fine, are also valuable for gems.

Tourmaline, on account of its property of polarising light, is used largely in the manufacture of polarising instruments.

(Dana, *Manual of Mineralogy*.)

TOURNEFO'RTIA, a genus of Plants belonging to the natural order *Boraginaceæ*, so named by Linnæus in honour of Joseph Pitton de Tournefort. It is characterised by having a salver-shaped or rotate corolla, of which the throat is naked; the stamens included within the tube of the corolla; the stigma is peltate, and the fruit consists of a berry which contains 4 1-seeded nuts. The species are about 50 in number, forming small shrubs or herbs, diffused through the hot parts of the world, as the West Indies, South America, Indian islands, and India.

TOXICODENDRON. [RHUS.]

TO'XODON (τόξον, a bow; ὀδούς, a tooth—from the curvature of the teeth), Professor Owen's name for an extinct genus founded on *Toxodon Platensis*.

Mr. Darwin, during his sojourn in Banda Oriental, having heard of some giants' bones at a farm-house on the Sarandis, a small stream entering the Rio Negro, rode there and purchased, for the value of eighteen-pence, the cranium now in the Museum of the Royal College of Surgeons in London, and the subject of Professor Owen's description. The people at the farm-house told Mr. Darwin, that the remains were exposed by a flood having washed down part of a bank of earth. When found the head was quite perfect; but the boys knocked the teeth out with stones, and then set up the head as a mark to throw at. Mr. Darwin found a perfect tooth, which exactly fits one of the sockets in this skull, embedded by itself on the banks of the Rio Tercero, at the distance of about 180 miles from the farm-house. Near the *Toxodon* Mr. Darwin found what he terms the fragments of the head of an animal rather larger than the Horse, and which he describes as having some points of resemblance with the *Toxodon* and others, perhaps with the *Edentata*. These fragments, now also in the museum of the College, Professor Owen has ascertained to belong to the lower jaw of the *Toxodon*. Mr. Darwin observes that the remains appeared so fresh as to render it difficult to believe that they had lain buried for ages underground. The bone contained so much animal matter, that when heated in the flame of a spirit-lamp it not only exhaled a very strong animal odour, but likewise burned with a slight flame. ('Journal.') The place where the remains were found is about 120 miles N.W. from Monte Video, and the cranium was embedded in a whitish argillaceous earth forming the banks of the Sirandis.

The first notice of this discovery appears in the 'Proceedings of the Geological Society of London,' in a paper by Professor Owen, from which we take the following brief account:—

The cranium measures 2 feet 4 inches in length, and 1 foot 4 inches in extreme breadth. The form of the skull is elongated, depressed, and chiefly remarkable for the strength and wide expanse of the zygomatic arches, and the aspect of the occipital foramen and occipital region of the skull, which slopes from below upwards and forwards. The maxillary portion of the skull is compressed laterally, narrow, and with large intermaxillary bones slightly dilated at their extremity.

The teeth consist of molars and incisors. The latter are four in number in the upper jaw, the two middle ones very small, the two

external ones very large, curved, and with their sockets extending backwards in an arched direction through the intermaxillary bones to the maxillary, and terminating, without diminishing in size, immediately anterior to the grinding teeth, where the large persistent pulps of these incisors were lodged. In form and relative size these teeth must have resembled the dentes scalprarii of the Rodents.

The molar teeth no less present a close approximation in their form and structure to the molar teeth of the Herbivorous Rodents. They are seven in number on each side of the upper jaw, and, from the form of the sockets, appear to have corresponded with each other in structure.

"After summing up the different affinities, or indications of affinity, which are deducible from this most curious and interesting fossil mammal, we are led to the conclusion, assuming it to have had extremities cased in hoofs, that it is referrible to the order *Pachydermata;* but the structure, form, and kind of teeth in the upper jaw prove indisputably that the gigantic *Toxodon* was intimately related to the Rodent order. From the characters of this order, as afforded by the existing species, the *Toxodon* however differs in the relative position of the supernumerary incisors, and in the number and direction of the curvature of the molars. If moreover the lower jaw, next to be described, belong, as I believe, to the *Toxodon*, the dental character of the genus will be—

"Incisores, $\frac{4}{6}$; Pro Laniariis Diastema; Molares, $\frac{7-7}{7-7}$.

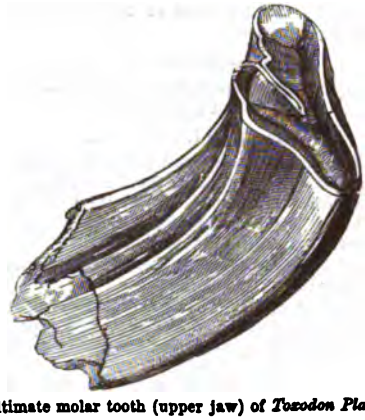
"The *Toxodon* again deviates from the true *Rodentia*, and resembles the Wombat [MARSUPIATA] and the Pachyderms in the transverse direction of the articular cavity of the lower jaw. It deviates from the *Rodentia*, and resembles the *Pachydermata* in the relative position of the glenoid cavities and zygomatic arches, and in many minor details already alluded to.

Skull of *Toxodon Platensis*, profile.

Top view of the Skull of *Toxodon Platensis*.

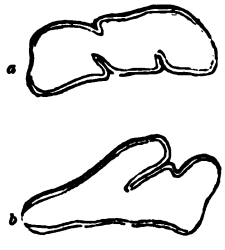
Skull of *Toxodon Platensis*, seen from behind.

"The affinity above alluded to is too obvious to have escaped popular notice, and the Capybara, from its aquatic habits, has obtained the name of Water-Hog. It is highly interesting to find that the continent to which this existing aberrant form of Rodent is peculiar should be found to contain the remains of an extinct genus characterised by a dentition which closely resembles the Rodent type, but manifesting it on a gigantic scale, and tending to complete the chain of affinities which links the Pachydermatous with the Rodent and Cetaceous orders."



Penultimate molar tooth (upper jaw) of *Toxodon Platensis*.

Incisor tooth of lower jaw of a *Toxodon*.



a, grinding surface of penultimate upper molar tooth of *Toxodon Platensis;* *b*, grinding surface of a corresponding molar tooth of the lower jaw.

Fragment of anterior part of lower jaw of a *Toxodon*, with teeth in situ. (All from Owen.)

TOXO'STOMA. [MERULIDÆ.]
TOXOTES. [ARCHER-FISH.]

TRACHEARIA, a subdivision of the great class *Arachnida*. It includes those forms of this class which carry on their respiration by means of ramifying tracheal tubes. They have two or four eyes. This division includes the various forms of Mites, Ticks, Shepherd-Spiders, and Sea-Spiders. The following is a synopsis of the families of this sub-class from the 'Manual of Natural History,' by Messrs. Adams, Baikie, and Barron :—

Order I.—*Monomerosomata.*

Body without division, the head, trunk, and abdomen being united into a single mass; abdomen not annulated.

Sub-Order I.—*Errantia.*

Mouth with distinct mandibles; palpi always present; animals free.

Family 1. *Acaridæ*.—This includes the True Mites. [ACARIDÆ.]

Family 2. *Trombiidæ*, Garden-Mites.—Palpi jointed, with a moveable appendage below the tip; feet formed for walking; eyes latero-anterior; cheliceræ ending in a moveable claw.

Trombidium holosericeum is of a blood-red colour, and is very common in gardens during the spring.

Family 3. *Gamasidæ*, Spider-Mites.—Palpi filiform, incurved, short, free; mouth with two didactyle cheliceræ; body depressed; skin soft or scaly; legs formed for walking; tarsi unguiculate. The Red Spider of our hot-houses belong to this family.

Family 4. *Orbitidæ*, Wood-Mites.—Palpi fusiform, hid under the head, without hooks; mouth with didactyle cheliceræ; eyes not distinct; body hairy or scaly, produced and rostrate in front; legs formed for walking.

Sub-Order II.—*Suctoria.*

Mouth in form of a sucker, with or without palpi; no apparent mandibles; animal attached.

Family 5. *Ixodidæ*, True Ticks. [IXODES.]

Family 6. *Bdellidæ*, Plant-Ticks.—Palpi antenniform; mandibles unguiculate or cheliform; eyes distinct; suckers in form of an elongated beak; body with a caselet; legs formed for walking.

Family 7. *Hydrachnidæ*, Water-Ticks.—Palpi with the last joint armed with points, the third and fourth joints larger than the others; body simple, oval, or rounded; eyes supero-anterior; legs ciliated, formed for swimming; parasitic in the young state; aquatic.

The species are found in fresh-waters. *Hydrachna* has the mouth composed of plates forming a projecting sucker.

Family 8. *Leptidæ*, Harvest-Ticks.—Palpi short; suckers porrected; body depressed, coriaceous, ovately rotund; legs six, two being undeveloped.

Leptus autumnalis is very common in autumn upon grass and other herbage. They crawl upon the human body and insinuate themselves into the skin, producing great irritation. They are called Harvest-Bugs.

Order II. *Adelarthrosomata.*

Body divided into three or four distinct segments; abdomen distinct, annulated; mouth with conspicuous didactyle pincers or cheliceræ.

Family 1. *Solpugidæ*, False Scorpions.—Mandibles in the form of large compressed claws, with a moveable finger; palpi large, in the form of feet, or of cheliferous arms; body oblong, soft; abdomen hairy.

Family 2. *Cheliferidæ*, Book-Scorpions.—Mandibles short; didactyle at the end; palpi very large, awn-like, with a pincer at the end; body ovate, depressed, narrowed in front; legs of equal size, short, ending in two hooks. *Chelifer cancroides* is found in herbariums, old books, &c., where it feeds upon the minute insects which frequent such situations.

Family 3. *Phalangidæ*, Shepherd-Spiders. — Mandibles very conspicuous, composed of two or three pieces, free, ending in a didactyle pincer; palpi filiform, ending in a hook; body short, rounded; abdomen segmented; legs elongated. This family comprises the well-known forms called Harvest-Men.

Sub-Class III. *Aprobranchiata.*

This sub-class includes the genera *Nymphon* and *Pycnogonum*, which are the types of two families, *Nymphonidæ*, the Sea-Spiders, and *Pycnogonidæ*, Parasitic Sea-Spiders. These are often referred to the class *Crustacea*. [SIPHONOSTOMATA.]

TRACHELIASTES. [LEBNEADÆ.]
TRACHE'LIDES. [HETEROMERA.]
TRACHELIOPTERUS. [SILURIDÆ.]
TRACHELI'PODA. [MALACOLOGY.]
TRACHINIDÆ. [*See* SUPPLEMENT.]
TRACHIURUS. [TÆNIOIDES.]
TRACHYCEPHALUS. [IGUANIDÆ.]
TRACHYCYCLUS. [IGUANIDÆ.]
TRACHYPHONUS. [PICIDÆ.]

TRACHYPTERUS, a genus of Fishes belonging to the riband-shaped forms of *Acanthopterygii*. The body is elongated and compressed; dorsal fin extending the whole length of the back, a few of the anterior rays sometimes elongated; ventral fins fragile, if not worn or broken, rather long; no anal fin; caudal fin-rays rising almost vertically from the horizontal line of the vertebral column; a row of small spines along the lateral line.

T. Bogmarus, the Vaagmaer, or Deal Fish, is described by Dr. Fleming in the 'Magazine of Natural History.' He was the first British naturalist who has made known its occurrence in Scotland. The species found in the north of Europe differ from those of the Mediterranean. One specimen only has been recently caught alive at Sanda in Orkney. It is thus described :—Length three feet; body excessively compressed, particularly towards the back, where it does not exceed a table-knife in thickness; breadth nearly five inches, tapering to the tail; colour silvery, with minute scales, the dorsal fin of an orange colour, occupying the whole ridge from the head to the tail, with the rays of unequal size; head four inches and a half long, compressed like the body, with a groove on the top; eyes one inch and a quarter in diameter; both jaws armed with small teeth. Various specimens, probably to the number of twelve or more, appear to have been obtained on the island of Sanda between 1817 and 1829. The Vaagmaer is rare in Iceland. It differs from the two species found in the Mediterranean, *T. falx* and *T. iris*, and also from *T. leiopterus*.

TRACHYTE. [ROCKS.]

TRACHYTELLA, a genus of Plants belonging to the natural order *Dilleniaceæ*, so named from τραχυτης, 'roughness,' because the leaves are remarkable for their asperity. The genus belongs to the tribe *Delimaceæ*, of the above family, by having the sepals and petals from 4 to 5, numerous stamens, and 1 or 2 baccate many-seeded carpels. The known species are only two in number, natives of China and Cochin-China, climbing in habit, with racemes of white flowers. The leaves of *T. Actæa* have so very rough a surface that they are employed in Canton for polishing both wood and metal.

TRADESCA'NTIA, a genus of Plants belonging to the natural order *Commelynaceæ*, which was so named in honour of the English botanist John Tradescant, who was gardener to Charles I. The species are natives of America and of India. Many of them, being of a highly ornamental nature, are cultivated in flower-gardens; a few are used medicinally in the countries where they are indigenous. Thus *T. axillaris*, according to Rheede, is used in India as an application to the abdomen in cases of tympanites; and Martius describes the stem and leaves of *T. diuretica* as being employed in Brazil as emollient applications in rheumatic pains, intestinal derangements, and in retention of urine; while in North America *T. Virginica* is employed in cases of bites of venomous spiders, as well as some other species, whence it has obtained the name of Spider-Wort, but it is doubtful whether they possess any other than simple emollient properties. The hairs of the stamens of this plant exhibit a circulation, in the cells of which they are composed.

TRAGACANTH. [ASTRAGALUS.]
TRAGELAPHUS. [ANTILOPEÆ.]

TRA'GIA, a genus of Plants belonging to the natural order *Euphorbiaceæ*, named after Tragus, a German botanist, whose real name was Bock. The species are found in India and in America, are climbing in habit, and some are remarkable for stinging as violently as nettles. *T. cannabina* is so named from its leaves resembling those of the *Cannabis*, or Hemp, and of which the roots given in infusion are considered diaphoretic and alterative. *T. involucrata* is a small plant without taste or smell, but the native physicians of India consider it calculated to strengthen the system in cachectic states of the constitution and in chronic cases of syphilis. *T. volubilis*, which is a stinging climber, and has a very acrid juice, is employed in conjunction with common salt for the destruction of some kinds of ulcers.

TRA'GOPAN. [PHASIANIDÆ.]

TRAGOPO'GON (from τράγος, a 'goat,' and πώγων, 'beard'), a genus of Plants belonging to the natural order *Cichoraceæ*, which is usually considered only a tribe of the great order of *Compositæ*. The genus *Tragopogon*, or Goat's Beard, is so named from the long silky beard or pappus of the seeds. The genus is distinguished by having a simple involucre of many leaves. Receptacle naked. Pappus stalked, plumose. Achenia longitudinally striated. The species are found in the temperate parts of Europe and of Asia. One, *T. gracilis*, is found in the Himalaya Mountains, of which the leaves are eaten by the natives as lettuce is in Europe, but without being blanched. The best-known species however is *T. porrifolius*, or Salsify, which is occasionally cultivated in this country, but frequently in France and Germany. The English *T. pratensis* may be cultivated for the same purpose. The roots of Salsify are the parts esteemed; they are long and tapering, their flavour mild and sweetish, and are boiled or stewed like carrots. The stalks of year-old plants are sometimes cut in the spring, and, when similarly dressed, taste like asparagus.

TRAGOPS. [ANTILOPEÆ.]
TRAGULUS. [MOSCHIDÆ.]

TRANSITION ROCKS. When the general terms Primitive and Secondary were much in use among geologists, certain assemblages of rocks, which were of intermediate position, and seemed to unite the mineral aspect of the Primitive with the organic enrichments of the Secondary, were for these reasons called Transition Gebirge, Roches de Transition, and Transition Rocks. These terms are not much used at the present day. [GEOLOGY.]

TRAP. This geological term, one of the most general use and comprehensive signification, seems to have been originally employed by Bergman and the German and Swedish miners, in the sense of the word 'trappa,' Swedish, or 'treppe,' German, meaning stairs, and the

aspect of the rocks now called Trap, in successive terraces on hill sides, is such as often to justify the use of the word. In modern works on topographical geology a very great proportion of the ancient rocks of fusion are familiarly called Trap, not because they have any certain mineral composition, but because, whether granitic, sienitic, porphyritic, or hornblendic, they appear under particular relations of position or geological age. In this sense the term is purely geological, and we have as distinctive designations Eruptive Trap, Contemporaneous Trap, Overlying Trap, Interposed Trap, &c. By other writers the term is restricted so as to leave out such massive and generally deep-seated rocks as granite, or even contracted to the hornblendic and felspatho-hornblendic rocks, which appear as dykes, interposed beds, and overlying masses. It thus appears to be a collective term more convenient than precise. In a geological sense it may be replaced by descriptive words, such as Irruptive, Interposed, Overlying, &c., and in a mineralogical sense it is advantageously changed for Basalt, Greenstone, Felsparite, Sienite, Serpentine, Diallage Rock, &c.

TRAPA, a genus of Plants belonging to the natural order *Onagraceæ*. The fruit of *Trapa* is furnished with spines, and the species are commonly called Water-Caltrops, from the plants floating on the surface of lakes, and on that of slow-running waters. They are found in the temperate parts of Europe and of Siberia, in Cashmere, India, Cochin-China, and China. The genus is characterised by having a 4-parted adherent calyx; petals and stamens 4; ovary 2-celled, with solitary pendulous ovules. The fruit is hard, indehiscent, 1-celled and 1-seeded. The seed is large and exalbuminous; the two cotyledons very unequal. The floating habit and clustered leaves easily distinguish these plants. The leaves under water are cut into capillary segments, and the petioles are tumid in the middle.

T. natans, the European species, is remarkable for its fruit with 4 spines, being of a blackish colour and large size, and its seed, which nearly fills it, being farinaceous, and good to eat, whether raw, roasted, or in soups, and is somewhat like a chestnut in taste. It was known to the Romans by the name Tribulus. Pliny says (lib. xxi., c. 58), "About the rivers Nilus and Strymon the inhabitants gather it for their meat."

T. bispinosa, Roxb. ('Corom. Pl.,' ii. 234), has the nut with two opposite, straight, barbed, spinous horns, noticed by Sir W. Jones under the Sanscrit name of Sringata: it is commonly known all over India by the name Singara, both names having reference to its horned appearance. It is also found in the Lake of Cashmere. In India the nuts are sold in all the bazaars, as their farinaceous kernels are much esteemed by the Hindoos. A species called by the same name, Singhara, forms a considerable portion of the food of the inhabitants of Cashmere.

T. bicornis is distinguished from the last by its two horns being recurved and very obtuse. It is carefully cultivated in lakes, ponds, and other receptacles of water.

TRA'PELUS, Cuvier's name for a genus of Lizards which have the form and teeth of the *Agamæ*, but their scales are small and without spines. They have no pores on the thighs.

Trapelus Ægyptius (*Agama mutabilis*, Merrem.).

T. Ægyptius is a small reptile, which sometimes puffs out its body, whence the name of *orbicularis*, Daudin. It is also remarkable for its changes of colour, hence it is called by the French Le Changeant d'Egypte.

TRASS. A deposit of volcanic ashes and scoriæ thrown out from the Eifel volcanoes, and accumulated in valleys and old lakes under the influence of water, is thus designated. It is equivalent, or nearly so, to the Puzzolana of the Neapolitans. (Lyell's 'Principles of Geology.')

TRAVELLER'S JOY. [CLEMATIS.]

TRAVERTIN, the Italian term for Concretionary Limestone, produced from springs holding carbonate of lime in solution.

TREACLE-MUSTARD. [ERYSIMUM.]

TREE, COTTON. [GOSSYPIUM; BOMBAX.]

TREE-FERN. [CYATHEA.]

TREE-FROGS. [AMPHIBIA.]

TREE-MALLOW. [LAVATERA.]

TREES. [EXOGENS; AGE OF TREES.]

TREFOIL. [TRIFOLIUM.]

TREFOIL, BIRD'S-FOOT. [LOTUS.]

TREMANDRA'CEÆ, *Poreworts*, a natural order of Exogenous Plants, consisting of slender shrubs very much resembling heaths, usually covered with glandular hairs. The leaves are without stipules, either alternate or whorled, entire or toothed. The flowers are often large and handsome, seated on solitary axillary pedicels. The calyx has 4 or 5 sepals with a valvate æstivation; the petals equal in number to the sepals and much larger; the stamens hypogynous, double the number of the petals, with anthers 2- or 4-celled, opening by a pore at the apex; ovary 2-celled, with a simple style and stigma; seeds pendulous, and furnished with a caruncle at the apex; albumen fleshy, in the axis of which lies a straight cylindrical embryo.

This is an order of Australian plants, containing but two genera, *Tetratheca* and *Tremandra*.

Tetratheca glandulosa.

1, cutting with flowers; 2, ovary with simple stigma; 3, 4-celled anther; 4, anther opening by a simple pore; 5, section of capsule showing its two cells; 6, seed with the caruncle and embryo lying in albumen.

TREMATODA. [ENTOZOA.]

TREMELLA. [TREMELLINI.]

TREMELLI'NI, the name of the last order of the Cohort *Hymenomycetes* in Fries's arrangement of the natural order *Fungi*. The type of this order is the *Tremella*, a genus constituted by Dillenius, and applied to a variety of forms of *Fungi* belonging to this group, but now arranged under other genera. The *Tremellæ* of Dillenius included all kinds of the lower forms of plants which possessed a gelatinous character; and as these exhibited a tremulous motion on being shaken, he gave them this name. It was for a long time a matter of dispute among botanists as to where the *Tremellæ* should be placed. Linnæus arranged them with the *Algæ*, Persoon with the *Fungi*, and Smith as *Algæ Ambiguæ*. As however their nature became better understood, many anomalous forms were removed from among them; and several genera having been formed, they are now arranged among the *Fungi*.

The plants of this order are known by their amorphous character, having a soft gelatinous appearance, and looking like gummy exudations of the substances on which they grow. Their sporidia are free. They have been at various times objects of superstition, and have also been employed in medicine. In the wooded countries, where they are

very common, the people call them Witch-Guts, Witch-Meat, and Witches'-Butter.

The genus *Tremella* is known by its receptacle being gelatinous, homogeneous, bearing fruit all round, and destitute of papillæ. The sporidia are submergent. It has a large number of species, of which nine are known as British. They are all of them found on the decaying branches, trunks, and stumps of trees.

The genus *Exidia* is known by possessing a gelatinous homogeneous receptacle, covered above only with a papillate hymenium. The most remarkable species of this genus is the *Exidia Auricula Judæ*, Jew's Ear. It has obtained its common name from its resemblance whilst growing to a human ear. The whole plant is sessile, concave, and flexuous, of a leathery consistence, and a reddish-brown colour. It is found mostly on living trees, especially the elder. It is generally from one to three inches wide. This plant was at one time held in much repute for its medicinal properties. It has an astringent character, and has been used in infusion as a lotion in ophthalmia, and also as a gargle in sore throat. It has also been used in the same cases as a poultice.

E. glandulosa, Glandular Exidia, or Witches'-Butter, is an effused mass more or less plane, thick, and undulated, varying from a whitish-brown to a black colour; the hymenium is covered with spicules.

The genus *Dacrymyces* has a gelatinous homogeneous receptacle filled within with suberect flocci, and interspersed sporidia. This genus, sometimes called Tear-Mould, yields species which attack wrought wood, and produce what is called dry-rot. The *D. moriformis*, Mulberry Tear-Mould, is of a rich deep purple colour, and is found on wrought wood in a clustered rounded form resembling a mulberry.

There are three other genera belonging to the order *Tremellini*—*Nœmatelia*, *Agyrium*, and *Hymenula*: they have each one species, and all of them were formerly described under the genus *Tremella*.

TREMOLITE. [Hornblende.]

TREPANG. [Holothuriadæ.]

TRETOSTERNON. [Chelonia.]

TREWIACEÆ, a natural order of Plants belonging to the Rectembryose group of incomplete Exogens. This order has for its type a single genus, *Trewia*, which was named after Christopher James Trew, a physician of Nürnberg. The species are but few: they are trees with opposite and stipulate entire leaves and dicecious flowers: the antheriferous flowers are arranged in long racemes, and the pistilliferous flowers are axillary and solitary. The calyx in both flowers is 3-4-cleft; the stamens are numerous; the style is 4-cleft; the fruit is a drupe, 4-celled, with one seed in each cell.

The plants of this order are natives of tropical India, and their properties are at present unknown, nor is their structure well understood. *Trewia* is mostly referred to *Euphorbiaceæ*.

TRIÆNODON. [Squalidæ.]

TRIAKIS. [Squalidæ.]

TRIANTHEMA, a genus of Plants of the natural order *Portulaceæ*, so named from τρεῖς, three, and ἄνθος, a flower, in consequence of the flowers growing in threes, in the axils of the leaves. The species occur as weeds in every part of the plains of India. *T. obcordata*, like the plants of the family to which it belongs, is employed by the natives of India as a pot-herb; but the nauseous and bitter roots of *T. monogyna* are said by Dr. Ainslie to be employed as a purgative by the inhabitants of Hindustan.

TRI'BULUS (τρίβολος, three-spiked or pointed), a genus of Plants belonging to the natural order *Rutaceæ*, the fruit of which is armed with prickles. It has a 5-parted calyx; petals 5, spreading; stamens 10; ovary superior; capsules 5, gibbous, spiny, many-seeded. The species are found in the south of Europe and the subtropical and tropical parts of the world, with diffuse, often procumbent stems, with solitary white or yellow flowers in the axils of the leaves. *T. terrestris* is sometimes cultivated in the gardens of the West Indies on account of the sweet scent of its flowers. This, as well as *T. cistoides*, has some aperient properties ascribed, and is therefore sometimes used medicinally in the countries where it is indigenous. [Trapa.]

TRICHAS. [Sylviadæ.]

TRI'CHECHUS. [Phocidæ.]

TRI'CHIA. [Trichospermi.]

TRICHI'LIA, a genus of Plants belonging to the natural order *Meliaceæ*. The species are found in the tropical parts of America, and a few in Africa and in Australia. An Indian species, *T. spinosa*, is not well known, but the oil of its seeds is said to be a useful remedy in chronic rheumatism and paralytic affections. Several are possessed of active properties. Forskal found the fruit of one species in the mountains of Yemen used as an emetic, and called Jouz-al-Cai, or the Emetic Nut, whence he named it Elcagi, now called *T. emetica*. The seeds bruised are used for washing the hair, as well as an application in itch. *T. trifoliata*, a native of Curaçoa, has an unpleasant smell in all parts, and is said to possess active properties. *T. cathartica* is described by Martius as having great bitterness, and as employed in Brazil as a cure for fevers, &c. *T. moschata* is remarkable in Jamaica for the odour of musk which it diffuses all around, on which account it is called Musk-Wood.

TRICHINA. [Entozoa.]

TRICHIURUS. [Tænioides.]

TRICHOCEPHALUS. [Entozoa.]

TRICHODERMA'CEÆ, a tribe of Plants belonging to the sub-order *Gasteromycetes*, of the natural order *Fungi*.

TRICHODESMA (from the root τριχο, hair, and δέσμος, a bond), a genus of Plants belonging to the natural order *Boraginaceæ*. The species have little beauty and are of little use. *T. Indica* and *T. Zeylanica* are reputed in India to have diuretic properties, but are probably only demulcent. They are likewise reckoned among the numerous plants which are supposed to have the power of curing the bites of snakes, but probably possess no other power than what they derive from their mucilaginous nature.

TRICHOGLOSSUS. [Psittacidæ.]

TRICHOMANES. [Hymenophyllæ.]

TRICHONE'MA, a genus of Plants belonging to the natural order *Iridaceæ*. It has a regular 6-cleft perianth, with spreading segments; the three stigmas are bifid; the lobes slender. *T. Columbæ* is the only British species; it has a solitary 1-flowered nodding scape; filiform compressed leaves; the spathe longer than the tube of the corolla; the style shorter than the stamens. The flower is pale purple or violet, with a yellow centre. It is found in sandy places in Jersey and Guernsey. (Babington, *Manual of British Botany*.)

TRICHOPHORUS. [Merulidæ.]

TRICHOPHYTON. [Entophyta.]

TRICHOPTERA. [Neuroptera.]

TRICHOSANTHIS, a genus of Plants belonging to the natural order *Cucurbitaceæ*. Many of the species are edible, and from the long often sinous-formed fruit they have been named Snake-Gourds; the *Anguina* of some botanists. The fruit of many of the species is eaten in India, whilst that of others contains a purgative principle.

TRICHOSPERMI, a tribe of Plants belonging to the sub-order *Gasteromycetes*, of the natural order *Fungi*. It is known by its peridium being single or double, bursting when full grown, and pouring forth abundant naked dust-like sporidia. The sporidia are subglobose and rather large, and are collected more or less in the centre of the peridium, and are loose or interwoven with the flocci. The genera belonging to this order are rather numerous, and are divided into *Trichogastres*, those having a fleshy consistence, and *Myxogastres*, those having a soft and mucilaginous consistence.

To the first division belong all those forms of *Fungi* which are popularly known as Puff-Balls, Blind-Man's-Buff, Devil's Snuff-Boxes, &c. They have obtained these names on account of the property they possess of giving out when in a ripened state the sporules with which their interior is filled. These sporules are so exceedingly small and light, that on the peridium, or external covering of the plant, being broken, they rise into the air like smoke. Many of these sporules do not measure more than from $\frac{1}{10000}$th to $\frac{1}{20000}$th of an inch in diameter. They possess a curious property of repelling the particles of water, so that if the surface of a basin of water is covered with them, the hand may be plunged to the bottom of it without being wetted. [Bovista; Lycoperdon; Fungi.]

TRICHOSTOMA. [Neuroptera.]

TRICHO'TROPIS (from the root τριχο, hair, and τρόπις, a keel), a genus of Gasteropodous *Mollusca*.

The shell is turbinated and carinated externally; the aperture wide, but still longitudinal and rather longer than the spire, its base entire without any notch, although immediately below the obliquely truncated base of the columella there is an indistinct canal. The whole shell is thin and delicate, the outer lip especially. Epidermis horny, forming numerous sharp-pointed bristle-like processes on the edges of the carinæ outside the shell, very strong, and by its contraction in drying frequently breaking the edge of the lip.

Operculum horny, much smaller than the aperture, composed of elliptical laminæ; its apex or nucleus lateral. Animal resembling in most particulars a *Buccinum*.

But two or three species of this genus are known.

Trichotropis bicarinata. *a*, operculum.

TRICKLASITE. [Fahlunite.]

TRICOCCÆ, the name of a natural order in the 'Fragments of a Natural System' of Linnæus. *Euphorbia* was selected by Linnæus as the type of this order. [Euphorbiaceæ.]

TRICONDYLA. [Ctenostoma.]

TRIDA'CNA. [Tridacnidæ.]

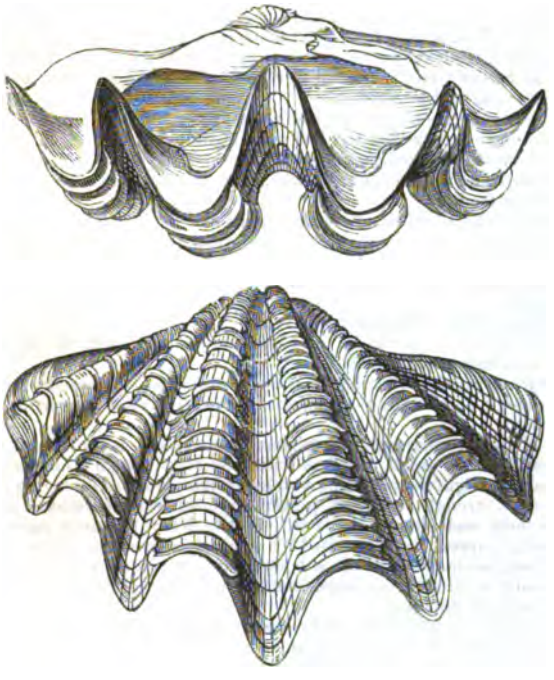
TRIDA'CNIDÆ, a family of Conchiferous *Mollusca* comprising the genera *Tridacna* and *Hippopus*.

Tridacna.—Animal oval, cordiform, having the lobes of the mantle united nearly throughout the circumference: three apertures; two

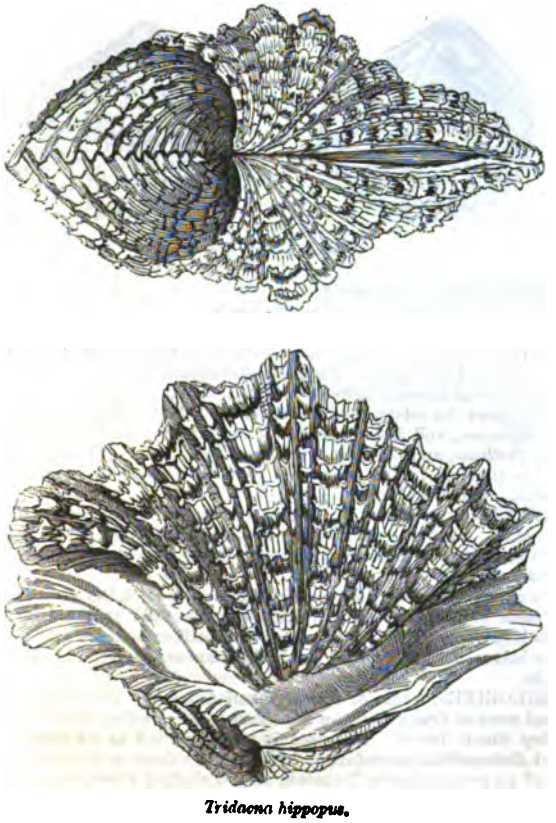
posterior and inferior for the anus and for respiration, the third anterior, corresponding with the gape of the lunule, and giving passage to a thick, cylindrical, and byssiferous foot, in nearly all the species. Mouth oval, furnished with great lips, at the extremity of which are two pairs of pointed labial palps. (Deshayes.)

Shell regular, equivalve, inequilateral, transverse; with a gaping lunule. Hinge with two compressed, unequal, anterior, and intrant teeth. Ligament marginal, external. (Lamarck.)

T. gigas. Shell very large, transversely oval, with great imbricato-squamous ribs, the scales shot, arched, and lying near together; the interstices of the ribs not striated.



Tridacna gigas.



Tridacna hippopus.

The size and weight of this immense bivalve, the largest and heaviest known,* combined with the beautiful marble-like appearance and whiteness of the inside of the valves, have always caused it to be sought for as an ornament for grotto-work or for garden-fountains; and, indeed, the valve of a large individual forms a very picturesque basin for catching the clear falling water and transmitting it through the deep interstices of its indented edge to the reservoir below. Wolfart's fossils were not improbably the relics of some ancient and long-neglected pleasure-ground. The specimen whose valves serve for holy-water vessels (Bénitiers) in the church of Saint Sulpice was presented to Francis I. by the republic of Venice; and Lamarck observes that, large as these are, still larger have been known.

This species can hardly have been the *Tridacna* of Pliny ('Nat. Hist.,' xxxii. 6), which was probably only some overgrown European oyster that required three bites. A fine well-fed Indian giant *Tridacna* would furnish forth a dish for a dozen. But it is not improbable that the *Pedalia*, or oysters a foot long, from the Indian Sea, noticed in the preceding sentence of the same book and chapter, may have been *Tridacnæ* of modern authors.

The figure of *T. gigas* given in the 'Zoology of the Astrolabe' was designed at Carteret Harbour, New Ireland. The natives brought many very large individuals, whose flesh was abandoned to them, and which they ate raw. The naturalists of the expedition found the species again at Tongataboo, at the Moluccas, at Timor, and at Wagiou. It appeared always to inhabit rather shallow water.

Some fine specimens are to be seen in the Garden of the Zoological Society, Regent's Park.

T. hippopus (*Chama hippopus*, Linn.; *Hippopus maculatus*, Lam.; *Tridacna maculata*, Quoy, 'Voyage of the Astrolabe.')

This well-known but beautiful species, now much used in the ornamental arts for inkstands, &c., has a transversely ovate shell, which is of moderate size, ventricose, ribbed, subsquamous, and white spotted with red or purple; the lunule is heart-shaped and oblique.

The naturalists of the 'Voyage of the Astrolabe' found this species at Carteret Harbour, New Ireland, and also at Vanikoro, where they collected specimens left dry on the reefs.

TRIDACOPHYLLIA. [MADREPHYLLIÆA.]

TRIDACTYLUS, a genus of Orthopterous Insects, belonging to the family *Gryllidæ*. They are minute exotic insects, fossorial in their habits, using the anterior tibiæ. The posterior tarsi are replaced by narrow bent moveable appendages. The antennæ are very short, and 10-jointed.

TRIENTA'LIS, a genus of Plants belonging to the natural order *Primulaceæ*. In British botany this genus is somewhat conspicuous, as it is the only one which belongs to the Linnæan class *Heptandria*. The parts of the fructification are remarkable for being arranged according to the number seven.

T. Europæa, the European Chick-Weed, Winter-Green, is a British species. It is distinguished from the American species by possessing elliptical instead of lanceolate leaves. This plant is rare in England, being only occasionally met with in woods in the northern counties; it is however abundant in many parts of the Highlands of Scotland.

T. Americana, the American Chick-Weed, Winter-Green, has lanceolate leaves. It is found in mountainous districts in Canada and Virginia.

TRIFO'LIUM (*τρίφυλλον*), a genus of Plants belonging to the natural order *Leguminosæ*. This genus, which has obtained its Latin as well as its French and English designations, Trefle and Trefoil, from its leaves possessing three segments, is one of the most extensive in the vegetable kingdom. The calyx is tubular, 5-cleft; corolla remaining after decay; carina obtuse; stamens diadelphous, more or less connate with the petals, the filaments dilated above; the style smooth; legume ovate, with one or two seeds, sometimes oblong, with three or four seeds, and included within the decaying calyx and corolla. All the species are herbs. The leaves are mostly divided into three segments or foliolules; sometimes they are seen with four or five. The flowers are disposed in dense heads or spikes, and are of a purple white or cream-colour. De Candolle has arranged the numerous species of this genus under seven sections, the characters of which are founded principally on the inflorescence and on the form of the calyx, or of the corolla combined with it. We shall here select some of the most useful and remarkable of the species as illustrations of the genus.

T. incarnatum, Flesh-Coloured Trefoil, or Scarlet Clover. The spikes of flowers are at first ovate, at length cylindrical, solitary, and naked at the base; the calyx 10-nerved and hairy, with unequal awl-shaped acute teeth, longer than the tube and shorter than the corolla; stipules ovate and obtuse; leaflets obovate, crenated, villous; stem erect. The species is a native of the south of Europe, in damp meadows. [CLOVER, in ARTS AND SC. DIV.]

T. arvense, Hare's-Foot Trefoil. The stem erect, branched, or simple; heads of flowers very hairy, soft, nearly cylindrical, terminal, stalked; the teeth of the calyx longer than the corolla, setaceous, and somewhat spreading; stipules ovato-acuminate; leaflets lanceolate, obtuse. This plant is a native of Europe, and is abundant in corn-fields and dry pastures in Great Britain. Its soft hairy subcylindrical heads or spikes give it a very remarkable character.

T. maritimum, Sea-Side or Teasel-Headed Trefoil. The heads are

* Five hundred pounds have been recorded as its weight.

sessile and terminal; the teeth of the calyx broad, acuminate, rigid, the lower one much longer and larger than the rest, shorter than the claws of the petals, all of them at length enlarged and spreading; stipules lanceolate-subulate; leaflets oblongo-obovate; stem ascending. It is a native of Europe, in salt marshes and meadows near the sea-side. It is found on the east and south coasts of Britain.

T. Alexandrinum, Alexandrian Trefoil, or Clover, is a native of Egypt, about Alexandria. It is the only Trefoil that is cultivated in Egypt, where it is extensively used as fodder for cattle.

T. medium, Meadow-Trefoil, Marl-Clover, or Cow-Grass. The heads of the flower are lax, subglobose, solitary, terminal; the teeth of the calyx are setaceous, the lower one longer than the rest, about equal to the tube of the corolla; stipules lanceolate, acuminate; leaflets elliptical; stems branched, zigzag. It is a frequent plant in the pastures of Britain, where it can be recognised by its zigzag stem, from which circumstance it is sometimes called Zigzag-Trefoil.

T. pratense, Common Purple-Trefoil, or Red-Clover. The stem is ascending; the leaflets are oval or obcordate; the heads of flowers are dense and ovate; the teeth of the calyx are setaceous, the lower one longer than the rest; stipules ovate, bristle-pointed. This plant has reddish-purple flowers, and is frequent in meadows and pastures, where it blooms all through the summer. The leaves are usually marked with a white subsagittate mark in the centre.

T. repens, White-Trefoil, White- or Dutch-Clover. It has umbellate globose heads; legumes with four seeds; teeth of the calyx unequal; the leaflets obcordate, serrulate; the stem creeping. This plant is said to be the Shamrock of Ireland, and is worn by the Irish as the badge of their country. The original Shamrock does not appear to have been a clover, but the *Oxalis acetosella*, which has also leaves with three divisions. Leaves of this character have, from a very remote period, been regarded with superstitious reverence.

"The holy trefoil's charm"

was supposed to be very "noisome to witches," and to keep those who wore it from the influence of evil spirits of all kinds.

T. suffocatum, *T. glomeratum*, *T. subterraneum*, *T. fragiferum*, are all British species.

TRIGLA, a genus of Acanthopterygious Fishes, popularly known as Gurnards, and belonging to the family *Loricati* in the arrangement of Cuvier.

The head of *Trigla* is mailed and angular; the opercle and shoulder-bones armed with spines; the body is scaly; there are two distinct dorsal fins; beneath the pectorals are three detached rays; the branchiostegous membrane has seven rays; both jaws and the front of the vomer are armed with fine velvety teeth. The Gurnards are fishes always remarkable for singularity of form, and often for brilliancy of colouring. They derive their popular appellation from a grunting noise which they make when taken out of the water. In the British seas the commonest species are the Gray Gurnard (*Trigla Gurnhardus*), a silvery gray fish more or less clouded with brown and speckled with black; the Red Gurnard (*Trigla Pini*), of a bright rose-red colour; and the Sapphirine Gurnard (*Trigla Hirundo*), a large and handsome fish remarkable for the vivid green and blue hues of the inner surface of its large pectoral fins. The two last are most abundant in the western coasts. Several other rarer species are also inhabitants of the British seas. There are some beautiful small species in the Mediterranean, where also lives the Flying-Gurnard (*Dactylopterus volitans*), which differs generically from *Trigla* in having the fin-rays of the pectorals connected by membranes, by means of which the fish is enabled to support itself for some time in the air in the manner of the flying-fish. It is a handsome species, above a foot long. Another Flying-Gurnard (*Dactylopterus Orientalis*) lives in the Indian Ocean.

TRIGLO'CHIN (τριγλώχιν, three-pointed), a genus of Plants belonging to the natural order *Juncaginaceæ*. It has a perianth with six concave deciduous leaves, three outside and three inside; the anthers are sessile, lodged in the leaves of the perianth, and have their backs turned towards the ovary; the capsules are from three to six in number, are 1-seeded, and united by a longitudinal receptacle, from which they separate at the base. The genus has several species: they are inhabitants of marshes, sides of rivers, ditches, and wet meadows. Two only of the species inhabit Europe, and these are found in Great Britain.

T. palustre, the Marsh Arrow-Grass, has a 3-celled fruit, of a linear form, attenuated towards the base. It grows in damp marshy places, and is very abundant in many parts of this country.

T. maritimum, Sea-side Arrow-Grass, has a 6-celled ovate fruit.

TRIGLOCHIS. [SQUALIDÆ.]

TRIGONELLA (from τρεῖς, three, and γωνία, an angle), a genus of Plants belonging to the natural order *Leguminosæ*. It consists of strong-scented herbs with trifoliate leaves; the calyx is 5-parted and 5-toothed; the keel of the corolla is obtuse; the stamens are diadelphous; the style is smooth; the fruit a legume, unilocular, compressed, linear, and containing six or more seeds. The known species of this genus are upwards of thirty. Only five of them are European, and only one is found in Great Britain.

T. Fœnum-Græcum, the Common Fenugreek, has the stem erect, simple: the leaflets obovate, slightly toothed; the stipules lanceolate, falcate, entire; the calyx hairy; the teeth awl-shaped, of the length of the tube; the legume is falcate, many-seeded; the seeds large, ovate, wrinkled from dots; radicle of cotyledons prominent. This plant is a native of the south of Europe. Dr. Sibthorp found it in abundance on the shores of Asia Minor. This plant, or one of the genus, was known to the Greeks under the name Ἥδυσάρον, and to the Romans as Fœnum Græcum, Greek Hay, and the seed was held in great esteem as a medicine. The scent of the seeds is very strong, and it was undoubtedly this circumstance that recommended them to notice as medicinal agents.

T. ornithopodioides, the Bird's-Foot Trefoil, has a decumbent stem; the leaflets toothed at the extremity, the flowers three together; the legumes naked, twice as long as the calyx, with about eight seeds in each. This is the *Trifolium ornithopodioides* of Linnæus.

T. elatior, Tall Fenugreek, has an erect stem; stipules lanceolate, toothed; legumes racemose, pendulous, linear, slightly curved, obtuse, longer than the leaves. Dr. Sibthorp found this plant in Asia Minor and the Isle of Cyprus, and Sir J. E. Smith is of opinion that it is the Λῶτος Ἄγριος of Dioscorides.

T. esculenta, Esculent Trigonella, has pedunculated racemes, with the peduncle longer than the leaf; the legumes are linear, somewhat curved, crowded together, and pedicillate. This plant is a native of some parts of the East Indies, where its legumes are eaten by the natives as food.

TRIGONELLI'TES, an obscure genus of Fossil *Mollusca*, to which many names have been applied, as *Aptychus*, *Ichthyosagosites*, &c. It contains several forms which undoubtedly appertain to *Cephalopoda*, and offer analogies to a part of the *Sepiostcum*, and a part of the *Belemnite*.

TRIGO'NIA. [TRIGONIDÆ.]

TRIGO'NIDÆ, a family of Conchiferous *Mollusca*, the type of which is the genus *Trigonia*, Brug.

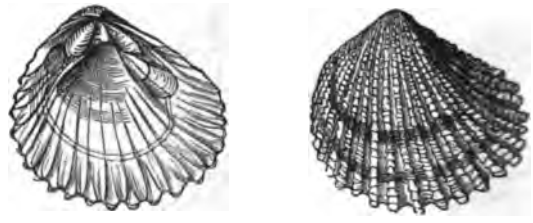
Trigonia has the following characters:—Animal having the mantle open along its length; no posterior tubes; foot powerful and trenchant.

Shell thick, nacreous, subtrigonal, equivalve, inequilateral, the umbones rather small and but little recurved; hinge complex, dissimilar, the right valve having two great oblong teeth, diverging from the umbo, strongly furrowed, penetrating into two excavations, of the same form and equally furrowed, in the left; ligament external; muscular impressions not united by a pallial impression. (Rang.)

T. margaritacea. Shell suborbiculate, nacreous within, ribbed externally with elevated verrucose somewhat sharp ribs, disposed in rays; margin plicated.

This species, which has only been found in the seas of Australia, appears to be of moderate size. Lamarck compares its external appearance to that of a pecten without ears. It has been found at depths ranging from 6 to 14 fathoms, on sandy mud.

The fossil species are numerous, especially in the Chalk.



Trigonia margaritacea.

TRIGONIDÆ. [RAIIDÆ.]

TRIGONOCARPUM. [COAL-PLANTS.]

TRIGONOCEPHALUS. [CROTALIDÆ.]

TRILLIACEÆ, *Parids*, a small natural order of Plants belonging to the class Dictyogens. They are distinguished by their bisexual tripetaloideous flowers, half-consolidated carpels, and axile placentæ. Lindley gives the relations of this order with *Smilaceæ*, *Roxburghiaceæ*, *Commelynaceæ*, and *Melanthaceæ*. It contains 4 genera—*Paris*, *Demidovia*, *Trillium*, and *Medeola*. [PARIS; TRILLIUM.] The species are found in thickets in the temperate parts of Europe, Asia, and North America. (Lindley, *Vegetable Kingdom*.)

TRILLIUM, a genus of Plants, the type of the natural order *Trilliaceæ*. It has 3 herbaceous sepals, 3 coloured petals, and 3 sessile stigmas. The berry is superior and 3-celled; the cells many-seeded.

T. erectum has a large præmorse rhizoma with thick horizontal fibres. The stem is about a foot in height, and sheathed at the base; the leaves large, acuminate, and sessile; the peduncle about half as long as the leaves, inclining to one side. The flower is large, and of a dark purple.

TRILOBITES, a race of extinct Fossil Animals. The forms of this animal were at first known by the name of the Dudley Fossil and the Dudley Fossil Insect. By some it was regarded as an insect, and called *Entomolithus paradoxus*; by others the form was considered as that of an extraordinary Testacean with a shell of three lobes; whilst others thought that the Trilobitic remains belonged to animals closely

approximated to the Chitons, or at least not differing greatly from them.

It is now agreed on all hands that Trilobites are Crustaceans.

The names imposed on some of the genera indicate the difficulties originally felt in understanding their structure.

Thus we have *Asaphus* (ἀσαφής, 'obscure'); *Calymene* (κεκαλυμμένη, 'concealed'); *Paradoxus* (παράδοξος, 'wonderful'); *Cryptonymus* (κρύπτω, 'to conceal'; ὄνομα, 'a name'); and *Agnostus* (ἄγνωστος, 'unknown').

Dr. Buckland ('Bridgewater Treatise') expresses an opinion that the nearest approach among living animals to the external form of Trilobites is that afforded by the genus *Serolis*. [ISOPODA.] He thinks that the most striking difference between this animal and the Trilobites consists in there being a fully developed series of crustaceous legs and antennæ in the *Serolis*, whilst no trace of either of these organs has yet been discovered in connection with any Trilobite. Brongniart, he observes, explains the absence of these organs, by conceiving that the Trilobites hold precisely that place in the Gymnobranchiate Crustaceans, in which the antennæ become very small, or altogether fail; and that the legs, being transformed to soft and perishable feet bearing branchiæ, were incapable of preservation.

A second approximation to the character of Trilobites occurs, according to Dr. Buckland, in the *Limulus*, or King-Crab (*Xiphosurus*), and he sees a third example of this disposition in *Branchipus stagnalis*. [BRANCHIOPODA; CHIROCEPHALUS.]

Mr. W. S. MacLeay, in his highly-interesting paper entitled 'Observations on Trilobites, founded on a comparison of their structure with that of Crustacea,' published in Sir Roderick Murchison's work on 'The Silurian System' (1839), points out the relations of these creatures with the *Crustacea*.

M. Milne-Edwards, in his 'Histoire Naturelle des Crustacés' (1840), expresses his belief that the Trilobites ought to be arranged between the *Isopoda* and the *Branchiopoda*. In all probability they belonged, he thinks, to the great division *Branchiopoda*.

Burmeister, one of the latest writers on the subject of Trilobites, concludes that their structural relations are with the *Phyllopoda*, amongst the Entomostracous *Crustacea*. He thus concludes his work on the organisation of Trilobites [ENTOMOSTRACA]:—

"The *Phyllopoda* live in stagnant fresh-water, especially in ditches, pools, or puddles, which are very rapidly produced after rain in the early part of the year, and last only till the middle of the summer, when they become dried up. During this period the animals of the tribe we are describing are usually seen in numerous companies, swimming about in the water at various depths, the species of *Branchipus* being most frequently close beneath the surface of the water. In swimming they turn their back downwards, their abdomen being upwards, so that the feet touch the surface of the water. The position of the eyes in *Branchipus* enables the animal to look both upwards and downwards. *Apus*, on the other hand, which has immoveable eyes, can only look downwards while swimming on its back, and it must turn itself if it wishes to look upwards. But this is quite natural, since in each case the animal, when in its usual position, and close beneath the surface of the water, can only have its enemies below, and therefore only needs to be secured against surprise in that direction. These creatures are however not much exposed to attack. Their prey, which consists of other little animals living in the water, they obtain during their constant swimming motion, and it is brought to the mouth by the motion of the water. Owing to this, the region and cavity of the mouth in many of these animals, when preserved in spirits of wine, are frequently entirely covered or filled up with extraneous substances.

"The *Phyllopoda* are never at rest, partially because they are entirely deficient in organs by which they could keep firm hold of anything, partially also because their motion of swimming produces at the same time the motion of the respiratory organs, which being independent of the will of the animal does not cease. I have not yet had an opportunity of observing *Limnadia* and *Estheria* in a living state, but both genera undoubtedly exist in the same manner. I am not however aware whether they swim on their back. Considering the affinities of the Trilobites with the *Phyllopoda*, I cannot doubt for a moment that their habits during life and their mode of existence were similar, and I therefore conclude:

"1. That these animals moved only by swimming, that they remained close beneath the surface of the water, and that they certainly did not creep about at the bottom as M. Klöden supposed.

"2. That they swam in an inverted position, the belly upwards, the back downwards, and that they made use of their power of rolling themselves into a ball as a defence against attacks from above.

"3. That they lived on smaller water animals, and in the absence of such on the spawn of allied species.

"4. That they most probably did not inhabit the open sea, but the vicinities of coasts, in shallow water, and that they lived gregariously in vast numbers, chiefly of one species.

"5 That the number of species could never have been very great. This is indeed proved by the mode of their appearance in the fossil state, inasmuch as scarcely more than six or eight species have been found together anywhere in one stratum.

"6. Although the number of species has not been large, the number of individuals was very great indeed, a fact likewise observed in the living *Phyllopoda*, of which we as yet scarcely know a dozen species, although these are grouped into about six different genera.

"7. The great differences existing in the dimensions of the present *Phyllopoda* according to their age, justify us in expecting such differences also among the Trilobites, and very large individuals of the latter therefore do not indicate a separate species, unless other differences are presented."

Dr. Buckland in his observations on the 'Eyes of Trilobites,' a point, as he says, deserving peculiar consideration, as it affords the most ancient and almost the only example yet found in the fossil world of the preservation of parts so delicate as the visual organs of animals that ceased to live many thousands and perhaps millions of years ago, remarks, that we must regard those organs with feelings of no ordinary kind, when we recollect that we have before us the identical instruments of vision through which the light of heaven was admitted to the sensorium of some of the first-created inhabitants of our planet. After referring to the labours of Professor Müller and Mr. Strauss, who have ably and amply illustrated the arrangements by which the eyes of insects and Crustaceans are adapted to produce distinct vision through the medium of a number of minute facets or lenses placed at the extremity of an equal number of conical tubes or microscopes, amounting sometimes, as in the Butterfly, to 35,000 facets in the two eyes, and to 14,000 in the Dragon-Fly; Dr. Buckland remarks that in eyes constructed on this principle, the image will be more distinct in proportion as the cones in a given portion of the eye are more numerous and long; and that as compound eyes see only those objects which present themselves in the axes of the individual cones, the limit of their field of vision is greater or smaller as the exterior of the eye is more or less hemispherical. The same principles of construction as to form, the disposition of facets, and optical adaptation, are obvious in the eyes of Trilobites.

Back of *Asaphus caudatus* (Dudley, Mus. Stokes), with the eyes, *a a*, well preserved. (Buckland.)

a, side view of the left eye of the same, magnified. (Buckland.)
b, magnified view of a portion of the eye of *Calymene macrophthalmus*. (Hœninghaus.)

According to Dr. Buckland each eye of *Asaphus caudatus* contains at least 400 nearly spherical lenses fixed in separate compartments on the surface of the cornea, and he observes that the form of the general cornea is peculiarly adapted to the uses of an animal destined to live at the bottom of the water: "to look downwards was as much impossible as it was unnecessary to a creature living at the bottom; but for horizontal vision in every direction the contrivance is complete. The form of each eye is nearly that of the frustrum of a cone, incomplete on that side only which is directly opposite to the corresponding side of the other eye, and in which, if facets were present, their chief range would be towards each other across the head, where no vision was required. The exterior of each eye, like a circular bastion, ranges nearly round three-fourths of a circle, each commanding so much of the horizon, that where the distinct vision of one eye ceases that of the other begins; so that in the horizontal direction the combined range of both eyes was panoramic."

M. Milne-Edwards, addressing himself to the subject of antennæ, observes that, as in *Apus*, one perceives no trace of those organs when the Trilobites are seen from above or viewed on their dorsal aspect, and that if any vestiges of those appendages exist, they will probably

be found on the lower surface of the head on each side of the mouth, as in the *Phyllopoda;* but he is compelled to admit that no specimen has yet been discovered which showed the slightest trace of them, remarking that there would be nothing astonishing if the antennæ, become already rudimentary and reduced to two in *Apus*, should in the Trilobite be entirely wanting.

The same author calls attention to the sutural lineation, termed by him the jugal line, which exists on each side of the upper surface of the head, and is more or less flexuous, springing from the posterior border, passing along the eyes, and reaching the frontal edge.

The lower surface of the head is occupied in front by a flat surface, sufficiently resembling, in the opinion of M. Milne-Edwards, that which exists in *Apus* and *Limulus*, but which is divided by prolongations of the jugal sutures, into two or three pieces, according as these lines unite on the median line of the front before they are recurved downwards and backwards, or at least remain separated for a more or less considerable space. Behind this region traces of the buccal apparatus have been detected, though but little appears to be known relative to its conformation. Dekay, C. Stokes, and Sars, have found a plate or lamina bifurcated posteriorly, which, in the opinion of M. Milne-Edwards would seem to constitute a labrum, or epistomian piece analogous to that which gives insertion to the labrum in certain *Isopoda*.

Under surface of the anterior portion of the shield of *Asaphus platycephalus*, from Lake Huron. (Stokes.—See 'Geol. Trans.,' N.S., vol. i., pl. 27.)

Dr. Buckland, in his 'Bridgewater Treatise, speaks of the great extent to which Trilobites are distributed over the face of the globe, and their numerical abundance in the places where they have been discovered, as remarkable features in their history. He notices their occurrence at the most distant points both of the northern and southern hemisphere. "They have been found," says Dr. Buckland in continuation, "all over Northern Europe, and in numerous localities in North America; in the southern hemisphere they occur in the Andes and at the Cape of Good Hope. No Trilobites have yet been found in any strata more recent than the carboniferous series; and no other Crustaceans, except three forms which are also Entomostracous [CRUSTACEA], have been noticed in strata coeval with any of those that contain the remains of Trilobites: so that during the long periods that intervened between the deposition of the earliest fossiliferous strata and the termination of the coal-formation, the Trilobites appear to have been the chief representatives of a class which was largely multiplied into other orders and families after these earliest forms of Marine Crustaceans became extinct."

The following is an outline of the arrangement of the species given in Burmeister's 'Organisation of Trilobites,' translated for the Ray Society, and edited by Professor Bell and the late Professor Edward Forbes:—

The *Palæadæ* are Crustaceous *Articulata*, belonging to the second order of the class *Crustacea* (divided into *Astracodermata*, *Aspidostraca*, and *Entomostraca*), characterised by the possession of two large compound eyes, by the absence of simple secondary eyes, and by having short undeveloped feelers, and soft leaf-formed feet, bearing gills. By these characters they are immediately related to the *Phyllopoda*, and might perhaps even be united with the latter in one tribe. Their principal difference would then consist in the absence of the constant numerical proportion of eleven rings of the thorax, common to all the *Phyllopoda*, which must be expressed by the formula of $4 \times 3 - 1$. Instead of this the *Palæadæ* exhibit fluctuating numerical proportions in the parts of the thorax, respecting the reduction of which to a constant formula nothing certain can be said, because we neither know the number of the accessory parts of the mouth, nor the position of the sexual openings. These animals underwent a progressive metamorphosis; they moved by swimming probably with their backs downwards, and they inhabited the ocean, living chiefly in shallow water. The whole group is divided into three families, which are characterised according to the nature of the shelly covering.

Family 1. *Eurypteridæ.*

In these there is no shell. The head, whose position is very distinct, bears two pairs of setaceous feelers, and one pair of accessory parts of the mouth. There are probably nine (?) rings in the thorax, the first of which bears a pair of very large rudder-shaped feet, furnished with five joints; and the succeeding rings seem to have borne similar leaf-like feet of an equal size. The abdomen consisted of three or six rings, and was terminated by a pair of rudder fins. There is only one genus belonging to this family, *Eurypterus*.

Family 2. *Cytherinidæ.*

These animals were contained in bivalve bean-shaped shells, which are the only parts preserved. They are more or less pointed towards the external wider margin; at the straight or dorsal margin they are rather thickened. They vary in size from $\frac{1}{4}$" to $\frac{3}{4}$", or even, though rarely, 1". The only genus is *Cytherina*.

Family 3. *Trilobitæ.*

The body covered by an affixed shell, which consists of as many rings as there are joints of the thorax (?). The head and the abdomen each similarly included in a large united shield, which, like the rings of the shell of the body, possesses a broad border that freely projects at the sides. The large eyes are situated in the lateral portions of the cephalic shield, remote from the true head. A peculiar suture passes through the cephalic shield, and divides it into two, three, or four special parts. The numerous members of this family which have been already described admit of a further division into natural genera, the most suitable classification of which may perhaps be the following:—

I. Trilobites incapable of rolling themselves up.

Group 1.—The lateral lobes of the rings of the body are situated in the same plane, and do not curve or bend downwards, but terminate towards the posterior part in a more or less prominent point, sometimes very long, which forms a somewhat obtuse angle in its principal direction with the direction of the lobe.

A. Trilobites with a simple large caudal shield (not much smaller than the cephalic shield), the axis of which is many-jointed, and equals, or even exceeds, the length of the body. *Ogygiidæ.* To this group belong two genera:—

1. *Trinucleus*, with six rings.
2. *Ogygia*, with eight rings.

Trinucleus Lloydii.

B. Trilobites having a simple though tolerably large caudal shield, the axis of which consists of but a few joints, and is always shorter than the body. The genera belonging to this division may be divided, according to the number of body-rings, into 8-jointed and 10-jointed.

3. *Odontopleura.*
4. *Argea.*
5. *Bronteus.*

C. Trilobites having a simple but very small caudal shield, the axis of which is many-jointed, but which is always shorter than the body.

6. *Paradoxides.*
7. *Olenus.*

Paradoxides Tessini.

Group 2.—The lateral lobes of the body-rings not horizontally extended in their whole length, but turned downwards from the centre, and not terminating in a point, but with an arched and rounded extremity. Furrowed on the surface along their whole length.

8. *Conocephalus.*
9. *Ellipsocephalus.*
10. *Harpes.*

II. Trilobites having the power of rolling themselves into a ball.

Section 1. Trilobites having the power of rolling themselves up into a ball with the axis of the body constructed posteriorly, the shell granulated, and generally more than ten body-rings.

A. Trilobites capable of rolling themselves up, and whose facial suture terminates exactly in the angles of the cephalic shield.

11. *Calymene.*
12. *Homalonotus.*

Calymene Bowningii, partially rolled up.

B. Trilobites having the power of rolling themselves up, whose facial suture terminates in the external lateral margin of the cephalic shield.

13. *Phacops.*

C. Trilobites capable of rolling themselves up, having the axis of the body diminishing posteriorly, and their facial suture extending to the posterior margin of the cephalic shield.

14. *Cyphaspis.*
15. *Proetus.*
16. *Archegonus.*

Section 2. Trilobites possessing the capacity of rolling themselves up; the body axis not shortened posteriorly; the shell finely lineated; the caudal shield not having radiated lateral furrows.

A. The body-axis consisting of ten equal rings.

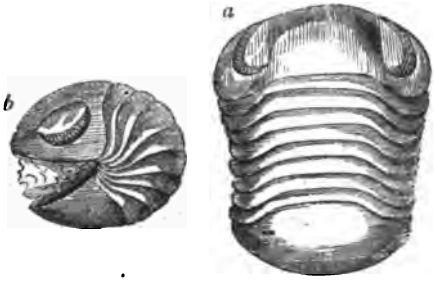
17. *Illænus.*

B. The body-axis consisting of nine rings.

18. *Dysplanus.*

C. The axis of the body consisting of eight equal rings.

19. *Asaphus.*



Asaphus (*Nileus*) *Armadillo.*

a, seen from above; *b*, profile, the animal rolled up.

D. Six-jointed Trilobites capable of rolling themselves up, and having the axis of the body equally broad throughout.

20. *Ampyx.*

In an appendix, Burmeister describes *Agnostus*, which is an anomalous form. The species are small, with nearly circular bucklers of two kinds, which M. Brongniart considers to have covered the whole of the body to which each of these discs belonged, and which Dalman regards as being only portions of the body, and as having belonged, some to the head, others to the abdomen, of a Trilobite whose thorax must have been reduced to a rudimentary state, or at least must have remained membranous. These two sorts of bucklers or shields have nearly the same form and size, but differ in the disposition of the eminences perceptible on their surface, and are divided into three lobes. The only species known is the *Agnostus* of Brongniart, *Battus* of Dalman.

Agnostus pisiformis. (After Dalman.)

The following is a list of the British genera of Trilobites, with their number of species:—*Acidaspis*, 1 species; *Amphion*, 4; *Ampyx*, 4; *Agnostus*, 2; *Arges*, 1; *Asaphus*, 20; *Bronteus*, 2; *Bumastes*, 1; *Calymene*, 11; *Cerawrus*, 1; *Eurypterus*, 1; *Griffithides*, 4; *Harpes*, 3; *Homalonotus*, 4; *Illænus*, 4; *Isoteles*, 10; *Nuttainia*, 2; *Ogygia*, 2; *Otenus*, 1; *Paradoxides*, 3; *Phacops*, 5; *Phillipsia*, 7; *Remopleurides*, 5; *Trinucleus*, 10.

In Mr. McCoy's 'Synopsis of the Carboniferous Fossils of Ireland,' the following new species are described and figured:—*Griffithides calcaratus*; *Phillipsia cælata*; *P. Colii*; *P. discors*; *P. mucronata*; *P. quadriserialis.*

In Mr. McCoy's 'Synopsis of the Silurian Fossils of Ireland,' collected by Mr. Griffith, the following new genera are described and figured:—*Forbesia*; *Portlockia*; *Tiresias*; *Trinodus.*

TRI'MERA, the fourth section of the order *Coleoptera* among Insects, according to the arrangement of Latreille. The insects popularly known as Lady-Birds and Puff-Ball-Beetles are characteristic of the families composing it.

The insects of this division have four palpi, two of which are labial and two maxillary. These palpi are short and slender, or with an enlarged terminal joint. The antennæ are also short and thickened at their extremities, in some species gradually, in others suddenly. The body is oval or hemispheric; the head is not produced anteriorly, and is deeply inserted in the thorax, which is short and transverse, or somewhat square and flattened. The abdomen, generally flat beneath and ample, is covered by the elytra, which are arched, very convex, and never truncated at the tip. The legs are short, with tarsi apparently composed of three joints, but in reality of four, the second being bilobed, and concealing between its lobes a minute third joint, the seeming absence of which has given origin to the name of the section. Westwood, with more propriety, has styled the division *Pseudo-Trimera.*

Latreille divided the *Trimera* into three families, which he styles *Fungicolæ*, *Aphidiphagæ*, and *Pselaphii.* The last has however been united by English entomologists with the *Staphylinidæ*, to which insects their truncated elytra, too short to cover the abdomen, and general aspect, give them a great resemblance. Westwood includes among his *Pseudo-Trimera*, the *Clavipalpi*, the seventh and last family of *Tetramera* in Latreille's arrangement. He styles the family *Erotylidæ*, from the typical genus *Erotylus.* They are chiefly exotic insects, supposed to feed on vegetable matter; and were regarded by Latreille as connecting the *Cyclica* (*Cassida Chrysomela*) with his trimerous family *Fungicolæ.*

The *Fungicolæ* of Latreille (*Endomychidæ* of British authors) are so styled from their habitat in the interior of cryptogamic plants of the class *Fungi*, on which they feed. Some species are found under the damp bark of trees, where however their food consists of the *Fungi* which are peculiar to such a locality. The perfect insect is very convex, oval, and glabrous, and many of the species are ornamented with brilliant colours. The antennæ are composed of eleven joints thickened towards the extremity, and larger than the head and thorax. Their elytra cover the abdomen, and the penultimate joint of the tarsus is deeply bilobed. The only known larva of an insect of this family is that of *Endomychus coccineus*, said by Samouelle to resemble the common glowworm. Curtis figures it. Westwood remarks that it has more analogy to the larva of the *Silphidæ* than to that of the glowworm or of *Coccinella.* The British species of this family belong to the genera *Endomychus* and *Lycoperdina.* They are but few in number. One of them, the *Lycoperdina Bovistæ* is found in great numbers inhabiting that common puff-ball the *Lycoperdon Bovista.* *Eumorphus* is an American genus, described by Weber, distinguished by the dilated flattened three-jointed clubs of the antennæ. It includes several eccentric forms, in which the elytra have broad dilated margins with the anterior tibiæ notched. Mr. Curtis considers them as related to those singular insects which constitute the genus *Mormolyce*, but Westwood regards the relation as one of the most remote analogy.

The *Aphidiphagæ* (*Coccinellidæ* of English authors) are animal-feeders preying upon Plant-Lice (*Aphides*), and correspond to the Linnæan genus *Coccinella.* In shape they are very convex and hemispheric, and have antennæ shorter than those of the last family, terminated by a compressed club in the form of a reversed triangle. The larva is depressed, ovate, and fleshy. The three anterior segments of its body are largest, and the abdominal ones tuberculed and spotted. Its head is small, with very minute antennæ and thick maxillary palpi. The pupa is found attached by its posterior extremity to a leaf, and undergoes its metamorphosis in that position. The larva emits from its tubercles a yellowish fluid having a disagreeable scent. When the perfect insect is laid hold of, it gives out a similar secretion from its joints, and folds its legs up as if simulating death.

The insects of this family are remarkable for brilliant colouring, being generally red or yellow, with black, red, white, or yellow spots. Individuals of the several species are so extremely variable and different from each other in their markings, as to render the construction of specific diagnoses in this family more difficult than in any other tribe of *Coleoptera.* Some have supposed that many of these varieties are hybrids between the sexes of different species, but M. Audouin maintains that the eggs produced from the union of allied species in the genus *Coccinella* are sterile. They creep slowly, but fly well, and many kinds are gregarious. The eggs are deposited in yellow patches among the plant-lice, so that the larva is hatched in the midst of its food. They abound in our fields and gardens, and are among the first beetles which come out in spring. They appear sometimes in immense swarms, and spreading over the fields cause needless alarm to the farmer, to whom, far from being a pest, they are a blessing, from the fierce war they wage against his enemies the *Aphides.*

The peasants in France style them 'Bêtes-à-Dieu,' honouring their useful qualities; whilst the English name of Lady-Bird does homage to their beauty. Some of the species are widely distributed, such as the very common *Coccinella septum-punctata*, which extends its range over all Europe and parts of Asia and Africa. In England we have six genera of *Coccinellidæ*, and more than fifty species.

TRIMESURUS. [CROTALIDÆ.]

TRINGA. [CHARADRIADÆ; SCOLOPACIDÆ.]

TRI'NIA, a genus of Plants belonging to the natural order *Umbelliferæ*, named after Dr. C. B. Trinius of St. Petersburg. The species of this genus, which are not numerous, have been referred to *Pimpinella* and *Seseli*, but the dicœcious flowers and the difference between the structure of the petals in the barren and fertile flowers render it very distinct. One of this species, the *T. glaberrima*, Smooth Honewort, is an inhabitant of Great Britain, but must be looked upon as a rarity. It has been found on limestone in Somersetshire, Cornwall, and Devonshire. The whole plant is of a pale glaucous green colour, has remarkable segments of the leaves, which are tripinnate; no involucre. It appears to be the same plant as the *T. vulgaris* of De Candolle, which is found in the southern parts of Germany, in Switzerland, and Austria.

TRINU'CLEUS. [TRILOBITES.]

TRIO'DIA, a genus of Grasses belonging to the tribe *Avenineæ*. The glumes are from 2- to 3-flowered; the outer palea rather coriaceous, smooth, rounded on the back, bifid, with an intermediate broad point sometimes becoming the base of a kneed awn. *T. decumbens* is found in mountain pastures in Great Britain.

TRIONYX. [CHELONIA.]

TRIOPTERYS. [*See* SUPPLEMENT.]

TRIOPTOLEMEA. [TRIPTOLOMEA.]

TRIOSTEUM (from τρεῖς, three, and ὀστέον, a bone, in reference to the three bony ends in each berry), a genus of Plants belonging to the natural order *Caprifoliaceæ*. It has a calyx, with an ovate tube and a 5-parted permanent limb, with linear lanceolate permanent lobes. The corolla is tubular, almost equally 5-lobed, gibbous at the base, and longer than the calyx. The stamens are 5, and inclosed; the stigma oblong and thick; the berry coriaceous, obovately triquetrous, crowned by the calyx, 3-celled, and 3-seeded. The species are permanent herbs, rarely suffruticose.

T. perfoliatum, Fever-Wort, has an erect hairy fistular round stem from one to four feet high. The leaves opposite, the pairs crossing each other, ovate, lanceolate, acuminate, entire, rather flat, abruptly narrowed into the petiole; the flowers sessile, apparently verticillate. It is a native of North America, in the United States, on rich rocky grounds, particularly in limestone soil.

The species of *Triosteum* will grow in almost any kind of soil, although they prefer a vegetable or peat mould, and they are easily propagated by dividing at the root or by seeds, which generally ripen in abundance.

TRIPHANE. [SPODUMENE.]

TRIPHA'SIA, a genus of Plants belonging to the natural order *Aurantiaceæ*, of which the species are found in the East Indies, Cochin-China, and China. The calyx is 3-cleft; petals 3; stamens 6, rarely 5-8; filaments awl-shaped, flat; anthers cordate, oblong; fruit baccate, 1-3-celled; seeds 1 in each cell. The species form thorny shrubs with simple or trifoliate leaves. The fruit of *T. trifoliata* is acid in taste, something like the orange, and is both preserved and eaten as a fruit.

TRIPHYLINE. [IRON.]

TRIPOLI, a Mineral, occurring massive, with a coarse dull earthy fracture. It is meagre and rough to the touch, and yields readily to the nail. Colour, various shades of gray, yellow, and red. It imbibes water, which softens it; when burned it becomes white and is hardened; it is very difficult of fusion. It was first brought from Tripoli in Africa, but has since been found in France, Italy, and Germany. It is employed in polishing metals, marble, glass, &c. It consists of silica, alumina, and oxide of iron.

TRIPOXYLON. [CRABRONIDÆ.]

TRIPSU'RUS. [PICIDÆ.]

TRIPTOLOMEA, a genus of Plants belonging to the natural order *Fabaceæ*, or *Leguminosæ*, and to the sub-order *Papilionaceæ*. The species are natives of warm climates, and yield the Rose-Wood of commerce.

TRISE'TUM, a genus of Plants belonging to the natural order *Graminaceæ*. The inflorescence is panicled; the spikelets 2-7-flowered; glumes with a keel, membranous; lower palea with 2 bristles, and a tender flexuose beard above the middle of its back; scale lanceolate.

T. flavescens, Golden Oat, or Yellow Oat-Grass, has the panicle much branched, spreading, erect; spikelets 3-flowered, all the florets awned. It is common in Great Britain, especially in rich pastures. Sheep are very fond of it.

TRISTI'CHIUS, a genus of Fossil Fishes from the Coal-Measures near Glasgow and Fermanagh. (Agassiz.)

TRI'TICUM, a genus of Plants yielding the various kinds of Wheat, and belonging to the natural order *Graminaceæ*. It derives its name, according to Varro, from 'tritum,' ground or rubbed, because the fruit in its preparation as a food for man undergoes the process of grinding or trituration. The various kinds of wheat have been known from a very early period, and mention is made of wheat as a food in the earliest records of the history of man. Both the Egyptians and Jews made use of wheat as an article of diet, and this food is early mentioned in the Bible. It was also used by the Greeks and Romans, and Theophrastus and Pliny make frequent mention of it. On account of the early cultivation of many of the kinds of wheat as articles of diet, it is impossible to tell where the most common species are really indigenous. All the species of *Triticum* are however found most abundantly in temperate climates, and there take the place of the foods used in the hotter parts of the world. Wheat is in northern climates what rice and maize are in warmer ones. The part of the plant of *Triticum* which yields so large a proportion of the food of man is the fruit, seeds, or grain. This fruit, although small in itself, generally forms a large proportion of the plant. When the fruit is ground, the testa, or seed-coat, is separated from what is called the flour. This flour consists of the powdered albumen and embryo of the seed. The proximate vegetable principles which this flour contains are starch and gluten. The starch is a highly carbonised vegetable principle, whilst the gluten is characterised by possessing nitrogen. Foods that contain carbonaceous matters are fattening, whilst those that contain nitrogen are strengthening. It is thus that wheat-flour has become to be the staple article of diet of the finest races of men in the world. The other cereal grasses contain the same principles, but the gluten or azotised principle is not in so large a quantity as in wheat, as the following analysis of 100 parts of the organic matter of wheat, rice, and barley will show:—

	Starch.	Gluten.
Wheat	70·00	23·00
Rice	85·07	3·60
Barley	79·00	16·00

The starch is often separated from the gluten and used for various purposes in domestic economy. [STARCH.] Gluten is identical with Fibrine, and is a form of Protein. [PROTEIN.]

The straw of wheat, and the chaff, or the culm, and the flowers, also contain 79 per cent. of organic matter. This consists principally of unazotised vegetable matter, and may therefore be used as an article of diet for cattle. The culms of wheat are also used for the purpose of making plait from which straw hats and bonnets are made, a manufacture of considerable importance in some parts of this country.

The genus *Triticum* is known by possessing solitary spikelets, with the glumes 2-valved and many-flowered; the valves carinate, acute, or mucronate; the paleæ 2-valved; the valves lanceolate, the external one acuminate, the internal one bifid at the extremity. The genus consists of about 40 species; of these 16 are European, and only 5 are natives of Britain. The species are divided into two groups—the *Cerealia*, yielding edible fruits; and the *Agropyra*, which are merely grasses. The latter group is by some writers, as Beauvois and Lindley, made into a distinct genus. It includes all the species that are natives of Great Britain.

The *Cerealia* are known by their spikelets being more or less ventricose and turgid, and the valves are ovate or oblong. These are again divided into the *Frumenta*, or True Wheats, in which the seeds fall out from the chaff; and the *Speltæ*, or Spelts, in which the seeds remain attached to the chaff. The most important species belonging to the former division are the following:—

T. vulgare, Common Wheat, has a 4-cornered imbricated spike with 4-flowered spikelets, the valves ventricose, ovate, truncate, mucronate, compressed under the apex, the nerve somewhat prominent. This species includes the *T. æstivum* and *T. hybernum* of many botanists. They appear however to be only varieties of this species, differing in their periods of growth. The native country of this species is not well ascertained: it has been found wild in some districts of Persia, also of Siberia, apparently removed from the influence of cultivation. The *T. hybernum* is the Lammas, or Winter-Wheat, and embraces by far the greater number of varieties which are cultivated as the food of man. The wheats known in Great Britain and on the Continent as Fox, Kentish, Talavera, Bohemian or Velvet, Red, White, and Red-Eared Bearded Wheats, are varieties of *T. hybernum*.

T. turgidum, Turgid, Cone, or English Wheat, is known principally by its prominent carinæ. About 10 varieties of this species are known to agriculturists, half of which are summer and half winter wheats. Of these the Clock, Great or Revel Wheat, and the Russian, or Blue English Wheat, are the best.

T. durum, True Beard-Wheat, has the prominent carinæ of the last wheat, with the valves ventricose, oblong, and three times longer than broad. It is a native of Switzerland. It has several varieties, all of which produce summer wheats, and are better known in Italy, Sicily, and Spain than in this country.

T. Polonicum, Polish Wheat, has the spike irregularly 4-cornered or compressed; the spikelets 3-flowered; the valves subventricose, oblongo-lanceolate, herbaceous, with many nerves. It is found native in some parts of Europe, not however in the country which gives it its name. In cultivation it yields summer wheats, which are adapted for warmer climates than Great Britain.

The Spelts include the following species:—*T. spelta*, Spelt-Wheat; *T. dicoccum*, Two-Grained, or Rice-Wheat; and *T. monococcum*, One-Grained Wheat.

The *Agropyra* do not possess ventricose-turgid spikelets, and the

valves are lanceolate or linear-oblong. This division includes the wheat-grasses, some of which are only known as troublesome weeds. The most remarkable instance of this is *T. repens*, Creeping Wheat-Grass, Couch-Grass, or Spear-Grass. The difficulty of getting rid of its creeping underground stem, the smallest portion of which if left in the ground sends up a fresh bud, is the cause of this plant being so great a pest to the farmer. The *T. maritimum*, a native of sea-coasts, seems to be only a variety of this plant.

T. junceum, Sea Rushy Wheat-Grass, *T. caninum*, Bearded Wheat-Grass, and *T. cristatum*, Crested Wheat-Grass, are other species of the *Agropyra*. [WHEAT, in ARTS AND SC. DIV.]

(Metzger, *Die Getreide-arten und Wiesengräser in Botanischer und Ökonomischer Hinsicht*, 1841; Koch, *Flora Germanica; Cyclopædia of Plants;* Sinclair, *Hortus Woburnensis;* Pouchet, *Traité de Botanique;* Babington, *Manual.*)

TRITON. [AMPHIBIA; SIPHONOSTOMATA.]

TRITO'NIA. [NUDIBRANCHIATA.]

TRITONOI'DEA (Swainson), a genus of *Mollusca*.

TRIURIDACEÆ, *Tailworts*, a small natural order of Plants belonging to Lindley's class Dictyogens. They have the dictyogenous structure, unisexual flowers, a free perianth, and numerous 1-seeded carpels. There are only two genera, *Triuris* and *Peltophyllum*. The species of these plants were discovered by Mr. Miers and Mr. Gardner in the woods of Brazil, where they delight in moist shady places. Their relations are with *Smilaceæ*, *Menispermaceæ*, and *Trilliaceæ*. (Lindley, *Vegetable Kingdom.*)

TRI'VIA. [CYPRÆIDÆ.]

TRIXA'GO, a genus of Plants belonging to the natural order *Scrophulariaceæ*. It has a tubular 4-cleft calyx, a tubular 2-lipped corolla, pointed capsules, and many-seeded cells. The seeds are slightly angular and very minutely crenate ribbed. *T. viscosa*, the only British species, has a round high simple stem, a fibrous root, and opposite leaves; the upper leaves are alternate, ovate, lanceolate, sessile, and acutely serrate. The flowers axillary, distant, and yellow; the anthers hairy. It is found in damp places in the west of Scotland and south of Ireland. (Babington, *Manual.*)

TROCHATELLA (Swainson), a sub-genus of *Mollusca* belonging to the family *Helicina*. [HELICIDÆ.]

TROCHELLA (Swainson), a sub-genus of *Calyptræa*, Lam., placed by him under the family *Haliotidæ*. The shell is conical, patelliform; spire central, of two or more whorls; umbilicus closed.

T. auriculata Sow. ('Man.,' f. 236); and *T. pilcus* ('Man.,' ff. 237-8), may be given as examples.

Professor Owen has contributed a most interesting addition to our knowledge of this genus, in his paper read before the Zoological Society of London, on the 8th November, 1842, on the anatomy of *Lithedaphus longirostris*, the synonyms of which he gives as "*Calyptræa Roissyi*, Dufo (?) upper valve, *Calyptræa equestris*, auct. (?) *Mitularia equestris*, Schumacher."

TRO'CHIDÆ, a family of Turbinated Gasteropodous *Mollusca*. The genus *Trochus* of Linnæus was placed by him between *Murex* and *Turbo*, in his last edition of the 'Systema Naturæ,' and comprised 26 species.

The *Trochoidea* of Cuvier form the first family of his Pectinibranchiate Gastropods [PECTINIBRANCHIATA], and are defined by him as distinguishable by their shell, whose aperture is entire, without notch or canal for a mantle-siphon, the animals being destitute of one; and by an operculum or some organ in lieu of it. They are, Cuvier observes, the *Paracephalophora Dioica Asiphonobranchiata* of M. De Blainville.

M. De Blainville makes the *Goniostomata* his first family of the order *Asiphonobranchiata*, and includes within it the great genus *Trochus*, Linn., only. He describes the animal as spiral, having the sides of the body often ornamented with digitated or lobated appendages, and provided with a short foot rounded at its two extremities; the head furnished with two tentacles, more or less elongated, carrying the eyes on a convexity of their external base, which is often sufficiently distinct to render the eye subpedunculate; mouth without any upper tooth, with a lingual spiral riband; anus on the right, in the branchial cavity, which holds one or two unequal comb-like branchiæ; organs of generation terminating in a female individual on the right in the branchial cavity, and in a male individual in a sort of triangular tonguelet sustained by a small ossicle. Shell subplanorbic or trochiform; the spire elevated, sometimes depressed (surbaissée), and more or less carinated on its last whorl, which forms a flat circular base; a moderate, depressed, and often nearly quadrangular aperture, with its external or right lip trenchant, angular, or folded in the middle. Operculum horny, circular, with a submedian summit, rolled regularly into a spiral; the whorls of the spire narrow and numerous.

M. De Blainville observes that all the species of this family are phytiphagous, marine, and live upon the rocks on the shore of the sea. He divides the group into *Solarium* and *Trochus*.

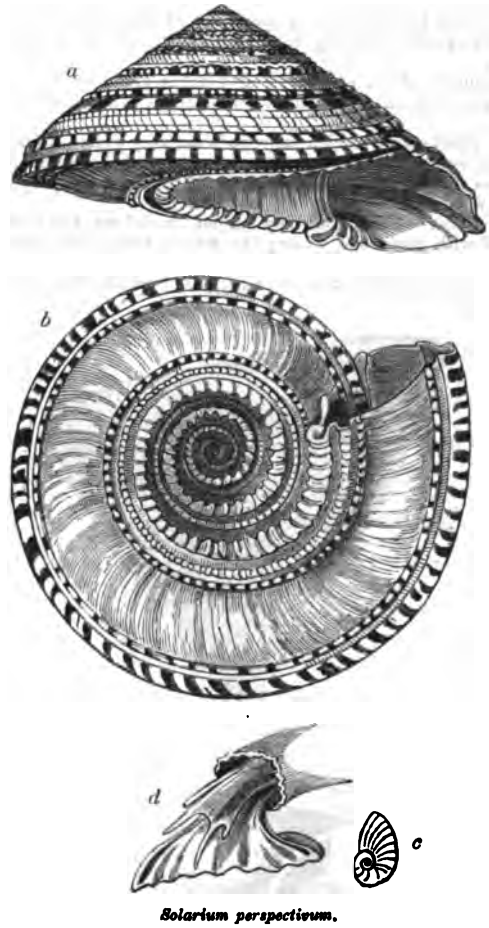
Solarium.—Animal unknown. Shell orbicular, rolled up (enroulée) nearly on the same plane, or planorbic; spire very much lowered (surbaissée); a large conic umbilicus, with its edges denticulated or not at the entrance; aperture not modified by the last whorl of the spire, which is entirely flat; no columella. Operculum unknown (Blainville).

The number of recent species recorded by Woodward is 25, and of fossil 56.

The species of this genus hitherto found have occurred in the seas of the warmer climates. The Mediterranean, the Indian Ocean, the coasts of Tranquebar, the South Seas, and those of Australia are the localities recorded by Lamarck. The specimens have been found near the shore—it seems to be a littoral genus—on rocks and weeds.

S. perspectivum. Shell orbiculate-conoid, longitudinally-striated, whitish-yellow, with articulated belts of white and brown or chestnut near the sutures; the notches of the umbilicus small. (Lamarck.) Animal with a large foot widened in front, and having a very strongly developed marginal furrow, yellowish on the sides, marked with a black stria above. The head presenting a large escutcheon. The tentacles short, stout, and marked with two longitudinal black bands on the sides. At their base are placed the eyes on very short pedicles. The branchial cavity appeared to be partially divided in two, lengthwise, by a sort of fold. The intestine describes two rather considerable circumvolutions before it passes the liver. Operculum large, oval, membranous, and strongly but sparingly spiral at one of its extremities. The colour is yellowish, like that of the whole animal.

Messrs. Quoy and Gaimard, who have given this description of the animal in the 'Zoologie' of the Astrolabe, state that they know nothing of the habits of this species, which was brought to them nearly dead by a Malay of Amboyna.



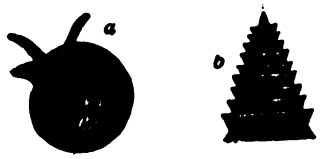
Solarium perspectivum.

a, front view; *b*, seen from below; *c*, operculum; *d*, anterior part of the animal. (Operculum and animal from the 'Atlas' of the Astrolabe.)

S. variegatum.—Shell orbiculate-convex, transversely sulcated, longitudinally striated articulately, variegated with white and bay; umbilicus patulous and crenelated. (Lamarck.) Animal nearly of the same colour as the shell, which it secretes; for it is brown, dotted with black, on all parts. The tentacles are stout, long, obtuse, carrying the eyes at a certain distance from their base on a convexity. The foot is oval, rather large, widened, notched, and auriculated in front.

It carries at its posterior part one of the most singular of opercula, of an unique form among molluscs, and already known in collections by the account of M. de Roissy, but without the knowledge of the species to which it was to be referred. It is a long, solid, calcareo-membranous cone, carrying membranous lamellæ spirally throughout its length. The interspaces are as it were ribanded. (Quoy and Gaimard.) It is found at Carteret Harbour in New Ireland.

Shell of *Solarium variegatum*.



a, the animal and shell of *Solarium variegatum*, together with the operculum, seen from below; *b*, the operculum. (Astrolabe.)

Trochus.—Animal well known, and as characterised above. Shell thick, ordinarily nacreous, trochoid, with the spire sometimes lowered (surbaissée), and at others rather lofty (elancée) and pointed at the summit; trenchant or carinated on its circumference, umbilicated or not; aperture depressed, angular or subangular, with disunited borders, the right lip trenchant; the columella bent, twisted, and often projecting in front.

Operculum horny, delicate, consisting of numerous narrow spiral whorls, increasing slightly from the centre to the circumference. (Blainv.)

The number of recent species of *Trochus* given by Woodward is 150, and fossil forms 360. The fossil forms are found in the Devonian rocks.

These plant-eating marine gastropods are very widely diffused, there being few seas without some of the species: they have been captured at depths varying from the surface to 45 fathoms, creeping on rocks and sea-weeds, sand, sandy mud, and gravel.

T. obeliscus. Shell conico-pyramidal, nodulous and granulous, coloured with green and white; the whorls tuberculato-nodose, and girt with many granose circles; the last whorl, as it were, removed or taken away (dempto); the lower surface planulate; the lip sinuated at the base.

Trochus obeliscus.

a, anterior part of the animal, a portion of the operculum being visible at the lower part of the figure; *b*, operculum.

Animal with stout and short tentacles, which are white with a brown border; the ocular peduncles large, pointed, and doubly circled with black. The muzzle is very wide, with a black riband near its border, as well as the head, which is moreover dotted with greenish. The foot is yellow below, and so dotted with brown on its sides that it appears black. The edge of the mantle is variegated with brown and greenish. The fringes of the feet are white and without filaments. (Quoy and Gaim.)

Lamarck gives the Indian Ocean as the habitat of his species. Messrs. Quoy and Gaimard, who captured the individual above described at Tonga, remark that in colour it is like *T. obeliscus*, but that it tends to *T. acutus* in its suddenly-pointed spire.

The same zoologists observe that the opercula of *Trochi* known in collections are nearly all of a chestnut-colour. This, they remark, is ordinarily due to the action of the air, for on the living animal they are transparent and yellowish. In the very turriculated species the animal draws itself back into the shell obliquely, dragging in with it in this manner its operculum, which otherwise could not lie flat in the aperture, which is always more or less flattened. These animals, they add, show themselves but little, and hide themselves far in, so that none of their parts can be perceived. It is even necessary to break the first whorl of the shell in order to draw them satisfactorily. ('Astrolabe.')

T. imperialis. (Genus *Imperator*, Montf.) Shell orbiculato-conoid; the apex obtuse, violet-brown above, white below, with transverse imbricato-squamous furrows; the whorls turgidly convex, squamose-radiate at the margin; the scales complicated; umbilicus infundibuliform. (Lam.)

Animal.—Foot oval, rather large; the muzzle elongated in form of a proboscis; the tentacles short, white, with a black or reddish line running lengthwise; ocular peduncles very stout, obtuse, the palmettes hardly visible. All these parts are whitish; the head and the mouth are striated across with black and violet: this last colour belongs only to the left side. The foot has some very bright marks on its sides; its lateral fringes are without filaments.

Operculum oval, smooth, whitish, and a little convex (renflé) towards one of its extremities. ('Astrolabe.')

Messrs. Quoy and Gaimard, who observe that the operculum of this species determined them to place it in the genus *Turbo*, state that it has only been hitherto found at New Zealand, where it is rare. They never obtained more than one living specimen. That from which the description and figure were taken was small, being only two inches in diameter, comprising the spines. It was covered with calcareous incrustations and marine plants, indicating the sloth of the animal. They found it in the Passe-des-Français, Tasman Bay.

Trochus imperialis, with animal.

a, anterior part of animal seen from above; *b*, inside of operculum; *c*, outside of the same.

Dr. J. E. Gray makes the *Trochidæ* the second family of his *Podophthalma*, the first section of the order *Phytophaga* in his

arrangement. The *Trochidæ* are immediately preceded by the *Turbinidæ* and followed by the *Stomatellidæ*.

Dr. Gray's *Trochidæ* consist of the genera *Pyramis, Cardinalia, Trochus, Polydonta, Clangulus, Phorcus* (*Phorus* ?), *Ziziphinus, Canthiridus* (*Cantharidus* ?), *Thalotia, Monodonta, Gibbium, Gibbula, Rotella, Livona, Talopia, Camitia*, and *Delphinula*. ('Synopsis Brit. Mus.,' 1840.)

In Woodward's 'Manual,' *Solarium* is referred to *Chitonidæ*, and *Trochus* to *Turbinidæ*.

TROCHIDON. [TROCHIDÆ.]

TROCHI'LIDÆ, the scientific name for the family of Humming-Birds.

Linnæus, in his last edition of the 'Systema Naturæ,' placed the genus *Trochilus* at the end of his order *Picæ*, and next to the genus *Certhia*.

Cuvier includes the *Colibris* (*Trochilus*, Linn.) in his order Passereaux, placing the group between the Grimpereaux, or Creepers (*Certhia*, Linn.), which in Cuvier's arrangement comprises the Sun-Birds and the Hoopoes (*Upupa*, Linn.). [CINNYRIDÆ.]

M. Lesson, in his 'Manuel,' places the *Trochilidæ* next to the *Philedonidæ*, and at the end of the *Tenuirostres*, making the family consist of two genera only, namely, *Colibri* (*Polytmus*, Briss.; *Trochilus*, Linn. and Auct.), and *Ornismya*, Less. (*Mellisuga*, Briss.; *Trochilus*, Linn., Temm., Vieill.; and *Orthorhynchus*, Lacép.). The same zoologist, in his elegantly illustrated work 'Les Trochilidées, ou les Colibris et les Oiseaux Mouches,' gives the following definition of this brilliant group:—

Trochilus (auctorum).

Synonyms:—*Mellisuga* and *Polytmus*, Briss.; *Trochilus*, Linn., Gm., Lath., Vieill., Temm.; *Trochilus* and *Orthorhynchus*, Lacép.; *Trochilus, Cynanthus, Phæthornis, Campylopterus*, and *Lampornis*, Sw. ('Zool. Journ.'); *Trochilus, Ramphodon*, and *Ornismya*, Less.; *Bellatrix, Calliphlox, Polytmus, Glaucis, Anthracothorax, Heliactin, Hylocharis, Basilinna, Chrysolampis, Smaragdites*, and *Eulampis*, Boie ('Isis,' 1831).

Zoological Characters.—Bill longer than the head, straight or arched, the upper mandible a little widened at the base, rounded above and beyond the nostrils, tapering into a point; lower mandible straight or slightly bent above and below, entering within the upper mandible, dilating a little towards the point, and of the same length as the preceding. Nostrils basal, very small, covered by the advanced feathers of the forehead, placed in a lateral fosset, separated from each other by a slight ridge. Wings with the quill-feathers graduated; the first the longest, and so on in succession. Tail composed of ten feathers, very variable in length and form. Tarsi delicate, slender, naked or feathered to the heels, scutellated, having in front three equal toes, the two internal ones a little connected at their base, the hind toe rather stout, all furnished with compressed, curved, and hooked claws, which are rather robust for the toes. Tongue extensible, long, divided at the summit into two widened filaments, which are slightly spatulate, and supported by two very long branches of the os hyoides acting like a spring, tubular in the centre, or formed of two co-adapted (adossés) cartilaginous canals.

Geographical Distribution.—America (including many of the adjoining islands), principally between the tropics; but, at the same time, there are species which range very far to the south, and others to the north.

Food.—Soft insects, such as spiders, tipulæ, gnats, ants, and also small coleopterous insects; accessorily the honied juice of flowers.

Plumage.—That of the male brilliant, sumptuous, and with metallic reflections. The livery of the females is nearly always sombre, tarnished, or with but little brilliancy. The young resemble the females, and only gradually gain the dress of the males. The feathers have their barbules constantly disposed in facets, even in those whose plumage is dull.

In the 'Synopsis' of his 'Classification of Birds' Mr. Swainson gives the following arrangement and definitions, observing that the typical characters alone are given of what he considers to be the primary groups; but as the circular succession of the sub-genera in each is a subject which requires more investigation than he had been able to give it, he will not attempt to impose names upon the minor groups, which could not as yet be properly demonstrated.

Family *Trochilidæ*. Humming-Birds.

Wings excessively long, falcated. Feet very small.

Genera:—*Lampornis*, Sw.; Ex. *L. mango*. *Trochilus*, Auct.; Ex. *T. longirostris*. *Cynanthus*, Sw.; Ex. *C. forficatus*. *Phæthornis*, Sw.; Ex. *P. superciliosus*. *Campylopterus*, Sw.; Ex. *C. recurvirostris*.

He places the *Trochilidæ* between the *Cinnyridæ* and the *Promeropidæ*.

Prince C. L. Bonaparte, in his 'Specchio Comparativo' (1827), places the family *Anthomyzi*, with the genus *Trochilus*, between the families *Tenuirostres* and *Ægithali*. In his 'Birds of Europe and North America' (1838) the *Trochilidæ* are arranged between the *Upupidæ* and the *Certhidæ*, and comprise the genera *Trochilus, Lampornis*, and *Calliphlox*.

Mr. G. R. Gray, in his 'List of the Genera of Birds,' gives the *Trochilidæ* a place between the *Nectarinidæ* and the *Meliphagidæ*, making the first-named family consist of the following sub-families and genera:—

Sub-Family 1. *Lamporninæ*.

Genera:—*Campylopterus*, Sw.; *Eulampis*, Boie; *Petasophora*, G. R. Gray; *Lampornis*, Sw.; *Glaucis*, Boie; ——— (?) (*Chrysurus*, Less.); *Topaza*, G. R. Gray; *Calothorax*, G. R. Gray (Lucifers, Less.).

Sub-Family 2. *Phæthorninæ*.

Genera:— *Grypus*, Spix; *Phæthornis*, Sw.

Sub-Family 3. *Trochilinæ*.

Genera:—*Patagona*, G. R. Gray (*Patagones*, Less.); *Cœligena*, Less.; ——— (?) (*Glaucopes*, Less.); *Lesbia*, Less.; *Heliactin*, Boie; *Trochilus*, Linn.; *Heliothryx*, Boie; ——— (?) (*Platurus*, Less.); ——— (?) (Avocettes, Less.); *Polytmus*, Briss.; *Amazilia*, Less.; *Sephanoides*, Less.; *Orthorhynchus*, Cuv.; *Mellisuga*, Briss.; *Chrysolampis*, Boie; *Hylocharis*, Boie; *Lophornis*, Less. (*Bellatrix*, Boie; Coqueta, Less.).

The most recent work on this subject is by Mr. Gould, who is now (1855) bringing out a work on the *Trochilidæ*, in which every species will be figured. Mr. Gould has long been preparing for this great work, and has one of the finest collections of Humming-Birds ever made. The collection of the late Mr. George Loddiges, which in 1842 was the most extensive in Europe, contained 196 species. In Mr. Gould's collection there are above 300 species. This collection was publicly exhibited in the Gardens of the Zoological Society in Regent's Park, in 1851 and 1852. The monograph of the *Trochilidæ* which is to illustrate this great collection has already reached ten parts, and will be completed in sixteen.

The following is a list of the genera, as given by Mr. Gould:—

Gryphus, Spix.—Ex. *Trochilus nævius*, Dumont. It is the only species of this genus, and inhabits the mountainous districts of Brasil.

Glaucis, Boié.—Ex. *T. aquila*, Bourcier. It inhabits New Granada.

Phætornis.—Ex. *T. hispidus*, Gould. It is an inhabitant of Peru. There are several species.

Lafresnaya, Bonaparte.—Ex. *T. Lafresnayi*, Bois. There is another species, both inhabitants of Quito.

Doryfera, Gould.—Ex. *T. Ludovica*. Several species are natives of Peru.

Petasophora, G. R. Gray.—This is a genus remarkable for its beauty. The oldest known species constitutes the type, the *P. Serrirostris*. There are eight species, natives of Brasil.

Heliothrix, Boié.—The species of this genus are eminently adapted for flight. The type of the genus is *T. auritus*.

No other species are in Mr. Gould's collection. They are natives of Brasil and Guyana.

Delattria, Bonaparte.—This genus contains four species. Ex. *T. fulgens* of Swainson, a native of Mexico.

Heliodoxa, Gould.—Ex. *H. jacula*, Gould. It inhabits Santa Fé de Bogotá.

Helionaster.—Ex. *T. longirostris*, Vieillot. The species are natives of the Antilles and of Brasil.

Mr. Gould separates from the foregoing genus a species to which he gives the generic title of *Ptærophorus*. It is a native of the mountain range of Columbia, and ranks amongst the most gorgeous of the *Trochilidæ*.

Campylopterus, Swainson.—Ex. *C. latipennis*, the Blue-Throated Sabre-Wing. Nine species are known, natives of the borders of the Amazon.

Lampornis.—Ex. *T. Mango*. It inhabits Jamaica. There are several species.

Eulampis, Boié.—Ex. *T. holosericeus*. This species, according to Lesson, is confined to the Antilles.

Polytmus, Bonaparte.—This genus contains but one species, *T. polytmus* of Jamaica.

Topaza, Gray.—Ex. *T. Pella*, the Topaz-Throated Humming-Bird; a native of Rio Negro, Brazil.

Cœligena.—Ex. *T. cœligena*, the Purple Humming-Bird. A second species of this genus has been received by Mr. Gould from Bolivia.

Leucippus, Bonaparte.—No species are recognised by Mr. Gould natives of Venezuela.

Bourcieria, Bonaparte.—There are four species, of which *T. Wilsonii* is an example.

Aglæactis, Gould.—Ex. *T. cupreipennis*; a native of Columbia.

Florisuga, Bonaparte.—The type of this genus is *T. mellivorus* of Linnæus; a native of Cayenne, Surinam, and the Antilles. Two other species are known.

Hylocharis, Boié.—Of this genus, the Sapphire-Throated Humming-Bird, *T. sapphirinus*, and the Golden-Green Humming-Bird, *Ornismya prasina*, are examples. It is a native of Guyana, Cayenne, Brasil, and Berbice.

Docimaster, Gould.—This genus contains but one species, *T. ensiferus*.

Helianthea, Gould.—The types of this genus are *T. helianthea* and *T. Bonapartii*, natives of New Granada and Venezuela.

Patagona, Gray, contains only one species, *T. gigas*; a native of Chili.

Metallura, Gould.—Five species belong to this genus. They are natives of Bolivia.

Avocettinus, Bonaparte, contains two species.—Ex. *T. Avocetta.*

Chrysuronia, Bonaparte.—Four species are arranged under this genus. They are natives of Brazil and Peru. Ex. *T. Ænone.*

Heliangelus, Gould.—This is a gorgeous group. All the species are natives of the Andes. Six species are recorded.

Orestrochilus.—Six species are recorded from South America. Ex. *T. Chimborazo.*

Thaluranía, Gould.—The type of this genus is the Fork-Tailed Humming-Bird, *Ornismya furcata* of Lesson.

Saucerottia, Bonaparte.—Ex. *T. Saucerotti.* The species are natives of New Granada.

Amazilius, Bonaparte.—Ex. *Ornismya Amazilii* of Lesson. It is a native of Peru.

Thaumatius, Bonaparte.—Ex. *Trochilus Thaumatius.* Natives of Brazil.

Ramphomicron, Bonaparte.—Eight or nine species of this group are described. The type of the genus is *T. microrhynchus*, a native of Santa Fé de Bogotá.

Oxypogon, Gould.—The types of this genus, which contain but very few species, are the *Ornismya Guerini* and *O. Lindeni.*

Loddigesia, Gould.—One species of this genus is recorded, *T. mirabilis;* a native of Peru.

Spathura, Gould.—Ex. *Ornismya Underwoodii*, the Rough-Legged Racket-Tailed Humming-Bird. Natives of Peru.

Eriopus, Gould.—The species are natives of the Cordilleras, Peru, and Columbia. There are fourteen or sixteen species recorded.

Cynanthus.—Ex. *T. Nuna*, the Nuna Humming-Bird; a native of Peru.

Cometes, Gould.—This genus contains only two species, of supreme magnificence. Ex. *T. sparganurus*, the Sappho.

Trochilus, Linnæus and Bonaparte.—Mr. Gould gives to this genus the title of *Colibri.* The typical example is the Ruby-Throat, or Northern Humming-Bird, *T. Colubris.*

Ornismya, Bonaparte.—There are several species natives of Jamaica.

Selasphorus, Swainson.—Ex. *T. ruber*, the Nootka Sound Humming-Bird.

Sephanoides, Lesson.—Ex. *T. Galerita.* Valparaiso.

Chrysolampis, Boié.—This genus is represented by the Ruby-Crested Humming-Bird, *T. moschitus.* It is a native of the Antilles, and probably also of Guyana.

Orthorhynchus, Cuvier.—Ex. *T. chlorolophus*, a native of Martinique.

Cephalipis, Loddiges.—Ex. *T. Loddigesii*, Gould. It is a native of Rio Grande.

Lophornis, Lesson.—There are several species. Ex. *T. auratus;* a native of Guyana, Cayenne, and Brazil.

Discosura, Bonaparte.—Ex. *T. longicaudatus;* a native of Guyana.

Tryphæna, Gould.—The type of this genus is *Tryphæna Duponti*, a native of Mexico. There are four species described.

Augastes, Gould.—Ex. *T. superbus* (Vieill.); a native of Brazil. There are two species described.

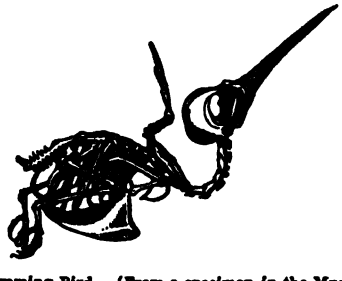
Calothorax, Gray.—The type of the genus is *Trochilus lucifer*, Swainson.

Heliactin, Boié.—One species is only recorded, *T. cornutus*; a native of Brazil.

Thaumastura, Bonaparte.—The type of this genus is *Trochilus Cora*, Lesson; a native of Peru.

Gouldia, Bonaparte.—The example of this genus is *T. Langsdorfi* of Vieillot, a native of Brazil. There are two or three species described.

The birds belonging to this family are no less remarkable for their structure than for the wonderful splendour of their plumage. The very deep keel of the sternum, the power of the bones of the wing, lengthened scapula, and the comparatively impoverished structure of the lower extremities, all exhibit an organisation of the locomotive system especially adapted to the development of the highest powers of flight.

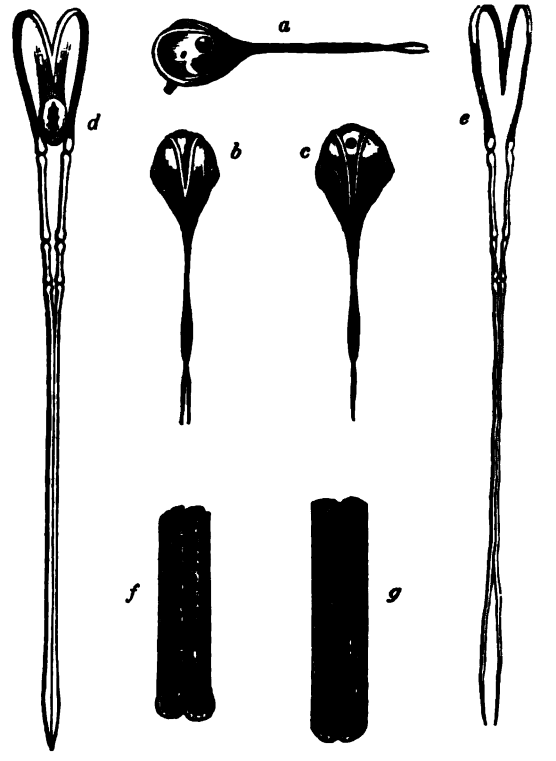


Skeleton of Humming-Bird. (From a specimen in the Museum of the Royal College of Surgeons in London.)

To put this framework in motion a corresponding development of the muscular system is applied. The enormous—for enormous, by comparison, they are—pectoral muscles, and the other muscles employed for working the wings, form nearly the whole fleshy substance of the bird: those allotted to the feet are reduced to the least possible quantity consistently with the requisite stability. All proclaims that the being before us is destined to pass the most active part of a high active life in the air; and when we proceed to inquire into the hist of this ethereal race, we shall at once perceive how admirably adapte to those habits this organisation is.

Another part of the mechanism of these minute creatures, int mately connected as it is with their existence, demands some mor The tongue is the principal organ for obtaining the food, which co sists of the honied juices of flowers and insects. This tongue is framed that, like the same organ in the Woodpeckers, it can be dra out of the bill by a sudden action of the os hyoides, comparable that of a spring suddenly released from the detent. It is very lo and can be protruded a good way from the bill.

In order that this tubular tongue may be thus projected upon t aliments which its terminations are appointed to seize and retain, t os hyoides which supports it is formed of two bony plates whic separate, pass below the cranium, re-ascend over the bones of th occiput, and proceed to form a point of resistance, or fulcrum, b their re-union on the forehead. The result of this disposition, whe brought into play by the muscles of the tongue, is a great power over the muscular tubes, furnished with circular fibres, which compos the organ of taste. The two small blades, or elongated spoon-lik terminations, seize the insects, or lick up the honied exudations, whic are on the instant carried to the aperture of the œsophagus by the elasticity and contractility of the two tubes, and forthwith swallowed. The long and slender bill comes admirably in aid to insert the tongue into the nectaria of flowers.



Bill and Tongue of Humming-Bird.

a, the head, profile; the tongue protruded from the bill, and showing its bifurcation; the two branches of the os hyoides are seen surrounding the cranium; *b*, the same seen from above, the two branches of the os hyoides uniting at a pointed angle in front; *c*, the same seen from below; *d*, the tongue much magnified, with some of its soft parts dissected away, but adhering to the os hyoides and its branches, as well as to the larynx, seen from above; *e*, the same seen from below, with the os hyoides only, and the two lamellæ of its point separated; *f*, portion of the tongue very much magnified, seen from above, so as to convey the idea of the manner in which the cylinders that form it are united; *g*, the lower side of the same. (Lesson.)

The sight of the Humming-Birds is well developed, and very acute within the range required ordinarily for its exercise: the sense of hearing is quick.

The plumage in which these dazzling birds are clad defies description either with pen or pencil. The most brilliant metallic tints, the hues of the richest gems, fade before the display made by many of the living adult males. "Splendet ut sol," says Marcgrave, speaking of one of them. Audebert applied himself to account for this brilliancy of colour, and to demonstrate on mathematical principles that it is due to the organisation of the feathers, and to the manner in which the luminous rays are reflected on falling upon them. M. Lesson thinks that this colour is, first, the result of the elements contained in the blood and elaborated by the circulation; and that, secondly, the

texture of the plumes plays the principal part in consequence of the manner in which the rays of light traverse them, or are reflected by the innumerable facets which a prodigious quantity of barbles or fibres present. As an example of the diversity of tints which spring from such scaly feathers, M. Lesson cites the emerald 'cravat' of many species, which takes all the hues of green, and then the brightest and most uniformly golden tints down to intense velvet black; or that of ruby, which darts forth pencils of light, or passes from reddish-orange to a crimsoned red-black.

The females generally speaking are without the splendour of the males; and are clad in modest, not to say sombre, plumage. The same may be said of the young males till the second year, when traces of the future brilliancy begin to appear here and there; but on the third year all remains of the sober livery of youth have vanished, and the bird shines out in the full radiance of his nuptial dress.

The small feet are generally of a dark colour: several species, especially those which live high up in the mountainous regions, have the tarsi warmly and largely protected with white plumelets, so that the birds look as if they had downy muffs on their legs.

The native names of the Humming-Birds were, as might be expected, first made known by the Spaniards and others who first invaded the New World. With the ancient Mexicans these bright creatures appear to have been great favourites. The radiant mantles worn by the natives in Montesuma's time glittered with the spoils of these diminutive birds, which were also employed in the art of design, and in the composition of those embroidered pictures which Cortes has so highly praised. Humboldt notices the religious belief of the Mexicans that Toyamiqui, the spouse of the God of War, conducted the souls of those warriors who had died in defence of the gods into the mansion of the sun, and transformed them into humming-birds; and it must be owned that they form an emblem of the soul hardly less spiritual than the butterfly of the Greeks. Hernandez treats of the Mexican species under the names of Hoitzitzilotototl, or *Avis varia;* and in the 'Nova Plantarum, Animalium, et Mineralium Mexicanorum Historia à Francisco Hernandez Medico in Indiis præstantissimo primum compilata, dein à Nardo Antonio Recchio in Volumen digesta,' &c. (Romæ, 1651, folio), we find seven species figured under the general title of Hoitzitzil, and the specific designations of Xiu Hoitzitzilin, Etsal Hoitzitzilin, Ystac Hoitzitzilin, Tenoc Hoitzitzilin, Quetsal Hoitzitzilin, Tozcacoz Hoitzitzilin, and Xoe Hoitzitzilin. Ximenes writes the word Huitzitzil. Gomara gives Vicicilin as the name. John de Laet writes Quenti as the Peruvian and Tomincios as the Spanish appellation. Ourissia is the name recorded by Nieremberg; and Guianumbi, according to Marcgrave and others, is the Brazilian designation. These and other Indian terms are said to signify 'rays of the sun,' 'tresses of the day-star,' 'murmuring birds,' and the like. The Spanish Tominos, or Tomincios, seems to refer to their diminutive size and small weight;* and Picaflores, another term employed by the Spanish or Portuguese creoles, to their mode of taking their food. Captain Lyon, R.N., in his 'Journal of a Residence and Tour in the Republic of Mexico' (1828), states that in the neighbourhood of Xalapa the Humming-Bird is distinguished by the names of Chupa-Rosa and Chupa-Myrta, Rose-Sucker and Myrtle-Sucker.

It is not to be wondered at that fable should have its share in accounting for the origin and describing the habits of these diminutive aërial beings. Thus, while the more sober believed that they were hatched from eggs like other birds, others fancied that they were transformed from flies, some going so far as to declare that they had been seen in the half-fly half-bird state. Then again they were supposed to live no longer than the flowers which afforded them food, and when those flowers faded they were believed to fix themselves by the bill to some pine or other tree, and there remain during the dreary months till the descending rains brought back the spring, when they revived again, to undergo the same alternation of life and death. Gomara states that they expired in the month of October, having previously suspended themselves by their feet from a branch in some warm place, and were renascent in April.

Humming-Birds were in the museum of the Tradescants under that name, this name having been given them on account of the noise they make with their wings whilst flying. In the 'Musæum Tradescantianum,' by John Tradescant (12mo., London, 1656), we find in the catalogue of 'Whole Birds,' "divers Humming-Birds, three sorts whereof are from Virginia."

Mr. Darwin states that two species are common in Chili, and that he has seen a third within the Cordilleras at an elevation of about 10,000 feet. He adds that in the wooded island of Chiloe, which has an extremely humid climate, *Melliwga Kingii*, skipping from side to side amidst the dripping foliage, is perhaps more abundant than any other kind. It there very commonly frequents open marshy ground, where a kind of bromelia grows: hovering near the edge of the thick beds, it every now and then dashed in close to the ground; but Mr. Darwin could not see whether it ever actually alighted. At the time of year referred to by him there were very few flowers, and none whatever near the beds of bromelia. Hence he was quite sure they did not live on honey; and on opening the stomach and upper intestine, by the aid of a lens he could plainly distinguish, in a yellow fluid, morsels of the wings of *Diptera*, probably *Tipulidæ*. It is evident, he observes, that these birds search for minute insects in their winter-quarters under the thick foliage. He opened the stomachs of several specimens, which were shot in different parts of the continent; and in all remains of insects were so numerous as often to present a black comminuted mass, as in the stomach of a creeper. Mr. Darwin goes on to state that in Central Chili these birds are migratory, making their appearance there in autumn, and that in the latter end of the month corresponding to our October they were very common. They began to disappear in the spring, and on the 12th of what would correspond to our March he saw, in the course of a long walk, only one individual. As this species migrates to the southward, it is replaced by the arrival of the larger kind presently to be noticed. Mr. Darwin does not believe that the small kind breeds in Chili, for during the summer their nests were common to the south of that country.

Numbers of the large species (*Trochilus gigas*) arrived in the neighbourhood of Valparaiso, during the year in question, a little before the vernal equinox. Mr. Darwin describes it as coming from the parched deserts of the north, probably for the purpose of breeding in Chili, and says that when on the wing its appearance is singular. He observes that, like others of the genus, it moves from place to place with a rapidity which may be compared to that of *Syrphus* among *Diptera* and *Sphinx* among moths; but, whilst hovering over a flower, it flaps its wings with a very slow and powerful movement, totally different from that vibratory one common to most of the species which produces the humming noise. He declares that he never saw any other bird where the force of its wings appeared (as in a butterfly) so powerful in proportion to the weight of its body. He tells us that when hovering by a flower, its tail is constantly expanded and shut like a fan, the body being kept in a nearly vertical position. This action, he says, appears to steady and support the bird between the slow movements of its wings. He further states that, although flying from flower to flower in search of food, its stomach generally contained abundant remains of insects, which he suspects are much more the objects of its search than honey; and that its note, like that of nearly the whole family, is extremely shrill.

The nests of these birds are as wonderful as any that are made. They vary greatly in form and structure; but in all the soft and delicate materials are so put together as to furnish as much warmth

Nest of Humming-Bird. (Lesson.)

Nest of Humming-Bird, with eggs. (Lesson.)

* Tomin, the third part of a drachm, Spanish troy weight.'

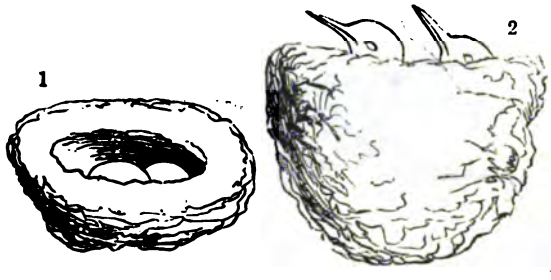
as possible, an object of first rate importance where the body of the parent, generally speaking, is so small, and the quantity of animal heat given out must be in proportion.

Prince Maximilian de Wied, on examining the flower of a palm-tree in Brazil, found affixed to it the nest of the Blue-Headed Humming-Bird (*Trochilus pileatus, Ornismya cristata*, Less.?), which, he says, much resembles that of the *Trochilus bicolor* of authors. He found it as well covered with moss as those of the Goldfinch and many other small European birds. The Prince adds, that in all humming-birds' nests two white eggs of an elongated form are found, which in some species are extraordinarily small. This rule as to the duality of the eggs is not without exception, if the information given to Sir William Jardine be correct, that the Doctor Humming-Bird, as it is provincially termed (*Trochilus hirsutus*), builds its nest suspended like that of the Yellow-Tail (*Cassicus cristatus*) with the entrance somewhat downwards, and lays only one egg. This nest is described as being of a lengthened form, composed of dried grass and slender roots, moss, &c., as not of the general compact structure, and as suspended from the leaf of some reed-like plant, to which it is cemented chiefly by the threads of spiders or caterpillars.

Nest of the Brazilian Amethyst Humming-Bird (*Ornismya amethistoides*, Less.). *a*, the egg.

Cotton, thistle-down, delicate fibres, a fungus-like substance, and other soft materials woven into a compact and fleecy substance, enter into the composition of the nests of Humming-Birds. The outside is in most instances covered with lichens, generally supposed to be stuck on with a sort of glue secreted by the bird; but we have reason to believe that this is not so. The nest generally appears to be made [illegible] spiders' webs over fragments of plants, their down, lichens, &c.; and the lichens, which are never turned the wrong way, are secured by the webs only.

Captain Lyon gives an account of a Humming-Bird which built its nest in an orange-tree. The young were hatched at first in a shallow nest, but as the young increased in size, the mother built her nest higher, so that from having at first the form of figure 1, it became ultimately like figure 2,



The parents are most valiant in defence of their nests. Oviedo relates how they will fly even at the face of a man who climbs a tree where their nests are, and strike him in the eyes, coming, going, and returning so swiftly, that no man would well believe it who had not seen it. Mr. Bullock says that the female of the Mexican Star lays two eggs, perfectly white, and large for the size of the bird; and the Indians informed him that they were hatched in three weeks by the male and female sitting alternately. He states that when attending their young, they attack any bird indiscriminately that approaches the nest. This pugnacious audacity probably fostered the Mexican belief that these diminutive bodies contained the souls of slain warriors.

Medical virtues have been attributed to these bright beings. Powdered Humming-Bird was considered a specific in cases of epilepsy; and the alleged efficacy of the birds in curing rheumatism secured a place for them in the old European Pharmacopœia.

We proceed to give a very few examples of the multitudinous forms presented by this gorgeous race.

Sickle-Winged Humming-Bird, *Trochilus falcatus* Sw. Green; throat and breast shining-blue; body and vent blue-green; tail even, rufous cinnamon; exterior quills falcated, the shafts dilated and compressed. It is a native of the Spanish Main.

Sickle-Winged Humming-Bird (*Trochilus falcatus*, Sw.), a little reduced.

Recurved-Bill Humming-Bird, *Trochilus recurvirostris*, Sw. Golden-green; throat shining emerald-green; middle of the breast and body black; lateral tail-feathers beneath topazine; bill recurved. (Sw.) It is a native of Peru.

Recurved-Bill Humming-Bird (*Trochilus recurvirostris*, Sw.).

Gould's Humming-Bird, *Ornismya Gouldii*, Lesson.—This bird, *Ornismya ornata*, and the Hausse Col Blanc (*O. strumaria*, Less.), form a small natural tribe. The Huppe Col (*O. ornata*), which is figured by M. Lesson (pl. xli., male and female, Oiseaux Mouches, very young, pl. xxiv., Trochilidées), is found in Guyana, Brazil, and Trinidad; the Hausse Col, figured by M. Lesson (pl. xlii., male; pl. xliii., female and young, Oiseaux Mouches), is found in Brazil.

Gould's Humming-Bird (*Ornismya Gouldii*, Less.)

The Bar-Tailed Humming-Bird, Sappho Humming-Bird of Lesson. This is the *Trochilus sparganurus*, or Bar-Tailed Humming-Bird of Shaw; *Ornismya Sappho*, Less.; *T. radiosus*, Temm. (Galleries of the Museum); *T. chrysurus*, Cuv.; *T. chrysochloris*, Vieill.)

It is a native of the east of Peru.

Bar-Tailed Humming-Bird (*Trochilus sparganurus*). (Lesson).

The Double-Crested Humming-Bird, *Trochilus cornutus*, Wied.; *Trochilus bilophus*, Temm.; *Ornismya chrysolopha*, Less.

Male.—Bill and feet very weak and obscure in colour. Two flattened fan-shaped crests, each composed of six small feathers, part from the forehead on a level with the eyes. The brilliancy of these crests surpasses description, glistening as they do with the hues of polished gold and red copper, changing into the gemmy tints of the ruby and emerald, now fire-coloured, anon the purest green, and presently the brightest yellow. The scaly feathers of the forehead between the two crests sparkle with metallic uniform green, changing to steel or sapphire blue. A camail of dark changeable violet extends from the throat behind the eyes, and descends along the sides of the neck to terminate in a point of long feathers before the breast. This uncertain violet graduating into a non-metallic blue, with its velvety very dark tint, is sharply defined on the milk-white of the breast, which extends to the lower part of the neck, so as to form a rather large white collar. The lower part of the belly is white; but the middle of the abdomen and the flanks are, like the back, golden-green, with which is mingled a little of the grayish colour of the base of the feathers.

Back and sides of the head behind, back, and feathers of the rump, metallic golden-green. Quills brown. Tail graduated, composed of four feathers longer than the six others; the two middle ones are brown, the two external pure white. The other shorter external tail-feathers are white, but their outer border is variegated with brown. The tail below is white, slightly smoked as it were. The wings reach only to the half of the tail, the general form of which is long, acuminated, and narrow. Length 4 inches 5 or 6 lines. Bill 6½ lines.

Double-Crested Humming-Bird (*Trochilus cornutus*, Wied), adult male.

The Cora Humming-Bird, *Ornismya Cora*. Less. Upper part of the head, back, rump, and coverts of the wings, uniform and metallic

Cora Humming-Bird (*Ornismya Cora*, Less.).

green. A wide iridescent gorget occupies the throat down to the half of the neck and to the cheeks; the lower part of the neck in

front, the breast, and all the lower parts of the body, are tarnished white, with a little brown on the flanks. Tail, consisting of eight browniah feathers, bordered with white within; two middle feathers much longer than the others, white on their internal side, brownish on their external border, and entirely brown at the extremity. Bill slender, black. Feet reddish. Total length 5 inches 5 lines (French); of this the tail measures 3 inches 2 lines, and the bill 6 lines. It is a native of Peru, and especially the Plain of Lima.

All the species of Humming-Birds are exclusively natives of the New World where they are found, from one extremity of the continent to another. One species is described as inhabiting America as far north as Sitka, whilst another has been found at Cape Horn. One group, the genus *Oreotrochilus*, is found at the height of 15,000 feet above the level of the sea, where they feed upon the *Coleoptera* and *Hymenoptera*, which frequent the alpine plants of these snowy regions. They abound however in the tropical regions of America, and are most numerous in the deltas and along the banks of the great rivers which flow through this vast continent.

Some species are found in the West Indian Islands which are not found on the continent. One island in the Pacific teems with these birds, and three species are found peculiar to the island of Juan Fernandez.

Many attempts have been made to bring these beautiful birds to Europe, but with one exception they have all failed. It has not been found difficult to keep them for a short period in captivity in their native countries, but no permanent success has attended the oft-repeated experiment of bringing them to the Old World.

TROCHILUS. [TROCHILIDÆ.]
TROCHOI'DEA. [TROCHIDÆ.]
TROCHOIDEUS. [PAUSSIDÆ.]
TROCHUS. [TROCHIDÆ.]
TROGLODYTES. [CHIMPANZEE; TROGLODYTINÆ.]

TROGLODYTINÆ, a family of Insessorial Birds, to which the Wrens belong.

Linnæus placed the true Wrens among his *Motacillæ*.

Meyer arranged them in the third sub-order, *Subulatæ*, of his fifth order, *Oscines*.

Cuvier gave them a place under his Bec-Fins (*Motacilla*, Linn.), with the generic names of *Regulus*, Cuv., and *Troglodytes*, Cuv.

M. Latreille makes them members of the second family, *Dentirostres*, of his second order Passereaux.

The position assigned to the sub-family *Troglodytinæ*, or Wrens, by Mr. Swainson, is between the *Sittinæ* (Nuthatches) and the *Buphaginæ* (Oxpecker), in the family *Certhiadæ*.

The following is his character of the *Troglodytinæ*:—Feet with the tarsus longer than the hind toe, which is but slightly developed; lateral toes nearly equal, and cleft to their base; the tenuirostral division.

The genera which Mr. Swainson arranges under this sub-family are —*Platyurus*, Sw.; *Thriothurus*, Vieill.; *Troglodytes*, Linn.; *Lochmia*, Sw.; *Tichodroma*, Ill.

Mr. Swainson arranges the Golden-Crested Wrens, or Gold-Crests, as he terms them, among the *Sylviadæ*.

Prince Bonaparte, in his 'Birds of Europe and North America,' places the genus *Troglodytes*, of which he records one European and three American species, next to the genus *Certhia*, in his sub-family *Certhinæ*; and he makes *Regulus*, of which he notices three European and three American species, the first genus of his sub-family *Parinæ*. *Regulus*, in the Prince's arrangement, is immediately followed by *Parus*.

The *Troglodytinæ* of Mr. G. R. Gray form the seventh and last sub-family of his family *Certhidæ*, and comprise the following genera:—*Rhinocrypta*, G. R. Gray; *Menura*, Dav.; *Pteroptochos*, Kittl.; *Scytalopus*, Gould; *Microura*, Gould; *Merulaxis*, Less.; *Thriothurus*, Vieill.; *Campylorhynchus*, Spix; *Rhamphocænus*, Vieill., and *Troglodytes*, Cuv.

The genera *Troglodytes* and *Regulus* are examples of this group.

Troglodytes Europæus, *Motacilla troglodytes*, Linn., is the Troglodyte, Roytelet, Beuf de Dieu, Berichot, and Roy Bertaud of the French; Reillo, Regillo, Rectino, Reatin, Fiorracino, Sericciolo, Re d'Uccelli, and Sbucofratte, of the Italians; Nelle Konge of Brunnich; Schneekoning, Konickerl, and Zaunschlupfrel, of Kramer; Zaun Sanger of Meyer; Haus und Waldzaunkonig of Brehm; Wren, Vraun or Ran, Cutty, Katy or Kitty Wren, and Kitty, of the English; Dryw of the Welsh.

This bird is found in northern and central Europe. Iceland, Greenland. The Faroe Islands. Resident in Sweden. England, Wales, Scotland, and Ireland, Orkney and Shetland. Spain, France, and Italy. Smyrna. Trebizond.

This familiar little bird, which has become sacred, like the robin, from the confidence which it shows in courting the neighbourhood of man, creeps about the hedges, making small flights, and in its search for insects generally entering the lower part of the hedge and working upwards. Like the Robin it will sing cheerily even in mid-winter, but the frost and snow are sometimes too much for it, and the little creature perishes with cold, which however it avoids by roosting in warm cattle-sheds, for the sake of the animal heat of the inmates, and in other sheltered places.

The nest is placed variously, according to circumstances. Linnæus says, "nidificat sub terra," and it has been sometimes found in a bank or old road. The materials generally vary with the situation. Thus if the nest be built against the side of a hayrick, hay is used; if against the trunk of a moss-grown tree, that moss is employed. It is large in proportion to the bird, and the shape is generally oval, the top being in the form of a dome, and the entrance by a small hole at the side or sometimes at one end. Feathers generally form the lining. Seven, ten, and even more eggs, white, with a few pale red spots, but sometimes spotless, are here deposited, and about ten days suffice for hatching the brood, 16 of which, it is asserted, have been seen in one nest, a large family for the diminutive parents to rear. But they are most assiduous in collecting food for their young, and though the incubation is short, the female sits very close, depending for her subsistence upon the male, who is in constant attendance on her. Insects and worms are their food.

The feathers in a Wren's tail make a killing trout-fly in the early part of the season.

In the 'Portraits d'Oyseaux' (1557) the following quatrain appears under the cut of this species:—

> "Cet oyselet, qu'on nomme Roytelet,
> Encontre l'Aigle à debat et querelle.
> Tousiours est gay, tant masle, que femelle:
> Et tousiours chante, aymant estre seulet."

The first lines allude to the old fable of the enmity which was supposed to exist between the Wren and the Eagle.

Wren (*Troglodytes Europæus*).

Regulus cristatus, *Motacilla Regulus*, Linn., is the Roitelet and Roitilet Huppé of the French, and Pennant thinks, with reason in our opinion, that it is the Soulcie, or Soucie, of Belon; it is the Regolo, Re d'Uccelli Col Ciuffo, Reattino, and Fior-Rancio, of the Italians; Kongsfogel of the Swedes; Fugle-Konge of Brunnich; Feuglegongen of Walter; Gekrönter Sänger, Sommer Zaunkoenig, Nordisches Saffranköpfiges und Goldkopfiges Goldhanchen, of the Germans; Goldhannel of Kramer; Gold-Crested Wren, Golden-Crested Wren, Golden-Crowned Wren, and Kinglet, of the English; Yswigw and Sywigw of the Welsh.

M. Temminck states that this species is sufficiently common in all the countries of Europe up to the Arctic circle. It is an inhabitant of Russia, Siberia, Sweden, Norway, and Denmark, but from these more northern localities there appears to be a kind of autumnal migration to the more temperate parts down to the Mediterranean. It is fairly spread over England, Wales, Scotland, and Ireland, and is found in Orkney and Shetland. It has been received from Trebizond. Edwards looked on it as inhabiting many parts of Asia, and it has been seen in Japan.

This beautiful and active little bird, which is a constant resident in these islands, may be frequently seen busy among the branches, especially of some larch or fir, running actively along and clearing away the insects. It is far from uncommon round London; and if the observer approach cautiously and stand still, he may watch its motions within a very few feet without disturbing it.

The cut of the 'Soucie,' in the 'Portraits d'Oyseaux,' has the following quatrain beneath it:—

"De tous oyseaux l'oyseau plus plein de ioye
Est la Soucie hantant sur les chemins,
Et sur les choux et herbes des iardins.
Il est petit plus qu'autre que lon voye."

Golden-Crested Wren (*Regulus cristatus*).

This bird must not be confounded with the rarer Fire-Crested Wren (*Regulus ignicapillus*), Roitelet triple Bandeau of Temminck, which is also to be seen in Britain. [REGULUS; SYLVIADÆ.]

TROGON. [TROGONIDÆ.]

TROGO'NIDÆ, a family of Insessorial or Perching Birds, remarkable for the beauty of their plumage.

Linnæus, in his last edition of the 'Systema Naturæ,' placed the genus *Trogon* in his order *Picæ*, between *Paradisea* and *Bucco*, in the body of the work; but in his 'Characteres Avium,' at the commencement of the Birds, where he divides the *Picæ* into three sections (1, those with walking feet; 2, those with scansorial feet; and 3, those with gressorial feet), he places *Trogon* in the second section, between *Ramphastos* and *Psittacus*. Latham also places it in the same second section, between *Crotophaga* and the Barbets.

In Swainson's 'Synopsis' the *Trogonidæ* are placed between the *Halcyonidæ* and the *Caprimulgidæ*, with the following characters:—

Trogonidæ, the Trogons.—Bill short, triangular, strong; the tips, and generally the margins, toothed; wings very short. Rasorial.

Trogon, Linn.—Both mandibles with their cutting margins serrated; the two anterior toes united as far as the first joint; nostrils concealed by bristles; tarsus entirely feathered. It inhabits tropical America. The Dentirostral type.

Sub-Genera *Harpactes*, Sw.—Bill stronger; both mandibles deeply notched at their tips, but the margins smooth; nostrils perfectly naked; tarsus only half feathered; the anterior toes less united. It inhabits tropical Asia. The Conirostral type.

Apaloderma, Sw.—Bill as in *Trogon*, but the dentitions almost obsolete; feet stronger; the two anterior toes cleft to their base. It is a native of Africa. The Tenuirostral type.

Temnurus, Sw.—Bill as in *Trogon*; tail-feathers forked at their tips, the points diverging. It inhabits South America.

Calurus, Sw.—Bill destitute of serratures; head (typically) with a compressed and elevated crest; upper tail-coverts enormously developed, and hiding the tail. It is a native of South America. The Rasorial type.

Under a line, and between the *Trogonidæ* and the *Caprimulgidæ*, are placed the genera *Crypticus*, Sw., and *Prionites*, Ill.; and Mr. Swainson, speaking of *Crypticus*, remarks that it is by this form, as he suspects, uniting to *Lamprotila*, that the circles of the *Halcyonidæ* and *Trogonidæ* are connected.

Mr. Gould's splendid 'Monograph of the Trogonidæ' was finished in 1838; and in the 'Introduction' to that work he observes, that those birds, as their general structure and their habits sufficiently indicate, belong to the fissirostral tribe of the *Insessores*. "Greatly insectivorous," says Mr. Gould, "they seize the flitting insect on the wing, which their wide gape enables them to do with facility; while their feeble tarsi and feet are such as to qualify them merely for resting on the branches, as a post of observation whence to mark their prey as it passes, and to which, having given chase, to return. As in all other groups, however, we shall find modifications of the type constituting the ground of generic or subgeneric divisions . . . If not strictly elegant in form, the Trogons in the brilliancy of their plumage are surpassed only by the *Trochilidæ*: their splendour amply compensates for every other defect. Denizens of the intertropical regions of the Old and New World, they shroud their glories in the deep and gloomy recesses of the forest, avoiding the light of day and the observation of man: dazzled by the brightness of the meridional sun, morning and evening twilight is the season of their activity."

The Trogons are described as solitary birds, extremely jealous of their freedom, never frequenting inhabited or open tracts, and delighting in the silence of deserts. "The interior of the thickest forests is their chosen abode for the entire year. They are sometimes seen on the summit of trees; but in general they prefer the centre, where they remain a portion of the day without descending to the ground, or even to the lower branches. Here they lie in ambush for the insects which pass within reach, and seize them with address and dexterity. Their flight is lively, short, vertical, and undulating. Though they thus conceal themselves in the thick foliage, it is not through distrust; for when they are in an open space, they may be approached so nearly as to be struck with a stick. They are rarely heard to utter any cries, except during the season of reproduction, and then their voice is strong, sonorous, monotonous, and melancholy. They have many cries, from the sound of one of which their name is derived. All those whose habits are known nestle in the hollows of wormeaten trees, which they enlarge with their bills so as to form a comfortable and roomy residence. The number of eggs is from two to four, and the young are born totally naked, but their feathers begin to start two or three days after their birth. The occupation of the male during incubation consists in watching for the safety of his companion, bringing her food, and amusing her with a song, which, though we should call it insipid, is to her without doubt the expression of sensibility. Some of the Courucous express the syllable 'pio,' repeated many times in succession with a powerful yet plaintive tone. Their accent almost reminds one of the wailings of a child who has lost its way, and it is thus that they cry to each other amidst the silence of the forests. As soon as the young are able to provide for themselves, they separate from their parents to enjoy that solitude and isolation which appear to constitute the supreme happiness of the species. Their aliments are composed of larvæ, small worms, caterpillars, coleoptera, and berries, which they swallow entire. The male, at various ages, the female, and the young differ in their plumage, which has given rise to the institution of more species than are really in existence." (Griffiths, 'Cuvier's Animal Kingdom.')

With regard to the geographical distribution of the Trogons, Mr. Gould says that they appear, on general survey, to be divided between America, including its islands, and the islands of the Indian Archipelago; two or three species only having yet been discovered on the continent of India, and those principally inhabiting the countries bordering the Indian Seas. The great nurseries for these birds in the Old World are, he observes, the islands of Ceylon, Sumatra, Java, Borneo, &c.; while over the whole continent of Africa only a single species has yet been discovered. "It is in South America however," continues Mr. Gould, "that we find the greatest number of species, and those of the most exquisite plumage: nor is this all; for it will be further observed that, in accordance with the great geographical distribution thus pointed out, there exist certain characters common to the species inhabiting each region, which, although not very apparent to the unpractised eye, constitute the basis of generic subdivisions, and doubtless have an influence upon their habits and manners."

Previous to the commencement of Mr. Gould's monograph, the number of described species amounted only to 22: to these Mr. Gould has added and characterised 12 others new to science, among which are three additional species of the sub-genus *Calurus*, of which two only were previously known, and those were confounded under one name. The total number of species known when Mr. Gould finished his monograph was 34, 23 of which are inhabitants of America and its islands, 10 of the Indian Islands and India, and one of Africa; but he states in his preface that he has reason to believe that many will yet be discovered, both in the Old and New World, particularly in those remote regions which civilised man has seldom, if ever, visited.

The remarkable plumage and shy habits of the Trogons did not escape the observation of the ancient Mexicans, in whose mythology one of the species at least (*Trogon pavoninus*) was celebrated. Another species, the Tzinitzcan of the Mexicans, *Trogon Curucui*, Linn., was employed by them, according to Hernandez (c. xliii.), in the fabrication of the figures and pictures ('imagines') used on festivals, in war, and in their temples. They were probably kept in one of the two houses which formed the Royal Menagerie of ancient Mexico, one of these houses being appropriated to birds which did not live by prey; the other to birds of prey, quadrupeds, and reptiles. Three hundred men, according to Cortes, were employed to take care of

these birds, besides their physicians, who watched their diseases and applied timely remedies. Of the 300 attendants, some procured their food, others distributed it, others took care of the eggs at the time of incubation; whilst others, at certain seasons, picked their plumage—for the king not only delighted in the sight of so many species, but was very careful of their feathers for the sake of the famous mosaic images and pictures, as well as of the other works which were made of them.

We give a few examples of this extensive family.

Trogon (*Calurus*) *resplendens* (Gould). This is one of the most beautiful of the family.

Trogon (*Calurus*) *resplendens*.
Upper figure, adult male; lower figure, female or young male. (Gould.)

Mr. Gould, after quoting *Trogon pavoninus*, Temm. ('Pl. Col.,' 372) as a synonym, truly observes, that it is scarcely possible for the imagination to conceive anything more rich and gorgeous than the golden-green colour which adorns the principal part of the plumage of this splendid bird; or more elegant and graceful than the flowing plumes which sweep pendent from the lower part of the back, forming a long train of metallic brilliancy.

So rich a dress must be fatally attractive; and accordingly we find that this, the most beautiful of a beautiful tribe, is only found in deep and gloomy forests remote from the haunts of civilised man.

It is a native of Guatemala in Mexico, where it is called Quesa. (Gould.)

T. Mexicanus (Sw.). The old male has the beak bright yellow; throat and ear-coverts black, gradually blending with the green which

Trogon Mexicanus, male. (Gould.)

Trogon Mexicanus. (Gould.)
Upper figure, youthful male; lower figure, female.

covers the chest and the whole of the upper surface; two middle tail-feathers green, with black tips; the two next on each side wholly black; the three outer on each side black, with white tips; wings black, the whole of which, with the exception of the primaries, is finely dotted with gray; a crescent of white encircles the chest; breast, belly, and under tail-coverts, fine scarlet; feet brown. Total length 11 to 12 inches; wing, 5¾ inches; tail, 7¾ inches.

The young male is distinguished from the adult by the gray freckles on the wings being rather stronger and more inclined to brown on the secondaries; by the extreme outer edge of the primaries being white; and by the tail being regularly barred with black and white, which character is most conspicuous on the outer edges.

The female has the top of the head, throat, chest, and back, dark brown, inclining to olive on the upper surface, and to rufous on the chest; across the chest an obscure band of light gray, the lower part and vent scarlet; wings black, slightly freckled with brown on the outer edges of the secondaries and shoulders; the outer edges of the primaries fringed with white; two middle tail-feathers chestnut-brown, tipped with black; the two next on each side wholly black; the remainder strongly barred with black and white for nearly their whole length; bill yellow, clouded with brown. (Gould.)

It is a native of the north of Mexico.

Mr. Gould states that this species is identical with the *Trogon glocitans* of Lichtenstein.

T. (*Apaloderma*) *Narina*, Le Vaill., is a native of South America.

Narina, whose name this the only known African species bears, was a Gonaqua Hottentot girl, whose charms and manners appear to have produced a great impression on Le Vaillant, and he devotes some pages to her in his 'Travels.'

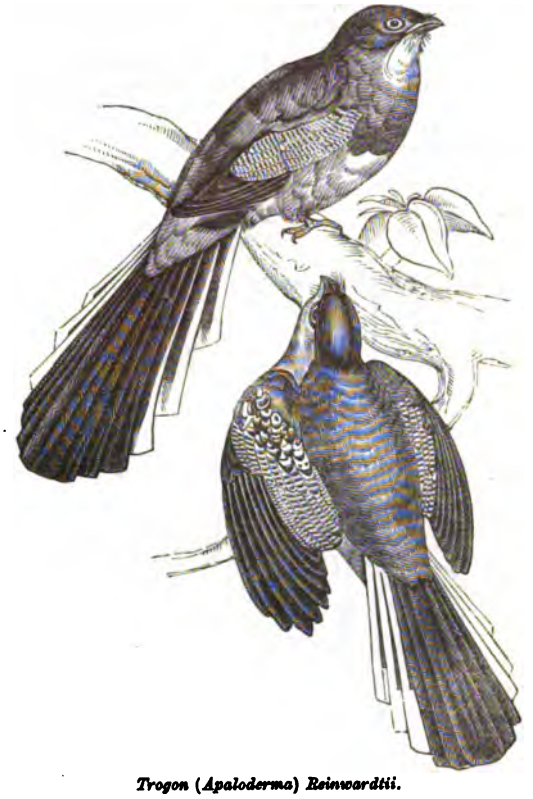
Mr. Gould quotes him for information respecting the habits and economy of this bird. Its favourite haunts are the thickest parts of the forest; and there it sits, nearly motionless, on a low dead branch during mid-day: in the morning and evening it captures its food, consisting chiefly of locusts, beetles, and other winged insects, with the addition of caterpillars. The account given of the young is extraordinary; for we find it recorded, that "the moment they are excluded they take flight, and follow their parents for a considerable period."

Trogon (*Apaloderma*) *Narina*, male and female. (Gould.)

This, if correct, is a rare instance of perfect development among the *Insessores*. We know that the young of the Gallinaceous birds will run as soon as they have left the shell; but their plumage is most imperfect, and it takes a long time to develop the feathers which are to sustain them in flight; whilst in the bulk of Insessorial cases the nestling is hatched with scarcely anything more than a rudimentary down.

T. (*Apaloderma*) *Reinwardtii*, Temm., is a native of Java and Sumatra, where it was discovered by Professor Reinwardt, whose name it bears.

This, Mr. Gould observes, is a scarce bird in cabinets of natural history; and he attributes its rarity to its being very local, remarking that the vast collections brought to this country by Sir T. Stamford Raffles and Dr. Horsfield did not contain an example.



Trogon (*Apaloderma*) *Reinwardtii*.
Upper figure, adult male; lower figure, young bird. (Gould.)

TROGO'NOPHIS (Kaup), a genus of Reptiles.

TROLLIUS, a genus of Plants belonging to the natural order *Ranunculaceæ*. It has a calyx of 5 or more coloured sepals, 5 or more small petals, which are linear, with an obscure depression above the contracted base; the capsules, or follicles, are numerous, and filled with obovate-angular polished seeds. The species are perennial; they are not numerous, and are found generally in the temperate parts of the world.

T. Europæus, European or Mountain Globe-Flower, has 10 to 15 sepals involuted in the form of a globe; the petals the same length as the sepals, or a little shorter; the leaves 5-parted, with the divisions cut and serrated. This plant is diffused throughout the north of Europe, in moist pastures in sub-alpine districts. It is abundant in the whole chain of the Alps, and is also found in mountainous districts in the north of England, Ireland, Wales, and Scotland. The flowers are large and handsome: in Scotland they are called Luckengowans, or Cabbage-Daisies. In some parts of England, as well as on the continent of Europe, they are gathered on festive occasions for making garlands and decorating the cottages of the peasantry. There are two species, *T. Asiaticus* and *T. Americanus*, which are found in Asia and America.

TRONA, the African name for Native Sesquicarbonate of Soda. [SODIUM.]

TROOPIAL. [MOLOTHRUS.]

TROOSTITE, *Ferruginous Silicate of Manganese*, a Mineral occurring crystallised. Primary form a rhomboid. Colour greenish, yellow, gray, and reddish-brown. Fracture conchoidal. Hardness 5·5. Brittle. Lustre vitreous, inclining to resinous. Translucent to transparent. Specific gravity 3·014 to 3·034. Found at Franklin, New Jersey, U. S. Its analysis, by Dr. Thomson gives:—

Silica	30·650
Protoxide of Manganese	46·215
Peroxide of Iron	15·450
Carbonic Acid and Water	7·300
	99·615

TROPÆO'LACEÆ, *Indian Cresses*, a natural order of Plants. The plants belonging to this order are smooth, tender, and herbaceous, with diffuse or twining stems, and alternate-petiolate peltate leaves; the flowers are irregular, axillary, and solitary; the calyx has 5

sepals, the upper one with a long distinct spur; the petals are unequal and irregular, the two upper are sessile and remote, arising from the throat of the calyx, the three lower stalked, and smaller, sometimes abortive; the stamens, 8 in number, perigynous, the filaments distinct; the anthers minute, erect, 2-celled, dehiscing longitudinally; ovary consisting of 3 carpels; style 1, stigmas 3, acute; ovules solitary, pendulous; the fruit is indehiscent, separating into three pieces which surround a common axis; the seeds are large, having no albumen, and filled with the embryo, the cotyledons of which are thick and consolidated together into a single body; the radicle lies within the projections of the cotyledons.

The species of this order differ from *Balsaminaceæ* in their more regular flowers, and in the juicy fruit not having a bony lining to the cells. They resemble *Geraniaceæ* in the possession of a spur. The genera belonging to this order are *Tropæolum*, *Magallana*, and *Chymocarpus*, all of them natives of South America.

Tropæolum majus.

1, branch, showing peltate leaves; 2, flower with calyx, spur, and petals; 3, anther; 4, tricapsular fruit with single seeds; 5, petal removed.

TROPÆ'OLUM (from *τρόπαιον*), a genus of Plants, the type of the order *Tropæolaceæ*. It has a 5-parted calyx, the upper lobe being furnished with a spur; 5 petals, unequal, the three lower ones smallest or altogether absent; 8 stamens, free from the base; 3 carpels, somewhat erose, kidney-shaped, indehiscent, furrowed, roundish; the seed large, filling the cell. The species of this genus, which derives its name from the petiole being inserted into the centre of the leaf, giving it the form of a buckler, are all of them inhabitants of South America. They are all climbing plants.

T. minus, Small Indian Cress or Nasturtium, has peltate-nerved orbicular leaves, the nerves mucronate at the apex; the petals each ending in a bristle-like point. This plant is a native of Peru. It is one of the species of the genus that was earliest brought to Europe, and was cultivated in England by Gerarde. It has deep-yellow flowers streaked with orange and red. The whole plant possesses an acrid flavour and odour which are peculiar to this order and the *Cruciferæ*. It is on this account that all the species of *Tropæolum* have obtained the common name of *Nasturtium*, which is the name of a genus of plants belonging to *Cruciferæ*. The fruit of this plant is pickled, and eaten in the same way as capers; the flowers and leaves may also be eaten as a salad. There is a variety in the gardens with double flowers.

T. majus, Great Indian Cress or Nasturtium, has the leaves peltate-nerved, orbicular, somewhat 5-lobed; nerves not mucronate; petals obtuse. This plant is also a native of Peru. It was introduced into England, according to Peter Collinson, says Smith, in the year 1686. It has much larger flowers than the preceding, but having the same colour and general appearance. The fruit of this, when green, like the preceding species, is made into a pickle, for which its warm biting character renders it very fit.

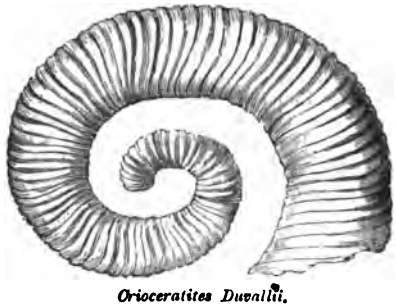
T. aduncum, Hooked Indian Cress or Nasturtium, is a native of both Mexico and Peru.

T. tricolorum, the Tricolor Indian Cress or Nasturtium, is a native of Chili at Coquimbo. It has a calyx of an orange-scarlet colour, and tipped with black, whilst the petals are yellow. It is the most showy and handsome of the species.

T. pentaphyllum, Five-Leaved Indian Cress or Nasturtium, has 5 leaflets which are ovate or ovato-lanceolate, entire, and stalked; only 2 petals, which are sessile, acute, quite entire, shorter than the calyx. It is a native of Buenos Ayres, Monte Video, and Brazil in the province of Cisplatine.

T. azureum, Purple Indian Cress or Nasturtium, has the leaves 5-parted, with linear unequal laciniæ; equal entire bilobed petals, much longer than the calyx, with a spur shorter than the petals. This plant was discovered by Mr. Miers, and first described in his 'Travels in Chili,' and had been previously seen by Mr. Bridges on the Carycam de Quillota, 4000 feet above the surface of the sea. It is remarkable for its blue flowers.

TROPÆUM, Mr. Sowerby's name for a genus of *Ammonites*, apparently identical with *Crioceratites*, and consisting of those species which have their whorls disconnected, such as *Crioceratites Duvallii*.



Crioceratites Duvallii.

TROPHIS (from *τρέφω*), a small genus of Plants belonging to the natural order *Artocarpaceæ*. The species are found both in the East and West Indies. The flowers are dicecious; spike lax, axillary; male, perigone 3-leaved, spreading, stamens 4; female, perigone 3-leaved; ovary ovate, 1-celled, 1-seeded; stigma bifid. The species form milky trees with alternate entire leaves.

T. Americana, the Ramoon-Tree, is 20 feet high, and a native of the West India Islands, where the leaves and twigs make a wholesome fodder for cattle in the inland woody parts of Jamaica. The drupes are about the size of grapes, and have a pleasant flavour.

T. aspera is a native of and common in all parts of India, sometimes shrubby, but it also grows into a small crooked tree. Its leaves are oblong, unequally serrate, and so scabrous as to be employed by the natives in polishing ivory. The berries are greedily eaten by birds.

T. spinosa another Indian species, less common, is thorny; leaves oblong lanceolate, grossly serrate towards the apex, smooth; female calyx twice the length of the ovary, and eaten by the natives in their curries.

TROPIC BIRD. [Phaeton.]
TROPIDOGASTER. [Iguanidæ.]
TROPIDO'LEPIS. [Iguanidæ.]
TROPIDOLEPI'SMA. [Scincidæ.]
TROPIDO'PHORUS. [Scincidæ.]
TROPIDORHYNCHUS. [Meliphagidæ.]
TROPIDOSAURUS. [Sauria.]
TROPIDU'RUS. [Iguanidæ.]
TROUT. [Salmonidæ.]
TRUFFLE. [Tuberaceæ.]
TRUMPET-FISH. [Centriscus.]
TRUMPET-FLOWER. [Tecoma.]
TRUMPETER (Ornithology), the vulgar name for *Psophia crepitans*. [Agami.]
TRUNK OF TREES. [Age of Trees; Exogens.]
TRYGON. [Raiidæ.]

TRYPHYLINE, a Mineral occurring crystallised and massive. Primary form a right rhombic prism. Massive variety has a coarsely lamellar or crystalline structure, with cleavages parallel to the planes of a right rhombic prism. Colour greenish-gray. Streak grayish-white. Hardness 5·0. Translucent in thin pieces. Specific gravity 3·6. Found at Bodenmais in Bayern. Its analysis gives:—

Phosphoric Acid	41·47
Protoxide of Iron	48·57
Protoxide of Manganese	4·70
Lithia	3·40
Silica	0·53
Water	0·68
	——99·35

TUBE, EUSTACHIAN. [EAR.]

TUBER, in Systematic Botany. [TUBERACEÆ.]

TUBER, in Structural Botany. [EXOGENS.]

TUBERA'CEÆ, a section of the sub-order *Gasteromycetes*, of the natural order *Fungi*. It is known by its sporangia being membranaceous, and scattered on a serpentine vein-like hymenium, and included in a concrete uterus. The sporidia are at first pulpy. This section includes the genus *Tuber*, the Common Truffle, and *Rhizopogon*, the White Truffle. The species of these genera are not numerous, and are found very generally diffused throughout the temperate parts of the world, and growing buried beneath the soil.

The genus *Tuber* has a closed uterus marbled internally with veins; the sporangia are pedicillate, and confined to the veins.

T. cibarium, the Common Truffle, is known by its surface being warty and of a black colour. It is found buried in the soil of woods, especially beech-woods, sometimes at the depth of ten or twelve inches or more. It is a native of Europe, and is also found in Japan and the East Indies. It grows abundantly in some parts of England. This is one of the few species of the natural order *Fungi* that is used as an article of diet. For this purpose they appear to have been used by the Greeks and Romans; the latter especially considered them a delicacy. It may be however a question as to whether the Roman 'tuber' is really the common truffle. There can however be no doubt that it had a similar form, origin, and use. The truffle when gathered for eating is about the size of a large walnut, and has a very peculiar smell. The flavour is not remarkable, and resembles in some measure that of the mushroom and morel.

T. moschatum, Musk-Scented Truffle, has a roundish smooth blackish appearance, and is a much rarer plant than the last. It has been found in Great Britain, and is characterised by the musky odour which it gives out.

The genus *Rhizopogon* has a sessile uterus, bursting irregularly, and marbled internally with anastomosing veins and sessile sporangia. The *R. albus* of Bulliard is the *Tuber albus* of older botanists, and is called White Truffle, and by some writers, from its Greek appellation, Root-Beard.

TUBERCULARI'NI, a tribe of Plants belonging to the sub-order *Coniomycetes*, of the order *Fungi*. The species are characterised by their sporidia being glued together and forming an erumpent disc. It includes the genera *Tubercularia* and *Fusarium*. All the species are found on dead and decaying sticks and branches and trunks of trees, and on the decaying stems of various herbs. The *Tubercularia vulgaris* is a very common fungus, and is found on dead branches, especially those of the currant-tree in the autumn of the year. It forms upon these branches little scarlet or rose-coloured patches which are frequently very conspicuous. The *Fusarium roseum* forms smaller red patches than the last, and is found on the stems of decaying herbaceous plants, as those of the bean, tulip, Jerusalem artichoke, &c.

TUBEROSE. [POLIANTHES.]

TUBICINELLA. [CIRRHIPEDIA; CETACEA.]

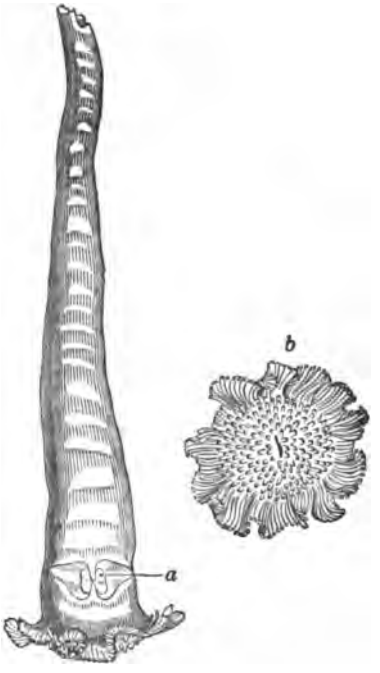
TUBICOLÆ. [ANNELIDA.]

TUBICOLI'DÆ (Lamarck), a family of Conchiferous *Mollusca*.

Lamarck observes that the *Tubicolidæ* are undoubtedly conchifers, but of such great singularity, that some among them have been referred to other classes by modern naturalists; and he adds that it is singular to find a bivalve shell inclosed in a testaceous tube, and still more singular to see it incrusted in or built into the wall of that tube, and concurring to complete such wall.

Aspergillum Novæ Zealandiæ.

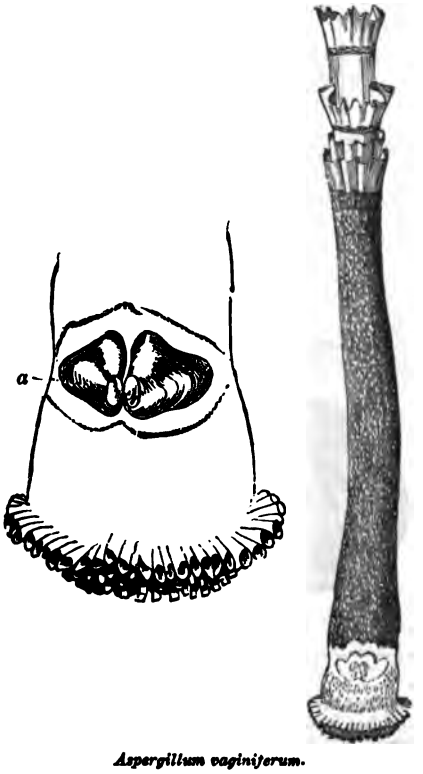
a, the valves incrusted in the tube; *b*, front view of disc.



Aspergillum Javanum.

a, the valves incrusted in the tube; *b*, front view of disc.

The singularity of the *Tubicolidæ*, as well as that of the *Pholades*, has, he further remarks, caused a misconception of the real essentials of the shells which belong to the family, namely, two similar, equal, regular valves, articulated by a hinge. As in the shells of the *Tubicolidæ* there are some which have accessory pieces apart from their valves; so, as one sees in the *Pholades*, some naturalists have taken them for multivalve shells, a notion which has given rise to very odd associations.



Aspergillum vaginiferum.

a, the valves incrusted in the tube.

The animals of this family are borers, burrowing in stone, wood, and even in thick shells; but some, nevertheless, live in the sand.

The following six genera are arranged by Lamarck under this family:—*Aspergillum*, *Clavagella*, *Fistulana*, *Septaria*, *Teredina*, and *Teredo*.

We here give figures of the more remarkable forms of the genera *Aspergillum*, *Clavagella*, and *Fistulana*, referring to the articles devoted to them for further information.

Aspergillum Javanum is a native of the East Indian Ocean.

The animal of *A. vaginiferum* has been found by M. Rüppel, and it appears to bear much analogy to that of *Pholas*. It is a native of the Red Sea.

A. Novæ Zealandiæ is a native of New Zealand.

Four species of *Clavagella* are recorded by M. Cailliaud.

1. *C. aperta*, Sow. (*C. lata*. Brod.; *C. sicula*, Delle Chiaje).
2. *C. balanorum*, Scacchi.
3. *C. elongata*, Brod.
4. *C. melitensis*, Brod.

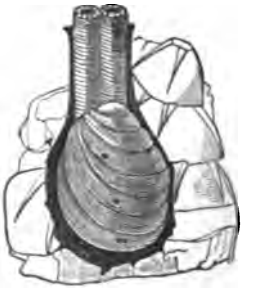
They are found in the Mediterranean and the Adriatic seas, at Nice, Venice, Naples, Palermo, and Malta.

We subjoin some of M. Cailliaud's figures, which give more information as to the shell than any yet published.

Clavagella aperta.

a, right valve in a very young state; *b*, the same more advanced, seen in the stone which has been cut to show the excavated part, and the right valve in situ: its young tube has six facets, and develops its first fimbriation or ruffle; *c*, the same still further advanced, also in the stone: its young tube has two ruffles; *d*, the same greatly increased and seen in the stone: a part of the mollusc is seen under its right valve and in its excavation, also the great muscle of the mantle and the aperture whence its small rudimentary foot comes forth; the lower extremity of the tube has been cut away to show the siphons terminated in papillæ: the tube presents five ruffles and the commencement of two others which the mollusc had not finished; *e*, another specimen, which had entered the stone horizontally, and afterwards had prolonged its tube in a perpendicular direction.

Another specimen of *Clavagella aperta*.



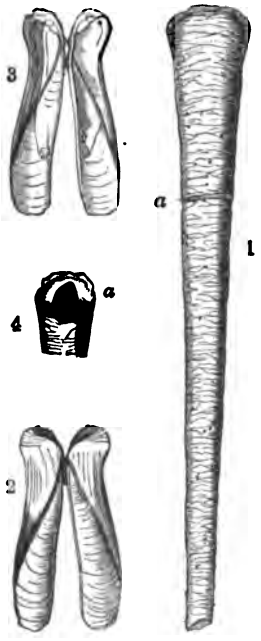
Clavagella Balanorum in an agglomeration of balani. The little tubes above noticed are here seen in the upper figure.

The genus *Fistulana* has the sheath tubular, most frequently testaceous, more convex and closed posteriorly, attenuated towards its anterior extremity, open at its summit, containing a free and bivalve shell; the valves equal, and gaping when they are closed. Animal having at its anterior part two cyathiferous calamules. (Lam.)

M. Deshayes remarks, in his last edition of the 'Animaux sans Vertèbres,' that Lamarck is evidently mistaken in supposing that the calamules, which he believed to exist in the *Fistulanæ*, were destined to carry the organs of respiration; this error, M. Deshayes observes, is rendered certain by two methods: 1st, the true *Fistulanæ*, although closed on one side, have never any calamules; 2nd, these calamules belong exclusively to the Teredines, and they have their branchiæ disposed as in all the *Conchifera*, and not dependent on these calamules.

As an illustration we give *Fistulana clava*, which is a native of the East Indian seas.

The *Fistulanæ* inhabiting a free tube have been found in sands or hard mud with the small end of the tube uppermost.



Fistulana clava. (Sowerby.)

1, showing the tube with a septum, *a*; 2, outside of the valves; 3, inside of the same. (G. B. Sowerby, 'Genera.') N.B.—Mr. Sowerby figures also a tube of this species without a septum.

TUBI'FERA, an order of *Polypiaria.*

TUBIPORÆA, or TUBIPO'RINÆ. [POLYPIFERA.]

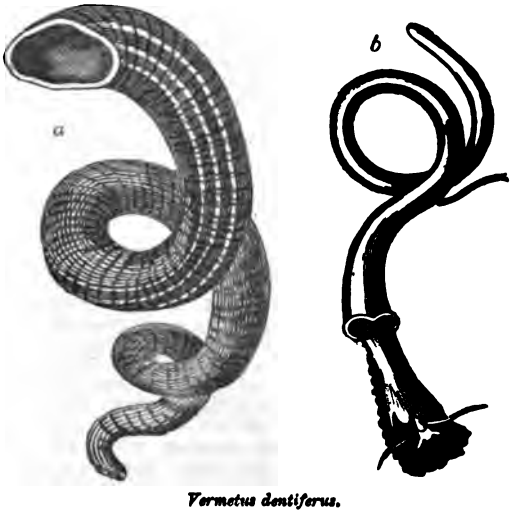
TUBULARIADÆ. [HYDROIDA.]

TUBULIBRANCHIA'TA, an order of Gasteropodous *Mollusca*, consists of the genera *Vermetus*, *Magilus*, and *Siliquaria.*

Vermetus (Adanson), has a tubular shell, the whorls of which, in the early age of the animal, form a kind of spire, but afterwards are prolonged into a tube more or less twisted or bent, like those of the tubes of *Serpulæ.* The shell is ordinarily fixed in an interlaced group of the same species, or partly enveloped in *Lithophytes.* As the animal does not creep, there is no foot properly so called; but that which in the ordinary gastropods forms the tail is bent downwards and carried forward in front of the head, where its extremity expands into a mass furnished with a delicate operculum which closes the entrance to the tube: it has sometimes various appendages, and its operculum is spiny in some species. The head of the mollusc is obtuse, and carries two moderate tentacles, which have the eyes at the sides of their external base. The mouth is a vertical orifice, and beneath it is seen on each side a filament which has all the appearance of a tentacle, but which in reality belongs to the foot. Their branchiæ only form one row, along the left side of the branchial vault.

Cuvier remarks that the species are rather numerous, but not very distinct.

V. dentiferus, a native of Australia, may be taken as an example.



Vermetus dentiferus.
a, shell; *b*, animal. ('Astrolabe.')

A single specimen of *Vermetus lumbricalis*, showing the spire.

Group of *Vermeti*, &c.

The number of species of *Vermetus* recorded by M. Deshayes in his 'Tables' amounts to eight living and one fossil (tertiary, from Angers). *Vermetus* occurs below the chalk: thus Dr. Fitton records six species, from the upper greensand, the gault, the lower greensand, Blackdown, and the Hastings sand.

The following are noticed by Messrs. Quoy and Gaimard ('Zoology of the Astrolabe'), in addition to *V. dentiferus*:—*V. Zelandicus*, *V. giganteus*, *V. carinatus*, and *V. roseus.*

Vermeti have been found at depths varying from near the surface to twelve fathoms, in sponges, under stones, on shells, in coral-sand, and sand.

Siliquaria (Brug.), resembling *Vermetus* in the head, in the position of the operculum, and in the tubular irregular shell, which has, however, throughout its length a slit which follows all its windings, and

which corresponds with a similar slit in the mantle which covers the branchial cavity. Along the whole length of this slit adheres a branchial comb, composed of a great quantity of foliations, distinct and, as it were, tubular. Linnæus placed them with the *Serpulæ*, and Cuvier observes that in these later times some have believed that they belong to the class of Annelida. Thus Lamarck supposed *Siliquaria* as well as *Vermilia* to be approximated to the *Serpulæ*.

Seven recent and ten fossil species have been recorded.

S. muricata, a native of the Indian Seas, may be taken as an example.

Siliquaria muricata.

Species of this genus have been found in sponges.

Magilus. [MAGILUS.]

TUBULIPORA. [POLYZOA.]

TUBULIPO'RADÆ. [POLYZOA.]

TUCUTUCO. [MURIDÆ.]

TUFF, or TUFA. The accumulations of scoria and ashes about a volcanic crater, which are re-aggregated so as to make a coherent or solid mass, are termed Volcanic Tuff. Similar but more ancient aggregations of the products of heat, re-aggregated into firm, solid, or even highly compact rock, are called Trap Tuff.

TULIP. [TULIPA.]

TU'LIPA, a genus of Plants belonging to the natural order *Liliaceæ*. This name is a corruption of the Persian word Thoulyban, or Toleban, which is the name the plants of this genus bear in Persia. The Persian word also signifies a turban. The genus is known by its perianth being composed of six sepals. The stigma is 3-lobed; the seeds are smooth, and it has neither nectary nor style. All the species are herbaceous plants, developed from a bulb; the flowers are mostly solitary, seated on a lengthened scape, at the base of which the leaves, not numerous, are developed. About thirty species have been described.

T. sylvestris, the Wild Tulip, has the stem 1-flowered, somewhat drooping; the leaves of the perianth ovato-acuminate, hairy at the extremity, the stamens hairy at the base. This is the only species of tulip that is a native of Great Britain. In England it occurs in the counties of Norfolk, Suffolk, Hertfordshire, and Middlesex, in a chalk soil. It has also been found in Scotland. It is found in the southern parts of Germany, in Switzerland, Italy, and France. It has yellow flowers, and blooms in April and May. It increases itself by throwing out a long stout fibre from its root, at the extremity of which a bulb is developed, and thus a new individual is produced at a considerable distance from the parent plant.

T. Oculus Solis, the Agen Tulip, has a 1-flowered glabrous stem; oblongo-lanceolate leaves; the stamens smooth; the exterior leaves of the perianth acuminate, the interior ones obtuse. This species was not known to Linnæus, and was first distinguished by St. Amans. It was found at Agen in France, and also grows wild in Italy, Germany, and other parts of Europe. The flowers are large and bell-shaped, of a fine scarlet-red colour, each petal marked with a broad black yellow-edged spot at its base. It blossoms in April and May.

T. suaveolens, the Early Dwarf, or Van Thol Tulip, is a native of the south of Europe. It blooms in March and April.

T. Celsiana, Small Yellow Tulip, has a solitary, mostly erect, flower; the leaves of the stem lanceolate; leaves of perianth greenish, lanceolate; the stamens slightly hairy above the base. This plant blossoms in March or April, and is a native of the south of Europe, and of the banks of the Volga. It was known to Clusius, Bauhin, Magnol, and Tournefort, but Linnæus confounded it with the wild tulip.

T. Clusiana, Red and White Italian Tulip. This tulip was confounded by Linnæus with the *T. Gesneriana*.

T. biflora, the Two-Flowered Yellow Tulip, is a native of the salt deserts about the Volga, and is found in company with *T. Celsiana*. The flowers are fragrant.

T. Gesneriana, Common Garden Tulip, has the stem 1-flowered and smooth, as well as the petals and filaments; the flower erect, the leaves ovato-lanceolate, glaucous and smooth; the lobes of the stigma decurrent and deeply divided. Of all the species of tulip this one is the best known, and has perhaps had more attention bestowed upon it than any other plant that produces only flowers. This species of tulip grows wild in the Levant, and appears to have been cultivated by the Turks in their gardens from an early period.

The Tulip was first introduced into France in 1611. It does not appear at what time it was first carried to Holland, but the Dutch were early in the habit of sending to Constantinople for tulip-seeds. It was in this country that the Tulip was destined to make the greatest impression. In the early part of the 17th century the passion for the possession of these plants became so strong, that dealing in them became one of the most important money speculations, and the bulbs of tulips were sold and resold at enormous prices, in the same manner as stocks are on the Stock Exchange of England. It became in fact a gambling transaction, in which persons ventured their capital, in the hope that particular kinds of tulips would realise a higher price. This practice was not carried on throughout Europe, but was confined to the Netherlands, and rose to its greatest height in the years 1634, 1635, 1636, 1637. Beckmann, in his 'History of Inventions,' gives an account of this remarkable tulipomania, as it was called. One variety of tulip, called the Viceroy, was exchanged for articles valued at 2500 florins. [TULIP, in ARTS AND SC. DIV.]

TULIP-TREE. [LIRIODENDRON.]

TUNGSTEN, a Metal. It was first obtained in its pure state in 1781. Its name is derived from 'tung sten,' two Swedish words, signifying 'heavy stone,' from the weight of one of its ores, which was also called Scheelite, in honour of the chemist Scheele.

Tungsten is found in combination with iron, lead, and lime, constituting Wolfram, Tungstate of Lead, and Tungstate of Lime. It also occurs sparingly in some ores of columbium, as in certain varieties of the minerals pyrochlore, columbite, and yttro-columbite. It is met with in very small quantities as an ochre, or as tungstic acid, forming a yellow powder on other Tungsten ores.

No use in the arts has been made of this metal or its compounds. Tungstic acid is a fine yellow, even brighter than chrome yellow, but it turns green on exposure to the sun's rays.

Tungstate of Lime occurs in square octahedrons. Cleavage octahedral, perfect. Colour yellowish-white or brownish. Brittle. Hardness 4 to 4·5. Specific gravity 6·075. It is composed of Tungstic Acid 7·8; Lime 19·06. Infusible alone, or only, on the thinnest edges.

TUNICA'TA, a family of Acephalous *Mollusca*. The following graphic description is given of these interesting forms of animal life in Forbes and Hanley's 'British Mollusca':—"Rarely is the dredge drawn up from any sea-bed at all prolific in submarine creatures, without containing few or many irregularly-shaped leathery bodies, fixed to sea-weed, rock, or shell, by one extremity or by one side, free at the other, and presenting two more or less prominent orifices, from which, on the slightest pressure, the sea-water is ejected with great force. On the sea-shore when the tide is out, we find similar bodies attached to the under surface of rough stones. They are variously, often splendidly coloured, but otherwise are unattractive, or even repulsive in aspect. These creatures are *Ascidiæ* properly so called. Numbers of them are often found clustering among tangles, like branches of some strange semitransparent fruit. They are very apathetic and inactive, living upon microscopic creatures drawn in with currents of water, by means of their ciliated respiratory organs. The leathery case is often encrusted with stones and shells, decorated with parasitical though ornamental plumes of corallines, and not seldom perforated by bivalves, which lodge themselves snugly in the tough but smooth skin. It is the analogue of the true shell of conchiferous *Mollusca*. It is a sac, closed except at two orifices, one of which is branchial, the other anal. This elastic, gelatinous, or coriaceous envelope is called the test, and incloses a second tunic or mantle, which is muscular, and adheres to the first only near the orifices. The branchial sac lines the interior of the mantle in part; it is both respiratory and pharyngeal. The remainder of the cavity is occupied with the principal organs of digestion, circulation, and generation. The chief nervous centre is situated between the two openings of the muscular tunic. The sexes of *Ascidiæ* are distinct." For our present knowledge of the structure and relations of these animals we are greatly indebted to Savigny. They were not however unknown to Aristotle. In the 'Historia Animalium,' he observes, under the head of Testaceous Animals (τὰ Ὀστρακόδερμα), that "there are some, such as those called Τήθυα, which are so entirely surrounded by their test or envelope as to have no part of their flesh exposed." So far, as Mr. M'Leay remarks, this accurately drawn character may apply to

the whole of the *Tunicata*. But Aristotle afterwards proceeds to a more definite description of the *Tethya*:—"But of all these animals (the Ostracoderms), those which are called *Tethya* have the most remarkable nature; for with them alone is the body entirely concealed in the test. This test or envelope (*τὸ ὀστρακον*) is between the texture of leather and shell, and may be consequently cut like a piece of tough hide. The animal adheres to the rocks by its test, and has two passages or orifices (*πόρους*), distant from each other, and so small as not to be easily visible: by means of these it imbibes and discharges the water. On opening one of these animals, the inside presents, in the first place, a membrane composed, as it were, of nervures (*ὑμὴν νευρώδη*), and communicating with a fleshy intestine (*τὸ σαρκῶδες*); so that the intestine of the *Tethyon* appears contained in the reticulated membrane. Although indeed the flesh is alike in all testaceous animals, this intestine resembles in form that of none of them. It is suspended at two places, namely, to the above-mentioned membrane, and to the muscle which proceeds from the side (literally, 'to the skin from the side'); and wherever it adheres to either of these it is narrowest. At each point of suspension this intestine tends towards those orifices which lead to the outside of the test, and by which it receives and discharges the food and water; so that if one of these apertures be the animal's mouth, the other must be its anus. One of these orificial processes (the branchial orifice) is thicker than the other. Within the cavity also of one or other of them there is a certain small cohering substance which divides it."

Mr. M'Leay, who, in his 'Horæ Entomologicæ,' thus translates a passage presenting almost insuperable difficulties to any but a zoological scholar, observes, that "the membrane, composed as it were of nervures," is a good description of the beautifully reticulated membrane which forms the branchiæ of the *Tethya*. Aristotle, he adds, appears however by some mistake to have considered the branchial pouch as surrounding the intestine; and he remarks that he suspects that the small cohering or continuous substance which Aristotle alludes to immediately after the mention of that part which Mr. M'Leay considers to be the branchial orifice, is the valvule of the anal orifice.

Dr. Fleming has given a very good view of this natural group in the article 'Mollusca' of the supplement to the 'Encyclopædia Britannica.'

Synopsis of the Sub-Genera.

Normal Group. 1. Branchial pouch with more than eight folds. Tentacula compound. Liver distinct.	1. *Cynthia*	Reticulation of the branchial pouch continuous.
	2. *Cæsira*, Sav.	Reticulation of the branchial pouch interrupted.
Aberrant Group. 2. Branchial pouch with only eight folds. Tentacula simple. Liver none.	3. *Styela*, Sav.	Ovaries several, one at least on each side of the body.
	4. *Pandocia*, Sav.	Ovary unique, that is, only the right one, which is comprised in the intestinal loop.
	5. *Dendrodoa*, M'Leay	Ovary unique, that is, only the left one, which is ramose or branched, and situated between the branchial pouch and the mantle.

"The *Tunicata*," says Dr. Fleming, "agree with their contiguous group the *Mollusca* in the remarkable variation that exists in their system of generation. Like every other solitary character that can possibly be adopted for the groundwork of a zoological system, the mode of generation ought to rise in importance only in inverse proportion to its degree of variation. In a group of animals for instance, where it varies according to the species, it is evidently of less importance, as affording natural characters, than among those groups where it remains less subject to variation. When the naturalist happens to consider that he ought always to obtain his group before he attempts to find its character, he is sure to perceive this truth; and it is on this very principle that Savigny, with his usual discrimination, has proceeded in the above natural arrangement of the genus *Ascidia*, which I have done little more than borrow from him. To this naturalist, whose works I cannot too often recommend to the careful attention of zoologists as models for imitation and true examples of the method in which natural history ought to be studied, I would willingly have dedicated the following genus" [DENDRODOA], "but his name happens to have been employed in other branches of the science." ('Linnæan Transactions,' vol. xiv.)

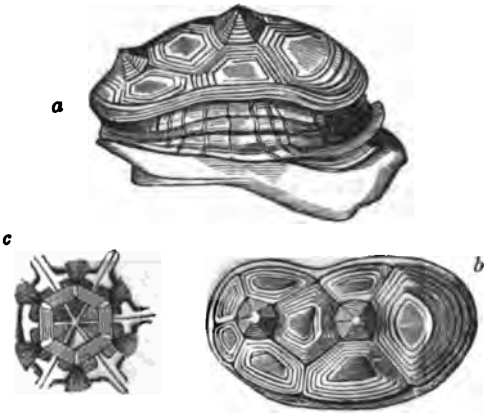
Mr. Broderip and Mr. G. B. Sowerby have described a curious form belonging to this natural group.

Group, *Tunicata*.—Family, . . . ?—Genus, *Chelyosoma*.

Generic Character.—Body sessile, fixed, involved in a coriaceous test or envelope dividedly laminate above; orifices conical, each closed with six trigonal valvules.

C. MacLeayanum is elongate-ovate, affixed at the base, flat above, octopartite, the laminæ striated; orifices prominent. It is found in the Arctic seas, adhering to stones.

This animal comes nearest to the *Tethya* above noticed, but there are no traces of tentacula surrounding the branchial orifice. It differs from the *Thalida* inasmuch as the mantle seems to adhere to the orifices only, and, instead of a simple valvule, each orifice of *Chelyosoma* is furnished with a complicated one. From the *Ascidida* it differs inasmuch as both its orifices are surrounded by six valves, instead of being quadrifid.



Chelyosoma MacLeayanum.

a, side view; *b*, seen from above; *c*, interior of valvule.

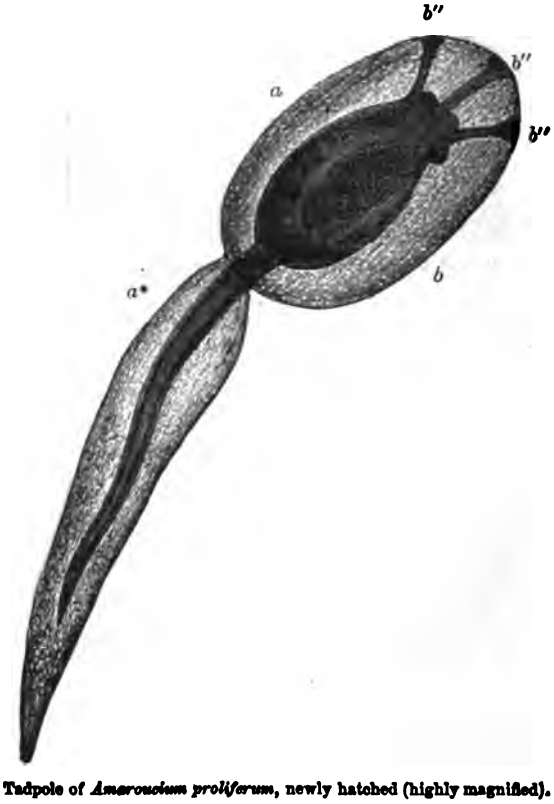
Forbes and Hanley, in their 'History of British Mollusca,' describe three genera of *Tunicata*:—

1. *Ascidia*.—Body sessile, covered with a coriaceous or gelatinous tunic; branchial orifice 8-lobed and 6-lobed. There are 16 species of this genus found on the British coasts.

2. *Molgula*, E. Forbes.—Body more or less globular, attached or free, with a membraneous tunic, usually invested with extraneous matter; orifices on very contractile and naked tubes; the branchial 6-lobed, the anal 4-lobed. Two species are British.

3. *Cynthia* [CYNTHIA], of which there are 13 species. [CLAVELINIDÆ; BOTRYLLIDÆ; MOLLUSCA; MALACOLOGY; BOLTENIA.]

The compound (and most probably all the) Ascidians, in their first state of development, after leaving the egg, assume the form of Tadpoles, and are locomotive by means of a vibratile tail, which they cast off when they quit the larva state and assume the sessile condition.



Tadpole of *Amaroucium proliferum*, newly hatched (highly magnified).

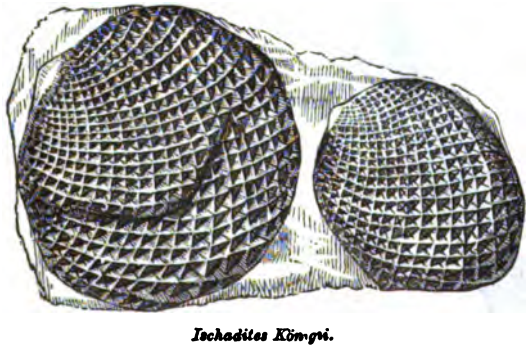
a, tegumentary body of the trunk seen within the pouch; *b*, pouch inclosing the vitellus, and forming the tunic of the body of the larva; *b''*, appendages terminating in suckers and enabling the animal to fix itself; *a**, tail formed by a prolongation of the tegumentary body, and inclosing a tubular appendage of the vitelline sac. (Milne-Edwards.)

This metamorphosis was observed by Sir John Graham Dalyell, both in a solitary and compound Ascidian, namely, in *Ascidia papilla* (solitary) and in *Aplidium verrucosum* (compound). (See 'Edinburgh New Philosophical Journal,' January, 1839, vol. xxvi., p. 152.) But in 1828 Messrs. Audouin and Milne-Edwards had proved that the compound Ascidians are at their birth endowed with sufficiently extensive locomotive faculties, and that, in the progress of age, they underwent a true metamorphosis ('Ann. des Sciences Nat.,' 1828, tome xv., p. 10); and M. Sars, as well as Sir John Graham Dalyell, subsequently verified the fact, which had been doubted by certain naturalists. The observations of M. Sars were made upon the *Botrylli* of the Norwegian coasts. The metamorphosis of these animals is admirably described and figured in the beautifully-illustrated paper by M. Milne-Edwards, entitled, 'Observations sur les Ascidies composées des Côtes de La Manche,' read before the French Academy of Sciences on the 11th of November, 1839, wherein the structure and general physiology of these highly-interesting animals is explained in a masterly manner.

Amaroucium proliferum, natural size.

Mass of the same species, magnified. (Milne-Edwards.)

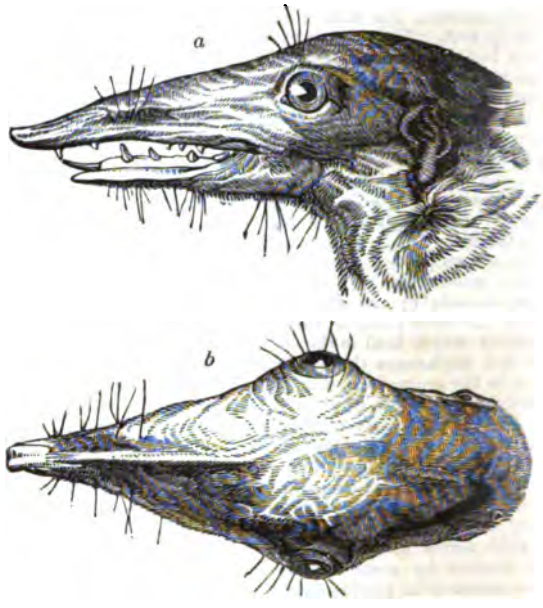
A fossil, supposed to belong to the *Tunicata*, has been figured and described by Sir Roderick Murchison in his 'Silurian System,' to which the name *Ischadites Königii* has been given.



Ischadites Königii.

TUNNY. [SCOMBRIDÆ.]

TUPAIA, Sir T. Stamford Raffles's name for a genus of *Mammalia* which Dr. Horsfield places among Cuvier's Insectivorous Carnassiers, the *Feræ* of Linnæus, and the *Falculata* of Illiger. It has the following generic characters:—Head oblong, depressed. Snout long, equally attenuated; nostrils lateral, semilunar. Eyes very large, and rather prominent. Ears large and oblong. Body cylindrical, covered with close fur and soft hairs. Tail longer than the body, linear, compressed. Feet plantigrade and pentadactyle, the soles naked, the toes compressed, and the claws falcular.

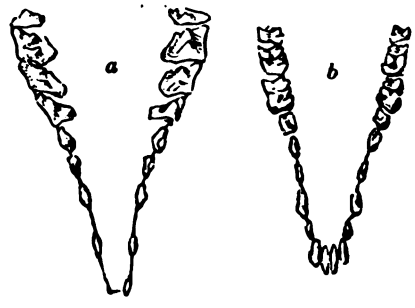


Head of *Tupaia tana*, natural size.
a, profile; *b*, seen from above. (Horsfield.)

In the Malayan language the name of *Tupai* is a general term for various small animals which have the external form and agility of the squirrel.

T. Javanica; Bangsring, or Sinsring, of the Javanese. Dr. Horsfield says that this species has the appearance of a sprightly animal, a character with which its manners, as far as they are known, perfectly agree. "Its body," says Dr. Horsfield, "is graceful and handsomely formed, and its limbs are slender and fitted for great agility: its size and exterior habits so nearly resemble the individuals of that family which Illiger has denominated *Animalia Agilia*, that, on a superficial view, it has been considered to belong to it. Our animal agrees with one of the most numerous sections of this family, the Squirrels, in the form of the body, the proportional length of the extremities, the breadth of the tail, and the faculty of carrying it on the back as a plume; but the succeeding details will show that its structure and organisation are essentially different."

Dental Formula:—Incisors, $\frac{2}{6}$; Canines, $\frac{2}{2}$; Molars, $\frac{14}{12}$.



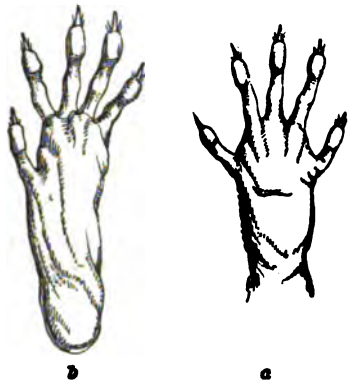
Teeth of *Tupaia Javanica*.

a, upper jaw: in this view the animal is supposed to be laid on its back, and the spectator to be looking down on the upper jaw; *b*, lower jaw seen from above. (Horsfield.)

Dr. Horsfield describes the claws as sharp, compressed, and curved: and, in comparison with those of *Sorex* and several other genera of this order, of considerable strength: they are, he observes, individually supported by a small protuberance similar to that which is found in the *Tarsii;* and the construction of the claws in the Bangsring is adapted, he remarks, to the same food and habits as those of the other species of *Tupaia*. The linear tail, of the same length as the body, is compressed, with the hairs spreading far on each side; but, adds Dr. Horsfield, it is less full and ornamental than in the Squirrel. The fur of the Bangsring is close, silky, and delicate, with a few longer, more rigid, and darker-coloured hairs dispersed among the long and straight hairs closely applied to the skin, with which the back, neck, sides, tail, and extremities above are furnished. The upper parts are brown, slightly diversified with gray of different shades; the lower

parts dirty white, with a slight tint of grayish: the tail agrees with the upper parts; and the scapular line, which is nearly an inch long, agrees with the neck.

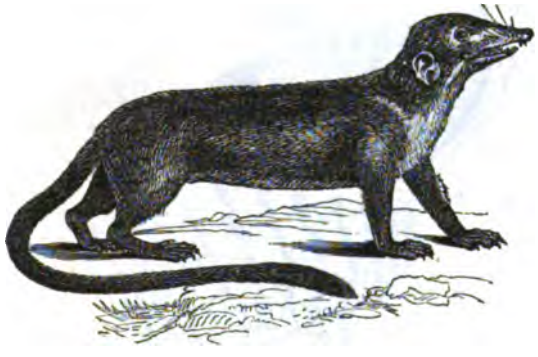
Head of *Tupaia Javanica*. (Horsfield.)



b *a*

a, fore foot of *Tupaia Javanica*; *b*, hind foot of the same. (Horsfield.)

The Banguring fell under Dr. Horsfield's observation during an early period of his researches in Java. In traversing the province of Blambangan, in 1806, he discovered it in the extensive forests which almost entirely cover the eastern extremity of the island; and he thinks that its range, though it may not be confined exclusively to that province, is extremely limited.



Tupaia Javanica. (Horsfield.)

Sir Stamford Raffles states that a tame *Tupaia ferruginea* was suffered to go about at perfect liberty, ranged in freedom over the whole house, and never failed to present himself on the breakfast and dinner-table, where he partook of fruit and milk.

TUPINAMBIS. [MONITORIDÆ.]

TUPISTRA, a genus of Plants nearly allied to the natural order *Smilaceæ*, and referred by Lindley to the order *Liliaceæ*.

TURBINA'CEA, M. De Blainville's name for his sixth family of *Polythalamacea*, including the genera *Cibicides* and *Rotalites*, microscopic *Foraminifera*. Lamarck's *Turbinacea* might include M. D'Orbigny's *Scisurella*. [TURBINIDÆ.]

TURBINELLA. [SIPHONOSTOMATA.]

TURBI'NIDÆ, a family of Gasteropodous *Mollusca*.

Linnæus places his genus *Turbo*, in his last edition of the 'Systema Naturæ,' between *Trochus* and *Helix*, with the following characters:—Animal a *Limax*, or Slug. Shell univalve, spiral, solid. Aperture narrowed, orbiculate, entire.

The *Turbinacea* of Lamarck belong to his first section of Trachelipods, and constitute the last family of his Phytiphagous or Plant-Eating Trachelipods, those, namely, which in general have no proboscis, but a muzzle with two jaws, and which appear to be simply herbivorous; those, finally, whose shell offers at the base of its aperture neither notch directed backwards nor any canal whatever. All are marine shells, conoid or turriculate, and appear to be provided with an operculum. When one of these shells is placed on its base, its axis is always inclined more or less, and is never vertical. ('Animaux sans Vertèbres.')

Lamarck's *Turbinacea* consist of the genera *Solarium*, *Rotella*, *Trochus*, *Monodonta*, *Turbo*, *Planaxis*, *Phasianella*, and *Turritella*.

The Sabots (*Turbo*, Linn.) of Cuvier comprise the Sabots properly so called (*Turbo*, Lam.); *Pleurotomaria*, of which he considers the *Scissurellæ* of D'Orbigny living species; *Turritella*, Lam.; *Scalaria*, Lam., and the terrestrial and fresh-water genera *Cyclostoma*, Lam., and *Valvata*, Müller. [TROCHIDÆ.]

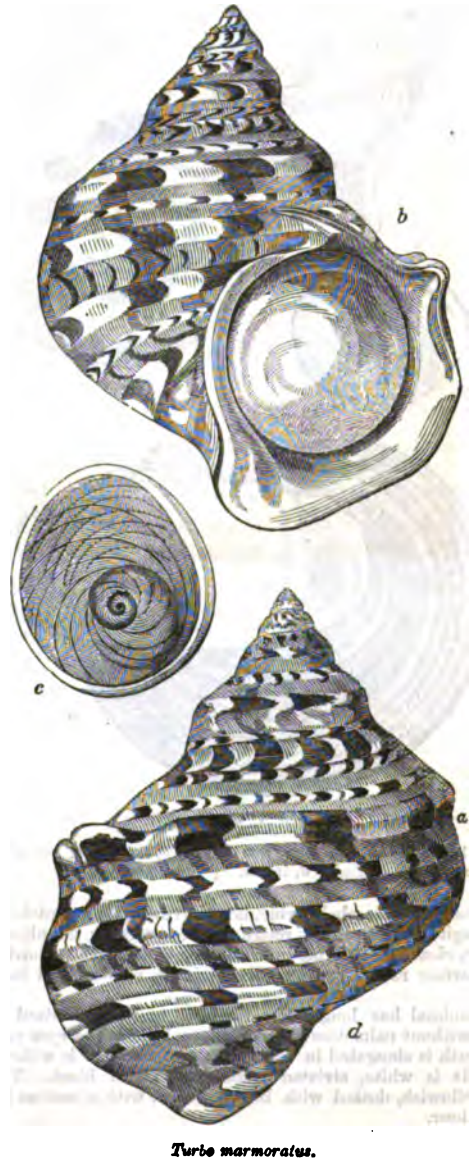
The *Cricostomata* of M. De Blainville consist of the genera *Turbo*, *Pleurotomarium*, *Delphinula*, *Turritella*, *Proto*, *Scalaria*, *Vermetus*, *Siliquaria*, *Magilus*, *Valvata*, *Cyclostoma*, and *Paludina*.

In Woodward's 'Manual of the Mollusca' the *Turbinidæ* are thus defined:—Shell spiral, turbinated or pyramidal, nacreous inside; operculum calcareous and paucispiral, or horny and multispiral. Animal with a short muzzle; eyes pedunculated at the outer bases of the long and slender tentacles; head and sides ornamented with fringed lobes and tentacular filaments (cirri); branchial plume single; lingual ribbon long and linear, chiefly contained in the visceral cavity; median teeth broad; laterals 5, denticulated; uncini very numerous (sometimes nearly 100), slender, with hooked points.

The shells of nearly all the *Turbinidæ* are brilliantly pearly, when the epidermis and outer layer of shell are removed. Many of them are used in this state for ornamental purposes.

The following genera are embraced in the family thus defined:—

Turbo.—Shell turbinated, solid; whorls convex, often grooved or tuberculated; aperture large, rounded, slightly produced in front; operculum shelly and solid, callous outside and smooth, or variously



Turbo marmoratus.

a, view of back; *b*, view of mouth with the operculum in; *c*, inside of operculum.

grooved and mammillated, internally horny and paucispiral. In *T. sarmaticus* the exterior of the operculum is botryoidal, like some of the tufaceous deposits of petrifying wells. Animal with pectinated head-lobes.

There are 60 recent species which are found principally in tropical seas. The fossil species amount to 360, found in the Lower Silurian rocks.

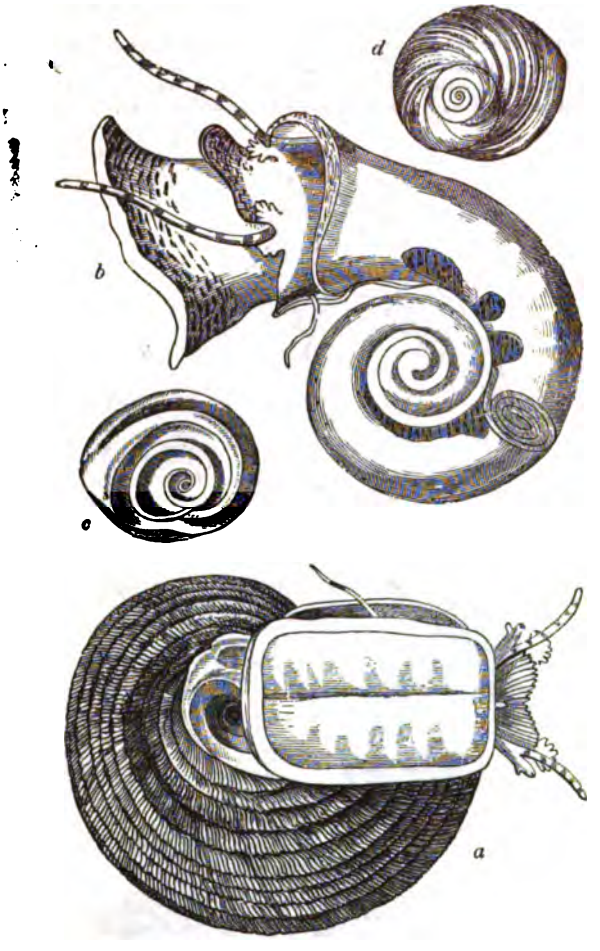
T. marmoratus has the shell subovate, very ventricose, imperforate, smooth, green marbled with white and brown or subfasciated; the last whorl transversely nodulous in a triple series, the upper nodules greatest; the lip at the base flattened into a short subreflected tail-like process; mouth silvery.

This shell when deprived of its external layer exhibits a silvery, iridescent, and very brilliant nacre.

T. torquatus has the shell orbiculate-convex, broadly and deeply umbilicated, transversely sulcated, substriated with close-set longitudinal lamellæ of a gray-green colour; whorls above, coronated; the last girt with a median carina; spire blunt at the apex. (Lam.)

The shell, when deprived of its first layer, is beautifully nacreous.

This species, which grows to a large size, inhabits King George' Sound. Only a few individuals were found alive.



Turbo torquatus.

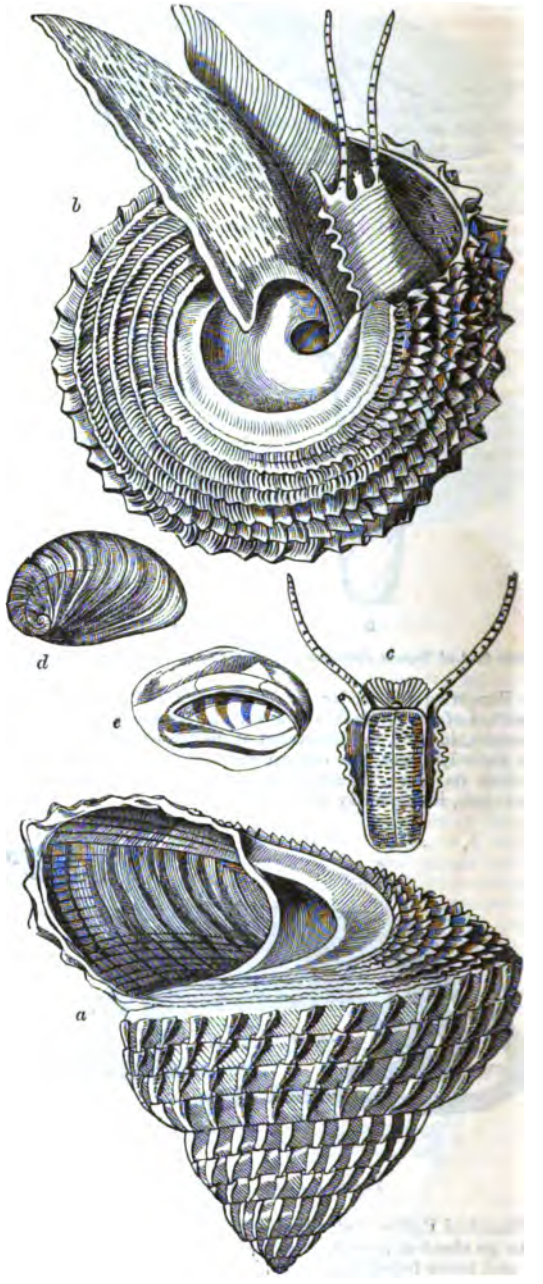
a, Shell with the animal, seen from below; *b*, the animal out of the shell; *c*, outside of the operculum; *d*, inside. ('Astrolabe.')

T. Cookii has the shell orbiculate-convex, with a ventricose dilated base, longitudinally plicate, rough, rufo-fuscescent; the plications very frequent, close-set, oblique, imbricato-squamous; the whorls convex; lower surface rather convex, concentrically rugous, and imperforate. (Lam.)

The animal has long filiform white tentacles, dotted with red-brown, without palmettes at their internal part; the eyes pediculated. The mouth is elongated in form of a proboscis, or is widened into a hood. It is white, striated transversely with black. The foot is large, yellowish, dotted with brown below, with a median line of the same colour.

The operculum is oval, rounded at one of its extremities with an oblong fosset, sometimes paucispiral. It is white and greenish. Its spiral is less pronounced than in the greater portion of the other Turbines.

Messrs. Quoy and Gaimard found this species in great numbers in Tasman's Bay, New Zealand, in the Bight of the Astrolabe (L'Anse-de-l'Astrolabe), and on the reefs of the Passe-des-Français.



Turbo Cookii.

a, Shell; *b*, shell seen from below, animal nearly in profile; *c*, anterior part of animal seen from below; *d*, inside of operculum; *e*, outside. ('Astrolabe.')

Phasianella.—Shell elongated, polished, richly coloured; whorls convex; aperture oval, not pearly; inner lip callous, outer thin; operculum shelly, callous outside, subspiral inside.

Animal with long ciliated tentacles; head-lobes pectinated, wanting in the minute species; neck-lobes fringed; sides ornamented with 3 cirrhi; branchial plume long, partly free; foot rounded in front, pointed behind, its sides moved alternately in walking; lingual teeth even-edged; laterals 5, hooked, denticulated; uncini about 70, gradually diminishing outwards, hooked, and denticulated.

The *Phasianellæ* are always smooth. This polish, and still more their continual movements, prevent them from being covered with *Serpulæ*, *Flustræ*, and other parasites which encrust sluggish shells. This agitation makes it difficult for them to preserve the contour of their aperture perfect, for it is very frail.

These are lively active animals, and voracious withal, for they were taken in nets baited with flesh let down into the sea. Their foot, endowed with great mobility, is elongated like a proboscis; its great peculiarity is its faculty of moving in two portions as it were, that is

to say, each of its sides advances separately and successively; and a longitudinal gutter may be perceived on its lower surface.

On the coasts of Australia, the *Phasianellæ* found at King George's Sound are larger and less numerous than at Port Western. They are few in number on the coasts of Van Diemen's Land. The operculum is always calcareous.

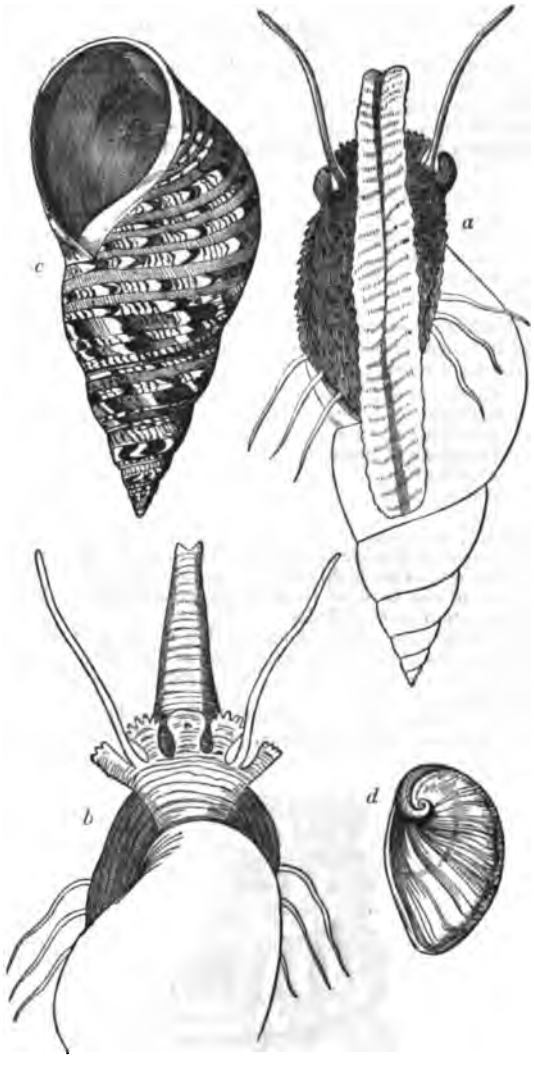
P. bulimoides. Shell oblong-conical, smooth, pale yellow, transversely banded; the bands frequent and diversely variegated and spotted; spire acute at the apex.

The animals are generally of a fine green nearly throughout. One will have more white dots on the foot, and another a violet or reddish spot on the lateral fringes on the foot; a third will have this organ yellowish and slightly fringed upon the borders. In all the tentacles are slender and long, the ocular peduncles stout and button-shaped, the palmettes laciniated. The muzzle, which is elongated a little in the form of a proboscis not retractile, can also modify itself into the shape of a rounded scutcheon (écusson). The fringes of the sides of the feet are very finely laciniated, and sometimes present brown ramifications of vessels; they carry three greenish filaments on each side.

The operculum is oval, calcareous, slightly convex, white, and covered for a portion of its contour by a fleshy lamina of the foot which supports it.

They are very common at Port Western, being the species above alluded to, and larger at King George's Sound.

Woodward records 25 recent and 70 fossil species.



Phasianella bulimoides.

a, animal and shell, seen from below; *b*, the same seen from above; *c*, shell, *d*, operculum. ('Astrolabe.')

Imperator has the shell trochiform, thick, with a flat or concave base; whorls keeled or stellated; aperture angulated outside, brilliantly pearly; operculum shelly. The species, about 20 in number, are found in South Africa, Australia, and New Zealand.

Trochus. [TROCHIDÆ.]

Rotella.—Shell lenticular, polished; spine depressed; base callous; lingual teeth 13; uncini numerous, subequal. There are 10 species found in India, the Philippines, China, and New Zealand.

Monodonta.—Shell turbinated, few-whorled; whorls spirally grooved and granulated; lips thickened internally and grooved; columella toothed, more or less prominently and irregularly; operculum horny and many-whorled. There are 10 species found in West Africa, the Red Sea, India, and Australia.

Delphinula.—Shell orbicular, depressed; whorls few, angulated, rugose, or spiny; aperture round, pearly; peristome continuous; umbilicus open; operculum horny, many-whorled. Animal without head-lobes; sides lobed and serrated. Twenty recent species, and about thirty fossil species have been recorded. *Liotia*, *Collonia*, and *Cyclostrema* are sub-genera.

Adeorbis.—Shell minute, not nacreous, depressed, few-whorled, deeply umbilicated; peristome entire, nearly continuous, sinuated in its inner side, and slightly so externally. Operculum shelly, multi-spiral.

Euomphalus.—Shell depressed or discoidal; whorls angular or coronated; aperture polygonal; umbilicus very large; operculum shelly, round, multi-spiral. (Salter.)

There are 80 fossil species.

Stomatella.—Shell ear-shaped, regular; spire small; aperture oblong, very large and oblique, nacreous; lip thin, even-edged; operculum circular, horny, multi-spiral. They are found on reefs and under stones at low-water.

Twenty species are recorded from the Cape, India, North Australia, China, Japan, and the Philippines.

Broderipia, Gray.—Shell minute, limpet-shaped, with a posterior submarginal apex; aperture oval, as large as the shell, brilliantly nacreous. Three species are found in the Philippines, Grimwood's Island, and the South Seas. (Cuming).

TURBINO'LIA. [MADREPHYLLICEA.]
TURBINOLIDÆ. [POLYPIFERA.]
TURBINOLOPSIS. [MADREPHYLLICEA.]
TURBO. [SCALARIA; TURBINIDÆ.]
TURBOT. [PLEURONECTIDÆ.]
TURDIDÆ. [MERULIDÆ.]
TURDUS. [MERULIDÆ.]
TURDUS SORDIDUS. [SWALLOW-TRIBE.]
TURF. [BOG.]
TURGITE, a Mineral from the Ural, consisting of peroxide of iron.
TURK'S CAP LILY. [LILIUM.]
TURKEY. [PAVONIDÆ.]
TURKEY-BERRIES. [RHAMNUS.]
TURKEY-BUZZARD (*Vultur aura*, Linn.); genus *Cathartes*, Ill.

Under the name of *V. aura*, two species at least have been confounded, one the true *V. aura*, and the other the *Urubu*, *V. atratus*: the former is figured by Wilson, pl. 75, f. 1, and the latter in the same plate, f. 2.

Mr. Darwin ('Journal,' 1839), after a most interesting account of the habits of the Caracaras (*Polyborus*), gives the following account of the two birds:—"We have now only to mention the Turkey-Buzzard (*V. aura*) and the Gallinazo. The former is found wherever the country is moderately damp, from Cape Horn to North America. Different from the *Polyborus Brasiliensis* and *Chimango*, it has found its way to the Falkland Islands. The Turkey-Buzzard is a solitary bird, or, at most, goes in pairs. It may at once be recognised from a long distance, by its lofty, soaring, and most elegant flight. It is well known to be a true carrion-feeder. On the west coast of Patagonia, among the thickly-wooded islets and broken land, it lives exclusively on what the sea throws up, and on the carcasses of dead seals. Wherever these animals are congregated on the rocks, there the vultures may be seen. The Gallinazo (*Cathartes atratus*) has a different range from the last species, as it never occurs to the southward of 41° S. lat. Azara states that there existed a tradition that these birds, at the time of the conquest, were not to be found at Monte Video, but that they subsequently followed the inhabitants from the more northern districts. At the present day they are numerous in the valley of the Colorado, which is 300 miles due south of Monte Video. It seems probable that this additional migration has happened since the time of Azara. The Gallinazo generally prefers a humid climate, or rather the neighbourhood of fresh water: hence it is extremely abundant in Brazil and La Plata, while it is never found on the desert and arid plains of Northern Patagonia, excepting near some stream. These birds frequent the whole Pampas to the foot of the Cordillera, but I never saw or heard of one in Chili; in Peru they are preserved as scavengers. These vultures certainly may be called gregarious, for they seem to have pleasure in society, and are not solely brought together by the attraction of a common prey. On a fine day a flock may often be observed at a great height, each bird wheeling round and round without closing its wings, in the most graceful evolutions. This is clearly done for sport-sake, or perhaps is connected with their matrimonial alliances."

Nuttall remarks that the Turkey-Buzzard has not been known to breed north of New Jersey in any of the Atlantic States; and he says that they seek out the swampy solitudes, and, without forming any nest, deposit from two to four eggs in the stump of a hollow

tree or log, on the mere fragments of rotten wood with which it is ordinarily strewed. Occasionally, in the Southern States, they have, he tell us, been known to make choice of the ruined chimney of a deserted house for this purpose. The eggs, which are described as being larger than those of a turkey, are yellowish-white, blotched irregularly with dark-brown or blackish spots, at the larger end chiefly. The male often attends while the female is sitting; and, if not materially disturbed, they will continue to occupy the same place for several years in succession. The young, which are covered with a whitish down, will, like their parents, eject the filthy contents of their stomachs over those who molest them. ('Manual of the Ornithology of the United States and of Canada.')

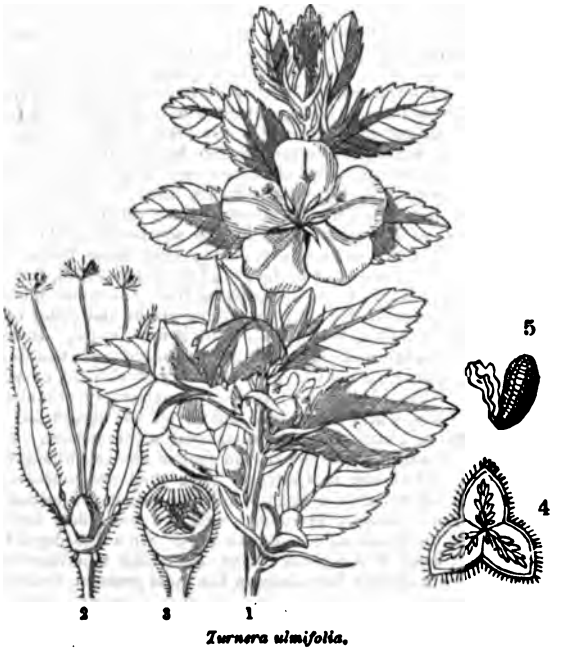
Turkey-Buzzard (*Vultur aura*).

TURKEY-HONE, a common name of *Whetslate* or *Novaculite*. [SLATE.]

TURMERIC. [CURCUMA.]

TURNERA. [TURNERACEÆ.]

TURNERA'CEÆ, a natural order of Exogenous Plants. It possesses an inferior calyx, often coloured, having 5 equal lobes imbricated in æstivation; 5 petals, which are inserted into the tube of the calyx, equal and twisted in æstivation; 5 stamens, which are also inserted into the calyx below the point of insertion of the petals, with which they alternate with oblong 2-celled anthers; a superior ovary 1-celled, with 3 parietal placentæ, indefinite ovules, 3 or 6 styles, which cohere more or less together; a 3-valved capsule, the valves bearing the placentæ in the middle, and opening from about as far as the middle of the capsule; seeds with a reticulated testa and a membranous aril, and a slightly-curved embryo lying in the midst of fleshy albumen, and having the radicle turned towards the hilum. This order has only two genera, *Turnera* and *Piriqueta*. All the species are herbaceous plants, in some instances having a tendency to become shrubby.



Turnera ulmifolia.

1, cutting, showing axillary solitary flowers; 2, section of flower, with ovary, style, and multifid stigma; 3, section of capsule; 4, valves with parietal placentæ; 5, seed with reticulated testa and aril.

The affinities of this order are with *Pourquieraceæ*, *Cistaceæ*, *Malvaceæ*, *Loasaceæ*, and *Passifloraceæ*, especially with the two last. The species of this order are exclusively natives of the West Indies and South America.

TURNERITE, a Mineral occurring in attached crystals. Primary form an oblique rhombic prism. Cleavage parallel to both diagonals of the prism. Fracture conchoidal. Hardness 4·5 to 5·0; readily scratches phosphate of lime. Colour yellow or brownish-yellow. Lustre vitreous. Translucent; transparent. Dissolves almost entirely in hydrochloric acid. It is found at Mont-Sorel, in the department of Isère. It consists principally of alumina, lime, and magnesia, with a small quantity of iron, and a minute portion of silica.

TURNIP. [BRASSICA.]

TURNIP-FLY. [HALTICA.]

TURNIX. [PERDICIDÆ.]

TURNSOLE. [HELIOTROPIUM; SUN-FLOWER.]

TURNSTONE. [CHARADRIADÆ.]

TURPENTINE is a name applied to the resinous secretion which exudes from most of the species of Coniferous Plants. [CONIFERÆ.] It consists of a mixture of oil of turpentine and resin. The oil of turpentine is obtained for commercial purposes by distilling the turpentine. The resin which is left after the distillation of the oil of turpentine is the rosin of the shops. [OIL OF TURPENTINE, in ARTS AND SC. DIV.]

TURPENTINE-TREE, a name given to some of the species of trees belonging to the genus *Pistacia*. [PISTACIA.]

TURPI'NIA, a small genus of trees of the natural order *Celastraceæ*, named in honour of M. Turpin, a French botanical artist. *T. pomifera*, an Indian species, is called Junki-Jam in Silhet, where it bears a yellow roundish fruit of the size of a medlar.

TURQUOISE (*Calaite*, *Odontolite*), a Mineral occurring in botryoidal or mammillated masses. Colour greenish-blue, of various shades. Fracture conchoidal, rough, and uneven. Commonly opaque; sometimes translucent on the edges. Streak white. Hardness 5·0 to 6·0. Specific gravity 2·8 to 3·0. It occurs in alluvial clay in Persia. It has been found to consist of—

Phosphoric Acid	30·90
Alumina	44·50
Oxide of Copper	3·75
Oxide of Iron	1·80
Water	19·00
	——99·95

The Occidental Turquoise, found near Simon, in Lower Languedoc, is stated to be merely bone coloured by phosphate of iron. According to La Grange, it consists of—

Phosphate of Lime	80·0
Carbonate of Lime	8·0
Phosphate of Iron	2·0
Phosphate of Magnesia	2·0
Alumina	1·5
Water	1·6
	——95·1

TURRÆA, a genus of Plants belonging to the natural order *Meliaceæ*, named in honour of an Italian botanist, G. Turra of Padua. Many of the species are highly ornamental, forming trees or shrubs in the interior of the Cape of Good Hope, in Madagascar, Mauritius, and in the eastern parts of India.

TURRILITES, De Montfort's name for a genus of Testaceous *Polythalamacea*, occurring in a fossil state in the Cretaceous Formations. Mr. Sowerby ('Min. Conch.,' vol i. page 81) gives the generic character thus:—

Shell spiral, turreted, chambered; the turns contiguous, all visible; chambers divided by sinuous septa, pierced in their discs; aperture round.

Turrilites costatus.

As far as we know, nearly all the species are sinistrorsal; the septa have generally the sinuosities of *Ammonites*, and the siphuncle is described by Mr. Sowerby as situated near the upper (external) part of the whorls. The cavity beyond the last chamber was very large, as in *Nautilus*, and probably inclosed the greater part of the animal, so that the shell was external. The British species (*T. costatus*, *T. tuberculatus*, *T. Bergeri*, *T. undulatus*, *T. obliquus*, of 'Min. Conchology') belong to the Chalk and Greensand, and these appear to be the strata which inclose the same and other species in France and other countries.

T. costatus may be taken as an example.

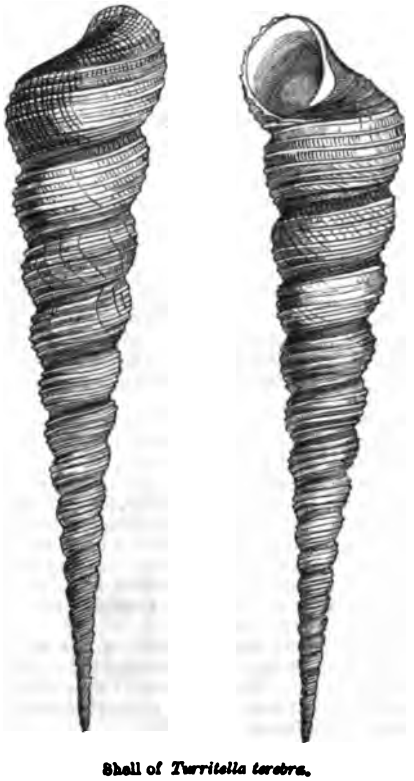
TURRIS. [ACALEPHÆ.]

TURRITELLA, a genus of Gasteropodous *Mollusca*.

Shell turriculated, pointed, rather delicate, generally striated in the longitudinal direction of the whorls of the spire, which are numerous; aperture rounded, entire, with the edges of the lip disunited above; the outer or right lip fragile. Operculum horny, its elements concentric.

Turritella rosea.

a, Shell and animal; *b*, operculum. ('Astrolabe.')



Shell of *Turritella terebra*.

T. rosea, Quoy and Gaim., has the shell elongate-conical, smooth, transversely very slightly furrowed, rosy; the whorls convex; the spire acute; the aperture subquadrate.

Animal with the head elongated into a proboscidiform muzzle, brown dotted with black. The tentacles are moderately long, obtuse, white, carrying sessile eyes very near their base. The foot in elongating itself has a quadrilateral form, a little widened in front; it is greenish or yellowish, dotted with brown. The mantle has its contour fringed and sprinkled with whitish lunules, disposed in a rather regular manner.

Operculum very delicate, round, and multispiral, like that of the *Cerithia*. ('Astrolabe.')

It was found in L'Anse-de-l'Astrolabe at New Zealand, at some fathoms depth. Messrs. Quoy and Gaimard state that their dredge brought up thousands of dead individuals, among which very few living ones were found. They describe them as timid animals, seldom developing themselves like the *Cerithia*. Length 2 inches 8 lines; breadth 2 lines.

T. terebra is found in the African and Indian seas. (Lam.)

Woodward gives 50 as the number of recent species, and 150 fossil.

TURTLE. [CHELONIA.]

TURTLE-DOVE. [COLUMBIDÆ.]

TURTONIA, a genus of Conchiferous *Mollusca*, named by Mr. Hanley after Dr. Turton. There is but one species, *T. minuta*, which has been separated from the genus *Kellia*. The shell is oblong, inequilateral, anterior side very short; ligament concealed between the valves; hinge-teeth 2—2. Animal with the mantle open in front; foot large, keeled; siphon single, slender, elongated, protruded from the long end of the shell. It is found in Great Britain; also in Norway and Greenland. (Forbes and Hanley, *British Mollusca*.)

TURTUR. [COLUMBIDÆ.]

TUSSILA'GO (from 'tussis,' a cough), a genus of Plants belonging to the natural order *Compositæ*. It has a simple involucrum, formed of a row of equal linear scales; the flowers of the head, of different sexes; the flowers of the margin, female, ligulate, entire; the flowers of the disc, hermaphrodite, tubular, 5-toothed; the stigmas linear; the receptacle naked; the pappus simple. The species are natives of Europe and America. Two are natives of Great Britain.

T. Farfara, Common Coltsfoot, has a single-flowered scape imbricated with scales, and cordate angular leaves, toothed, and downy beneath. This plant is a native of moist chalky and clayey situations throughout Europe. Its flowers come up in March and April, and have often disappeared before the leaves ascend from the ground. Dr. Sibthorp found this plant in Greece, and believes it to be identical with the Βήχιον of Dioscorides. It derives its specific name, Farfara, from its leaves resembling those of the white poplar, which was called Farfarus by the Greeks. [COLTSFOOT, in ARTS AND SC. DIV.]

TUTSAN. [HYPERICACEÆ.]

TYLO'PHORA, a genus of Plants belonging to the natural order *Asclepiadaceæ*. *T. asthmatica* is very common in the peninsula of India, and called in Telinga 'kaka-palla.' Dr. Roxburgh describes it as being frequently employed there as a substitute for ipecacuanha.

TYLOS. [ISOPODA.]

TYMPANUM. [EAR.]

TYNDARIDEA. [ALGÆ.]

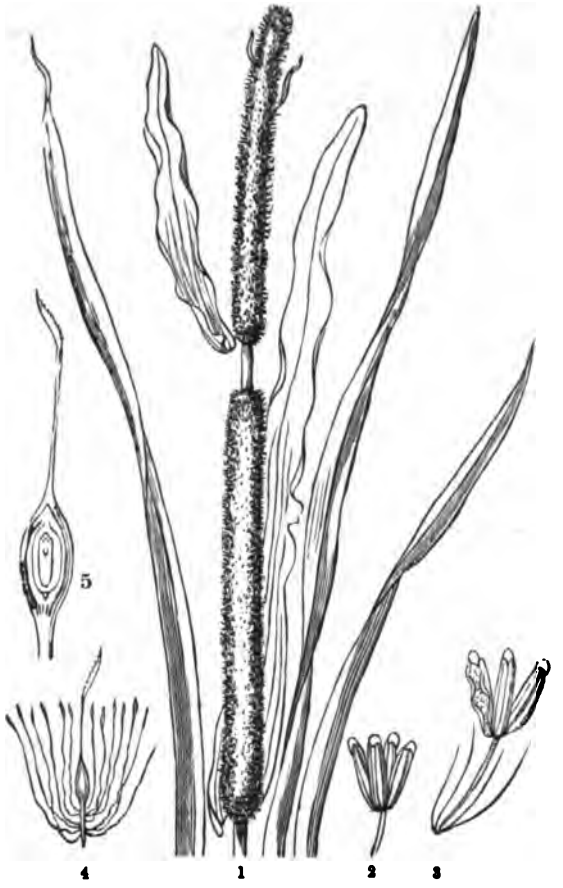
TYPHA. [TYPHACEÆ.]

TYPHA'CEÆ, *Typhads*, or *Bullrushes*, a natural order of Plants belonging to Lindley's spadicose group of Monocotyledons. The order includes two genera—*Typha* and *Sparganium*. They are herbaceous plants, growing in marshes and ditches, having stems without nodi and perennial rhizomata; the leaves are rigid, ensiform, and with parallel veins; the inflorescence is spicate or capitate, without a spathe; the flowers are unisexual; sepals 3 or more, sometimes merely a bundle of hairs; no petals; the male flowers have 3 or 6 stamens; the female flowers have a single superior 1-celled ovary; the fruit is dry, 1-celled, and 1-seeded; the embryo is in the centre of the albumen. The species of the two genera are abundant in the northern parts of the world, and are mostly absent in tropical countries.

The genus *Typha* is known by the male and female flowers being both seated on the same spike, the male flowers being uppermost; the stamens are setose, and united by the filaments; the ovarium is surrounded by setæ (*fig.* 4); and the style is persistent. There are three species of this genus, inhabitants of the temperate parts of the globe, and all are found in Great Britain. The name *Typha* is derived from Τυφος, a 'marsh,' because these plants grow in marshy places. In English they are called Cat's-Tail and Reed-Mace, the former from the resemblance of their spikes to the tail of a cat. They are frequently called Bullrushes, but this name is restricted to another genus, the *Scirpus*.

T. latifolia, Great Cat's-Tail or Reed-Mace, has linear nearly plane leaves, with the sterile and fertile flowers continuous. This is a very handsome aquatic, and grows abundantly in damp marshy places. The leaves are three feet in length and an inch in width. When the densely crowded spike is brushed and a lighted candle applied near it, a sudden flash is produced. This arises from the firing of the pollen that is diffused in the air. On the Continent the down of the flowers is used for stuffing pillows, &c. Cattle are fond of the leaves, and the roots are sometimes eaten as a salad. In common with *Sparganium*

and *Scirpus*, the leaves are used by coopers for filling up the interstices between the wood of their casks; also for making mats, chair-bottoms,



Typha angustifolia.

1, spadix crowded with flowers; 2, stamens with united filament; 3, ditto larger; 4, ovarium surrounded at the base with setæ; 5, section of ovarium exhibiting solitary pendulous ovule.

baskets, &c. It is this plant which many of the Italian painters have put in the hand of Christ when he was mocked by the Roman soldiers as a king.

T. angustifolia, Lesser Cat's-Tail or Reed-Mace, has linear leaves grooved below, with the sterile and fertile flowers removed at a little distance from each other. It is less frequent than the last species, but is not uncommon in the neighbourhood of London.

T. minor, Dwarf Cat's-Tail or Reed-Mace, has linear-setaceous leaves, with barren and fertile flowers at a great distance. This plant, on the authority of Dillenius, has been placed in the list of British plants. It is found in the south of Germany and Switzerland. Koch calls it *T. minima*. [SPARGANIUM.]

TYPHIS, a genus of *Mollusca*.

TYPHLOPHTHALMES. [SCINCIDÆ.]

TYPHLOPS, Schneider's name for a genus of Reptiles placed by Cuvier among the Ophidians, or Serpents, and thus characterised by him:—Body covered with small imbricated scales; the muzzle advanced, furnished with plates; the tongue rather long and forked; the eye like a point, hardly visible through the skin; the vent nearly entirely at the extremity of the body; one lung four times greater than the other.

These, adds Cuvier, are small serpents similar in point of aspect to earth-worms, and species are found in the warm climates of both continents.

Some have the head of the same size as the body, and obtuse. They resemble ends of fine packthread (bouts de ficelle mince). *Typhlops braminus*, Cuv. (Russel, 'Serp. Corom.,' xliii.).

The greater part have the muzzle depressed and obtuse, furnished with many plates in front:—*Anguis reticulatus*, Scheuchzer, 'Phys. Sacr.,' pl. 747.

In some the fore-part of the muzzle is covered in front with a single large plate whose anterior border is slightly trenchant:—*Anguis lumbricalis*, Lacép., ii., pl. xx.; Browne, 'Jam.,' xliv. 1; 'Seb.,' i., lxxxvi. 2.

Finally, there is one which has the muzzle terminated by a small conic point, and is entirely blind. Its posterior extremity is enveloped in an oval and horny buckler. *T. philippinus*, Cuv., 8 inches (French) in length, and entirely blackish. ('Règne Animal.')

TYPHLOPSIDÆ. [TYPHLOPS.]

TYPHO'NIUM, a genus of Plants belonging to the natural order *Aroideæ*. The spathe is convolute at its base. Spadix interruptedly androgynous below, with rudiments of the sexual organs below the stamens, naked, with a subulate apex. Ovaries with a single ovule, affixed at the base, erect. The species are all stemless herbs, indigenous to India.

T. orixense is described by Dr. Roxburgh by the name of *Arum orixense*, and as common in the shady mango-groves near Samulkota, where the soil is dry and fertile. It is called Ghekool by the natives. Like many other of the *Aroideæ*, this plant is exceedingly acrid.

TYRANT-SHRIKES. [LANIADÆ.]

U

URANUS. [MONITORIDÆ.]

UCA. [GECARCINUS.]

UDORA, a genus of Plants belonging to the natural order *Hydrocharidaceæ*. A probable species of this genus has been recently introduced into England, and described by Babington under the name of *Anacharis alsinastrum*. The following is his description in the 'Manual of British Botany':—

It has its leaves 3 in a whorl, oval-oblong, obtuse, serrulate (the male flower is unknown), the female flower with a tubular bifid spathe, many times longer than the sessile germen: sepals, and petals, broad, nearly equal; stigmas reflexed. The stem is long, branching; whorls of leaves many and close together. Flowers subtended by a leaf-like bract placed within the whorl of leaves. Flowers very small. The sepals tinged with green and pink externally, incurved, hooded, with a narrow diaphanous margin. The petals are flat, diaphanous, recurved, and oblong. Filaments at first curved outwards, their points placed under the hood of the sepals, afterwards erect, linear, blunt, diaphanous; stigmas recurved, linear, or deeply bifid; sepals, petals, and stigmas, of about equal length; the style adnate on three sides to the tube.

This plant was first observed in Great Britain by the late Dr. Johnston of Berwick-upon-Tweed, in the river Whiteadder, in Berwickshire. It was afterwards discovered in a canal near Nottingham, and subsequently in many other places. Although at first not known, yet late inquiries have led to the conclusion that this plant is the *Udora Canadensis* of American botanists, and that it has been introduced into this country by means of the timber that is brought from the New World. Its power of retaining its vitality adapts it to bear so long a journey without destruction. The pistilliferous plants have alone been seen in Great Britain. Its power however of reproducing itself by buds is so great that it has already become a serious pest in the rivers, canals, lakes, and ponds, to which it has had access. It is one of those plants in which a circulation can be seen, and has afforded to several observers the means of more closely watching these vegetable movements than any other plant which has yet been examined. It has been inferred by Dr. Branson and others, that the movements of the cell-contents of this plant are produced by cilia. Mr. Wenham however regards this movement as originating in the molecular activity of the proteinaceous endoplast.

(Babington, *Manual of Botany*; Marshall, *On the new Water-Weed*; Branson and Wenham, *On the Sap-Circulation of Anacharis alsinastrum*, in vol. iii. of the *Quarterly Journal of Microscopical Science*.)

ULEX, a genus of Plants belonging to the section *Loteæ*, of the natural order *Leguminosæ*. The species of this genus are branched evergreen shrubs, furnished with spines, and bearing yellow flowers. The calyx is 2-parted and 5-toothed; the legume oval-oblong, turgid, scarcely longer than the calyx, containing but few seeds; ovules numerous.

U. Europæus, Furze, Gorse, or Whin, has linear-lanceolate leaves, villous branchlets, ovate loose bracteas, and a pubescent calyx. It is a common inhabitant of the plains and hills of Great Britain. It is an erect evergreen shrub with beautiful yellow flowers, which appear in greatest abundance from February to May, although in mild seasons it may be seen in blossom all the year round, giving rise to the old proverb that "Love is out of season when the furze is out of blossom." The double-flowered variety of *U. Europæus* was first found in Devonshire, and is now not uncommon in gardens and shrubberies. The double flowers add very much to the beauty of the plant. It can only be propagated by cuttings.

U. nanus, Dwarf Furze, has the teeth of the calyx lanceolate, spreading; the bracteas minute, close, pressed; the leaves linear and smooth; the branches smooth, reclining. This plant is a native of Great Britain, also of the west of France, in poor gravelly soils, but not common on the continent.

U. strictus, Irish Furze, has few or no spines, with an erect, narrow, and compact habit. This plant was discovered in the county of Down

in the Marquis of Londonderry's park. It is an upright plant, seldom flowering; its branches are soft and succulent; and in size and character it stands between the two foregoing species.

ULLMANITE. [MANGANESE.]

ULMA'CEÆ, *Elmworts*, a natural order of Exogenous Plants. The flowers are hermaphrodite or polygamous, never in catkins; calyx divided, campanulate, inferior, irregular; stamens definite, inserted into the base of the calyx, erect in æstivation; ovary superior, 2-celled; ovules solitary, pendulous; stigmas 2, distinct. Fruit 1-2-celled, indehiscent, membranous or drupaceous. Seed solitary, pendulous; albumen none, or in very small quantity; embryo straight or curved, with foliaceous cotyledons and superior radicle. (Lindley.)

Ulmus campestris.

1, branch with leaves and fruit; 2, branch with flowers before leaves are expanded; 3, ovary and stigmas; 4, embryo; 5, single flower separated.

This order consists of trees or shrubs, which have scabrous alternate simple deciduous leaves and stipules. The genera belonging to it are *Planera*, *Abelicea*, *Ulmus*, *Celtis*, *Sponia*, and *Mertensia*. The species are natives of the north of Asia, the mountains of India, of North America, China, and Europe. This order is by most botanists made a section of the natural order *Urticaceæ*. It was however separated by Mirbel, and he has been followed by Lindley. They differ from *Urticaceæ* in the possession of a 2-celled fruit and hermaphrodite flowers. In all other respects they resemble *Urticaceæ*, and their affinities are the same. [URTICACEÆ.]

Most of the species of this order are trees, the timber of which is often very valuable. The bark of the Elm is used in medicine. [ULMUS.] The genera *Planera* and *Celtis*, like the Elm, have species which are handsome ornamental trees, and yield useful timber.

ULMUS, a genus of Plants, the type of the natural order *Ulmaceæ*. The flowers are small and the leaves are alternate. In most of the species the flowers appear earlier than the leaves: they are disposed in groups, and seated on short peduncles. The calyx is of a reddish colour, distinct from the ovary, imbricated in æstivation, with 4-8 segments, which remain until the fruit falls. The stamens are as numerous as the segments, and are inserted opposite to them. The ovary is elliptical, compressed, cloven at the summit, 2-celled, and 1 ovule in each cell. The fruit is a samara, the wing-like appendage being broad and present all round, except in a notch. Only one of the cells of the ovary develops its seed, so that the fruit is 1-seeded. The embryo has no albumen, and its radicle is straight and uppermost. The leaves are stalked, and unequal at the base, serrated, and generally rough to the touch; the axils of the primary nerves beneath are tufted with fine hairy filaments. The various species of elm are wild in Europe, North America, India, and China. Nearly 20 species have been enumerated by various writers, but it is not at all certain that these are true species. This uncertainty arises from the fact which is now generally recognised by the cultivators of the elm, that the seeds of the elm do not produce plants precisely like their parents, and that the amount of difference in the elm is greater than amongst most other species of trees. It is on this account that there are so many recorded varieties of the species which are cultivated for ornament or timber.

U. campestris, the Common English or Small-Leaved Elm, has leaves doubly serrated, rough; the flowers nearly sessile, 4-cleft; the fruit oblong, deeply cloven, glabrous. This tree is a native of the middle and south of Europe, the west of Asia, and Barbary. It is also found abundantly in France, Spain, and Italy. Although it is called the English Elm, a question has been raised as to whether it is a native of Britain; and some have supposed, on account of its not ripening its seeds in this climate, that it is an introduced plant, and that it was probably brought over by the Romans; whilst others have supposed it was brought from Palestine during the Crusades.

A great recommendation of the Elm is its endurance of a smoky atmosphere, and it will thrive in the vicinity of large towns. The noble elms of the parks of London are a living testimony of its value in this respect. Many of the public avenues in France, Holland, and Great Britain are composed entirely of this tree; and its growing in almost every variety of soil, and requiring but little pruning, are, in addition to its ornamental qualities, strong recommendations.

The recorded varieties of *U. campestris* are very numerous, and Loudon enumerates 18. Some of these have been constituted species by various botanists.

U. suberosa, the Corked-Bark Elm. This species, which derives its name from the corky nature of its bark, is supposed by Selby and others to be only a variety of *U. campestris*.

U. major, the Greater or Dutch Corked-Bark Elm, is considered a species by Smith, and recognised by Lindley and Hooker. It has rough ovate-acuminate leaves, very oblique at the base, sharply and doubly serrated, pubescent below, with dense tufts of white hairs in the axils; branches spreading, bright brown, winged with corky excrescences, when young nearly smooth; fruit obovate, slightly cloven, naked. This is a finer and more graceful-looking tree than the last. It has larger leaves, and the bark is even more corky.

U. effusa, the Spreading-Elm. This is not a British species. It has doubly-serrated leaves, unequal at the base; pedunculated pendulous flowers, with the margin of the fruit (samara) ciliated. This tree is a native of Russia, where it attains a great size.

U. montana, the Mountain, Scotch, or Wych Elm. It has obovate, cuspidate, doubly and coarsely-serrated leaves, nearly equal at the base, exceedingly scabrous above and downy beneath, bark smooth; fruit scarcely cloven, naked. Whatever may be the doubts as to the introduction of the *U. campestris* into Britain, there are none with regard to this species, which is always allowed to be British. The leaves of the Wych-Elm are larger than those of the English Elm.

U. glabra, the Smooth-Leaved Elm, is sometimes considered a variety of the last species. The leaves are ovato-lanceolate, acuminate, doubly and evenly crenato-serrate, cuneate and oblique at the base, quite smooth above, smooth or glandular beneath, with a few hairs in the axils; branches bright-brown, smooth, wiry, weeping; fruit obovate, naked, deeply cloven. This tree is a native of Britain, occurring in the greatest abundance in the county of Essex.

U. Americana, the American Elm. The petiole of the leaf is 1-1½ inch in length, covered with short hairs; the disc unequal at the base, 4 or 5 inches long, serrated, and mostly doubly so; axils of the veins joined by a membrane; the flowers are seated on peduncles, the peduncles short, glabrous; the stamens 5 to 8; the fruit ovate, acute, ciliated. Its flowers resemble those of *U. effusa*. This tree is found in North America, growing in low woods from New England to the Carolinas, where it attains a height of from 80 to 100 feet.

U. fulva, the Slippery Elm, has rough whitish branches; ovate-oblong acuminate leaves, nearly equal at the base, serrate with unequal teeth, very rough and hairy on both surfaces; the leaf-buds tomentose, scales of flower-buds downy; fruit not ciliated. This tree is also a native of North America.

U. alata, the Wahoo, or Cork-Winged Elm, is another American species. It is a small tree, seldom exceeding 30 feet in height, and is characterised by the bark dilating on each side of the branches between the leaves, and giving them a winged appearance. [ELM, in ARTS AND SC. DIV.]

ULNA. [SKELETON.]

ULODENDRON. [COAL-PLANTS.]

ULSEE, an Indian name for Flax.

ULTRAMARINE. [LAZULITE.]

U'LULA. [STRIGIDÆ.]

ULULI'NÆ. [STRIGIDÆ.]

ULVA. [ALGÆ.]

ULVACEÆ. [ALGÆ.]

UMBEL, a form of inflorescence in Plants, characteristic of the natural order *Umbelliferæ*. [INFLORESCENCE; UMBELLIFERÆ.]

UMBELLI'FERÆ, a natural order of Exogenous Plants. This is one of the best marked families of plants, so much so, that Jussieu says the whole order may be looked upon as a genus, and the various sub-divisions and genera as arrangements of the species. All the species are well marked, and have good distinguishing characters, and their inflorescence is always that of the umbel. The possession of an umbel was early made the combining character of these plants by systematic botanists, and they were called *Umbellatæ* on this account. In addition to this distinguishing character, they have also others, as the possession of 5 stamens and 2 stigmas, by which they were all brought under the class *Pentandria* and order *Digynia* of Linnæus.

Most of the species are herbs, seldom shrubs, with fistular furrowed

stems. The leaves are, in most cases, divided; sometimes they are simple; they are alternate, and all of them embrace or clasp the stem by a sheathing petiole. The flowers are white, pink, yellow, or blue, and are seated on umbels, which are either simple or compound, and these are with or without bracts at their base, which are called involucre, or involucellum, as they surround the umbels, or umbellules. The calyx is superior, either entire or 5-toothed. The petals are 5, and are inserted on the outside of a fleshy disc, which is placed on the top of the ovarium; they are usually inflexed at the point, and have an imbricate, rarely valvate æstivation. The stamens are 5, and are seated alternately with the petals, and are incurved during æstivation. The ovary is inferior, 2-celled, having solitary pendulous ovules, and is crowned by the disc, on which the petals are seated; the styles are two, distinct, with simple stigmas. The fruit, which is ordinarily called the seed, consists of 2 carpels, which are united by a common axis, the part by which they unite being called the commissure; the external part of each carpel is traversed by elevated ridges, which are divided into primary and secondary; there are 5 of the latter, and 4, between them, of the former; the ridges are separated by channels, below which are often placed, in the covering of the fruit, little receptacles of coloured oily matter, which are called vittæ. The seed, which is pendulous, usually adheres to the sides of the cell of the fruit, and this has led to the confounding the seed and fruit together. The embryo is minute, and is seated in the midst of a horny albumen, with the radicle pointing to the hilum.

Hydrocotyle Spananthe.

1, cutting, showing umbels with flowers and fruit; 2, flower enlarged; 3, fruit; 4, transverse section of fruit; 5, seed removed from pericarp, with small embryo and large albumen.

The order agrees with *Ranunculaceæ* in its sheathing leaves, as well as its large albumen and its acrid properties. Other relations have been pointed out, as with *Saxifragaceæ*, *Geraniaceæ*, also with *Araliaceæ*, from which it differs little, except in the number of the parts of the flower.

The following conspectus will show the sub-orders and tribes into which the numerous genera of this order have been distributed by De Candolle.

Umbelliferæ.

Sub-Order I. *Orthospermeæ.*—Albumen of seed flat on inner surface, neither involute nor convolute.
- *Hydrocotyleæ.*
- *Mulineæ.*
- *Saniculeæ.*
- *Ammineæ.*
- *Seselineæ.*
- *Angeliceæ.*
- *Peucedaneæ.*
- *Tordylineæ.*
- *Silerineæ.*
- *Cumineæ.*
- *Thapsieæ.*
- *Daucineæ.*

Sub-Order II. *Campylospermeæ.*—Albumen rolled inwards at the edges . . . . . .
- *Elæoseline æ.*
- *Caucalineæ.*
- *Scandicineæ.*
- *Smyrneæ.*

Sub-Order III. *Cœlospermeæ.*—Albumen curved inwards from base to apex.
- *Coriandreæ.*

Tausch has more recently proposed another arrangement, as objected to the albumen being made the basis of the primary divisions of the order.

The genera include above 1000 species. These are principally inhabitants of the northern temperate zone, and the greater number of them are found in the Old World. The proportion of species in the southern half of the world, compared with the northern, is as one to four; that of the New to the Old World, as one to three. Very few of the species are found in the tropics, and about 50 are enumerated as inhabitants of Australia.

The properties of this order are variable, and very important. One of the distinguishing characters of the order is the possession of an acrid principle which finds its full development in such plants as the Hemlock [CONIUM], the Cow-Bane [CICUTA], *Œnanthe*, *Heloscadium*, *Æthusa*, &c. This renders the whole order suspicious, more especially the vegetation, in which the poisonous principle is most developed. The acrid properties of these plants seem to depend upon the possession of a peculiar principle, which in as far as it has been examined in some of the species possesses alkaline properties. This is the case with Conia, a principle obtained from the Hemlock [CONIUM], which has been examined with the most care, although other plants of the order have been found to yield similar principles, but not possessing so much activity. Conia is remarkable amongst the vegetable alkaloids, for being fluid, volatile, and easily decomposed; and it is probable that most plants whose poisonous properties are dissipated by heat possess a principle of a similar nature. In this respect there is also another analogy between the *Umbelliferæ* and *Ranunculaceæ*, the poisonous qualities of the species of the last order being in a great measure annihilated by heat. It is not improbable that all the *Umbelliferæ* may possess a principle similar in nature, though not in intensity, to the Conia, and that it may contribute in some measure to render such plants as the parsley, samphire, and celery, desirable as articles of diet.

Another important secretion of the *Umbelliferæ* is a volatile oil. This secretion is found in all the species, with the exception of *Conium*, deposited in the canals of the pericarp, which are called vittæ. In some of the species it is more abundant than in others; and on this account the fruit, which is commonly called the seeds, is used frequently in diet as a condiment, and in medicine as an aromatic and carminative. Of these the carraway, the anise, the dill, the cumin, and coriander are best known.

A third secretion of these plants is a gum-resin. This probably, like the last two secretions, is common to the whole order, but is fully developed in only a few species. The gum-resins produced by this order have had a great reputation in medicine, and many of them are still looked on as valuable remedies. The Laser, or Silphion, of the ancients, is secreted by plants belonging to this order, and assafœtida, galbanum, gum-ammoniacum, opoponax, and sagapenum are much used as stimulant medicines in nervous diseases at the present day. Many of the species when wounded exude in small quantities a gum-resinous matter.

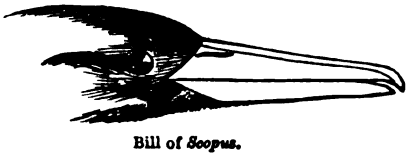
A fourth secretion, which also on account of its occasional excess renders this order important to man, is starch. This secretion, which forms so large a portion of the food of animals, is deposited in largest quantities in the roots of the carrot, the parsnep, the skirret, and the aracacha of the South Americans, and on this account these plants are extensively cultivated. Most of the roots however contain this principle, and might be used as articles of diet, but they also contain the poisonous principle of which we have before spoken. Heat will dissipate this, and some of the roots which are deadly poisonous when raw, it is said may be eaten with impunity when cooked. The roots of some of these plants resemble that of the horse-radish, and in winter, when the leaves are gone, may be dug up in mistake for it. Fatal consequences have in some cases ensued from such a mistake. Many of the *Umbelliferæ* are much affected in their secretions by climate and cultivation. Thus, the deadly hemlock in Russia is an inert and eatable plant, while the celery of our gardens, if cast on the roadside, becomes an active poison. The properties of all plants are more or less affected by climate and cultivation; but it is much more obvious where poisonous secretions are increased or diminished, as in the hemlock, or changed, as in the case of the celery.

(Jussieu, *Dict. des Sciences Naturelles;* Lindley, *Vegetable Kingdom;* Don; Miller, *Dictionary;* Burnett, *Outlines;* Christison, *Dispensatory;* Bischoff, *Lehrbuch der Botanik.*)

UMBELLUS. [BONASIA.]

UMBER (Ornithology), a name of the *Scopus umbretta*, Ombretta of the French, a bird belonging to the family *Ardeidæ*.

Scopus is distinguished from the Storks by its compressed bill whose trenchant culmen is expanded towards the base: the nostrils are prolonged into a furrow which runs parallel to the culmen to the end, which is slightly hooked.



Bill of *Scopus*.

S. umbretta is the size of a crow, colour that of umber; the male with an occipital crest. It is found generally in Africa.

Scopus umbretta.

UMBER, an Ore of Iron and Manganese, employed as a brown pigment. It occurs massive, amorphous. Structure earthy. Fracture conchoidal. Soft. Opaque. Dull. Meagre to the touch; adheres strongly to the tongue, and falls to pieces in water. Colour blackish, reddish, or yellowish-brown. Specific gravity 2·206. It occurs in beds with brown jasper, in the Isle of Cyprus. It consists of iron, manganese, silica, alumina, and water.

UMBILI'CUS. When the inner sides of the whorls or volutions of a spiral shell do not touch each other, so that its axis is hollow, that hollow is termed the Umbilicus. [TROCHIDÆ; TURBINIDÆ.]

UMBILICUS, a genus of Plants belonging to the natural order *Crassulaceæ*. It has a 5-parted calyx; corolla gamopetalous, campanulate, 5-cleft; lobes ovate, acute, erect, about the length of the tube; stamens 10, inserted in the corolla; scales 5, obtuse; carpels 5, attenuated at the apex; styles subulate. The species are herbs, indigenous to the south of Europe and the Levant. The leaves are rosulate or alternate, quite entire, or a little toothed. The flowers white or yellow, in branched or simple terminal racemes, never in cymes. There are about 17 species. They grow chiefly on rock-work and on old walls. *U. spinosus* and *U. leucantha* are natives of Siberia. Some of the species are British, and still remain in the old genus *Cotyledon*, out of which the genus *Umbilicus* has been formed. *U. erectus* is the *Cotyledon Umbilicus* of Linnæus, and is described under that genus. [COTYLEDON.]

UMBO (Conchology), the name for that point in a conchifer or bivalve shell which constitutes the nucleus or apex of each valve, and which is generally situated above the hinge, and always near it. [CONCHIFERA.]

UMBRELLA. [SEMIPHYLLIDIA.]

UNAU (*Cholæpus*), a genus of Edentate Animals inhabiting America. The position of this animal with the other forms of the Tardigrade *Edentata* will be seen in the following conspectus [BRADYPUS], drawn up by Professor Owen, and published in his work on the 'Osteology, Natural Affinities, and probable Habits of the Megatheroid Quadrupeds in general':—

Conspectus of the Families, Genera, and Species of the Leaf-Eating *Bruta*.

Order *Bruta*, Linn., Fisch. (*Edentata*, Cuv.).

Teeth none, or wanting a neck and enamel. Claws falculate, great, generally sheathed, bending downwards.

Tribe *Phyllophaga* (Leaf-Eaters).

Teeth few, composed of vascular dentine, hard dentine, and cement; the vascular dentine forming the great axis of the teeth. A descending apophysis in the jugal bone. The acromion concrete with the coracoid process.

Family I. *Tardigrada* (Syn. *Scansoria*, *Bradypodidæ*).—Feet long, slender, the anterior more or less longer than the posterior; fore feet di- or tri-dactyle, hind feet tridactyle; toes obvolute, falculate. Zygomatic arch open. Tail very short.

Genus 1. *Bradypus*, Linn., Ill. (*Acheus*, F. Cuv.).

Genus 2. *Cholæpus*, Ill. (*Bradypus*, F. Cuv.).

Family II. *Gravigrada* (*Eradicatoria*, *Megatheriidæ*).—Feet short, very strong, equal or subequal; fore feet penta- or tetra-dactyle; one or two of the external toes unarmed, fit for support and progression; the rest falculate. Zygomatic arch closed. Clavicles perfect. Tail moderate, stout, and acting as a fulcrum or prop.

Genus 1. *Megalonyx*, Jefferson, Cuv. (*Megatherium*, Desm., Fisch.).—Teeth $\frac{5—5}{4—4}$?, subelliptical, the middle of the crown excavated, the margins slightly prominent. Fore legs the longest; the tibia and fibula distinct; the heel-bone long, compressed, and deep; the falcular claws great and compressed.

Species, *M. Jeffersoni*, Cuv. (*Megatherium Jeffersoni*, Desm., Fisch.; *Megalonyx laqueatus*, Harlan).

Genus 2. *Megatherium*, Cuv. (*Bradypus*, Pander and D'Alton).—Teeth $\frac{5—5}{4—4}$?, contiguous, tetragonal, the crown transversely sulcated. The fore feet tetradactyle; the hind feet tridactyle, the two external toes unarmed; the falcular claws great and diversiform; those of the middle toe greatest, and compressed. Femur with an entire (unimpressed) head; tibia concrete, with the fibula at each extremity. Astragalus with the anterior face excavated above. Heel-bone long and thick.

Species, *M. Cuvieri*, Desm. (*Bradypus giganteus*, Pander and D'Alton).

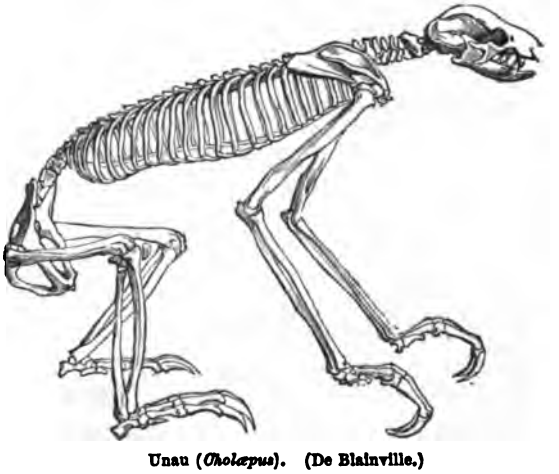
Genus 3. *Mylodon*, Owen (*Megalonyx*, Harlan; *Orycterotherium*, Harlan).—Teeth $\frac{5—5}{4—4}$, distinct; the anterior upper tooth subelliptical, moderately remote from the rest; the second elliptical; the rest trigonal, with the internal face longitudinally sulcated; the anterior lower tooth elliptical, the penultimate tetragonal; the last, which is the greatest, bilobate. Feet equal: fore feet pentadactyle; hind feet tetradactyle; the two external toes in both unarmed, the rest falculate; the falcular claws great, semiconical, and unequal. Head of the femur impressed by the round ligament; tibia and fibula distinct; astragalus with anterior face flattened above; heel-bone long and thick.

Species 1, *M. Darwinii*, Owen. The lower jaw with the symphysis longer and narrower; the second molar subelliptical; the last bisulcate, the internal furrow angular.

Species 2, *M. Harlani*, Owen (*Megalonyx laqueatus*, Harlan; *Orycterotherium Missouriense*, Harlan). Lower jaw with a shorter and wider symphysis; second molar subquadrate; the last trisulcate, the internal furrow biangular.

Species 3, *M. robustus*, Owen. Lower jaw with the symphysis shorter and wider; second molar subtrigonal; the last trisulcate, the internal furrow rounded.

Genus 4. *Scelidotherium*, Owen (*Megalonyx*, Lund).—Teeth $\frac{5—5}{4—4}$, either contiguous or separated by equal intervals; upper ones trigonal; the anterior of the lower ones trigonal, the second and third subcompressed, the external face longitudinally sulcated; the last the greatest and bilobate. Head of the femur impressed by the ligamentum teres; tibia and fibula distinct; astragalus with two excavations anteriorly. Heel-bone long, thick; falcular claw great and semiconical.



Unau (*Cholæpus*). (De Blainville.)

Species, *S. leptocephalum*, Owen; *S. Owieri*, Owen (*M. Owieri*, Lund); *S. Bucklandi*, Owen (*M. Bucklandi*, Lund); *S. minutum*, Owen (*M. minutus*, Lund).

Genus 5. *Cælodon*, Lund.—Teeth $\frac{4—4}{3—3}$

Genus 6. *Sphænodon*, Lund.

In the Unau the number of cervical vertebræ is 7; in the Three-Toed Sloth (*Bradypus tridactylus*) the number is 9.

Cervus [CERVIDÆ], *Capra* [CAPRIDÆ], *Ovis* [OVIDÆ], and *Bos* [BOVIDÆ, MAMMALOGY.]

Mylodon robustus.

UNCA'RIA, a genus of Plants belonging to the natural order *Rubiaceæ*. *Uncaria* is sometimes considered only as a sub-genus of *Nauclea*. The flowers are aggregate, on a globular receptacle; calyx tubularly urceolate, 5-cleft; corolla funnel-shaped, with a slender tube and naked throat; stamens 5; ovary 2-celled; capsules pedicellate, clavate, attenuated at the base; seeds imbricated, winged; embryo inverse and furnished with a perisperm. The species are chiefly natives of India, but a few are found in America. They are permanent cirrhiferous ramblers, hanging to different trees by the hooked old peduncles.

U. Gambier, Roxburgh, the Gambier Plant, is a native of Penang, Sumatra, Malacca, &c. The substance called Gambier by the Malays is prepared from it, and it is known in commerce by the names of *Terra japonica* and Catechu.

This plant was first described by Rumphius, 'Herb. Amb.,' v., p. 63, t. 34, f. 2 and 3, by the name of *Punis uncatus angustifolius*, but the process of preparing the extract was first fully described by Dr. C. Campbell, one of the early medical officers of the station of Bencoolen, who paid considerable attention to the useful plants of the neighbourhood. He states that it is chewed by the Malays mingled with betel-leaf and areca-nut in the same way that catechu is used on the continent of India, and was solicitous that a trial should be made of its power in tanning. The preparation he describes as simple:—"The young shoot and leaves are shred and bruised in water for some hours, until a feculum is deposited: this, inspissated in the sun to the consistence of a paste, is thrown into moulds of a circular form, and in this state the gambier is brought to market." [CATECHU, in ARTS AND SC. DIV.]

UNCITES, a fossil genus of *Brachiopoda*.

UNGKA-ETAM, the Asiatic name for *Hylobates Rafflesii*, Geoffroy. [HYLOBATES.]

UNGKA-PUTI, an Asiatic name for *Hylobates agilis*. [HYLOBATES.]

UNGUICULA'TA. Linnæus divided the *Mammalia* into the following sections:—*Unguiculata*, *Ungulata*, and *Mutica*.

The *Unguiculata*, or Clawed Mammals, included the orders *Bruta*, *Glires*, *Primates*, and *Fera*.

UNGULA'TA, Hoofed Mammals. Under this section Linnæus included the orders *Belluæ* and *Pecora*.

The *Belluæ* comprised the genera *Equus* [EQUIDÆ], *Hippopotamus*, *Sus* [SUIDÆ], and *Rhinoceros*.

The *Pecora* consisted of the genera *Camelus*, *Moschus* [MOSCHIDÆ],

UNGULINA. [LITHOPHAGIDÆ.]

UNICORN. [RHINOCEROS.]

U'NIO. [NAIADÆ; UNIONIDÆ.]

UNIO'NIDÆ. Mr. Swainson makes the *Unionidæ* the first family of his third tribe (*Atrachia*) of his order '*Dithyra*, Bivalve Shells, and thus defines and arranges it:—

Unionidæ, River Mussels, or Unios.—Animal fluviatile; shell solid, perlaceous; generally with cardinal and lateral teeth.

Sub-Family 1. *Unioninæ*.—One valve, with two cardinal and two lateral teeth; cardinal teeth short; the umbones, or bosses, smooth or longitudinally undulated.

Genera:—*Unio*, Lam. (with the sub-genera *Unio*, *Cunicula*, Sw., *Ligumia*, Sw., *Theliderma*, Sw., and *Megadomus*, Sw.).

Æglia, Sw. (with the sub-genera *Æglia*, *Naidea*, Sw., and *Cathyria*, Sw.).

Mysca, Turton (with the sub-genera *Potamida*, Sw., and *Lymnadea*, Sw.).

Sub-Family 2. *Hyrianæ*.—Bosses longitudinally sulcated; cardinal teeth long, compressed, placed on one side of the bosses; hinge-margin winged.

Genera:—*Iridea*, Sw.; *Castalia*, Lam. (with the sub-genera *Naia*, Sw., and *Castalia*, Lam.); *Hyria*, Lam.; *Hyridella*, Sw.

Sub-Family 3. *Iridininæ*.—Narrow and greatly elongated; hinge margin without teeth, but sometimes granulated.

Genera:—*Iridina*, Lam.; *Calliscapha*, Sw.; *Mycetopus*, D'Orb.

Sub-Family 4. *Anodontinæ*.—Cardinal teeth none; lateral tooth extending along the hinge or entirely wanting; hinge-margin generally winged.

Sub-Genera:—*Lamproscapha*, Sw.; *Symphynota*, Lea; *Anodon*, Lam.; *Hemiodon*, Sw.; and *Patularia*, Sw.

Sub-Family 5. *Alasmodontinæ*.—Lateral teeth entirely wanting; cardinal teeth one or two.

Genera:—*Calceola*, Sw.; *Alasmodon*, Say (with the sub-genera *Uniopsis*, Sw., *Margaritana*, Schum., and *Complanaria*, Sw.). ('Malacology.')

Dr. J. E. Gray makes the *Unionidæ* the eighth family of his order *Cladopoda*.

Genera:—*Anodon*, *Margaritana*, *Alasmodon*, *Damaris*, *Unio*, *Heterodon*, *Dipsas*, and *Monocondyla*.

The *Iridinidæ* form the ninth family of the same order in Dr. Gray's arrangement.

Genera:—*Iridina, Leila, Pleiodon, Hyria, Castalia.* ('Synopsis Brit. Mus.') [NAIADÆ.]

UNO'NA, a genus belonging to the natural order *Anonaceæ*, so called from 'unus,' one, the stamens being united with the germens. The generic character is, sepals 3; petals 6, the 3 inner the smallest; stamens numerous; carpels numerous, one- or many-celled; many-seeded, seeds in a single row. The species consist of trees, large shrubs, or climbing plants, found in hot parts of the world, as India and its islands, Africa, and South America. The bark and fruit of many of the species are aromatic, with some degree of acridity, and are employed as stimulating medicines or as condiments.

U. Æthiopica, a native of Ethiopia and Sierra Leone, is a tree with ovate-lanceolate leaves, which are also acute, smooth, and have the under surface glaucous; it has roundish, torulose, nearly sessile carpels. It has obtained more celebrity than other species, from being supposed to be that which yields the seeds formerly well known under the name of Ethiopic pepper, the 'Filfil-al-Soudan' of Arabian authors. They have been also called Guinea Pepper and Negro Pepper, in consequence of their having been employed as a substitute for that condiment by the negroes, from their aromatic and pungent taste. They must not be confounded with the *Amomum Granum Paradisi*, obtained also from the west coast of Africa.

U. aromatica, another species, which is a native of or introduced by the negroes into Guyana, is however considered by some to be the species yielding the Negro Pepper. It has oblong, acuminate, and smooth leaves; peduncles axillary, 1-2-flowered; carpels oblong, terete, torulose, nearly sessile. Every part of the plant is aromatic, and the fruit is used as a condiment by the negroes of Guyana.

U. undulata, a native of Waree in Guinea, has aromatic fruit similarly employed.

U. Narum is one of the climbing species, a native of Malabar, which Rheede describes as possessed of medicinal properties, the roots being so used, as well as the sweet-scented greenish-coloured oil obtained from them by distillation.

U. musaria has been so called from its bark being used for making musical instruments, as is indeed also that of the foregoing species. This is a rambling shrub, a native of Amboyna, &c., the roots and bark are also used medicinally. *U. tripetala, U. uncinata, U. odorata*, &c., natives of the Indian islands, are remarkable for the sweet scent of their flowers. *U. esculenta*, a native of the Indian peninsula, has fruit which is edible. Some species, as *U. sylvatica*, are valued for their timber. *U. longifolia* is an elegant tree, with smooth, pointed, and undulate leaves, which is much cultivated in some parts of India to form avenues and to afford shade. It is sometimes called Deodara, which is properly the name of the celebrated Himalayan Pine, *Pinus* or *Cedrus Deodara*.

UPAS TREE. [ANTIARIS; STRYCHNOS.]

U'PUPA. [UPUPIDÆ.]

UP'UPIDÆ, a family of Insessorial or Perching Birds.

Linnæus placed the genus *Upupa* between *Merops* and *Certhia* [CERTHIADÆ], among his *Picæ*, in his last edition of the 'Systema Naturæ:' the species of *Upupa* recorded by him are *U. epops, U. promerops*, and *U. paradisea*.

Mr. G. R. Gray makes the *Upupidæ* (*Upupa*, Linn.), the first family of the *Tenuirostres*, consist of the following sub-families and genera:—

Sub-Family 1. *Upupinæ.*

Genera:—*Upupa*, Linn.; *Fregilupus*, Less.; *Falculia*, J. Geoffr.; *Neomorpha*, Gould; *Seleucides*, Less.; *Craspedophora*, G. R. Gray; *Ptiloris*, Sw.

Sub-Family 2. *Promeropinæ.*

Genera:—*Promerops*, Brisson; *Rhinopomastus*, Smith; *Epimachus*, Cuvier.

The *Upupidæ*, in Mr. Gray's arrangement, are immediately succeeded by the *Nectarinidæ*.

Our limits will not permit us to notice particularly in this article more than the genera *Upupa, Promerops*, and *Epimachus*.

Upupa, Linn.—Bill very long, slightly arched, slender, triangular, compressed; nostrils basal, lateral, ovoid, open, surmounted by the feathers of the forehead; feet with three anterior toes, the external joined to the middle toe up to its first joint; one posterior toe; claws short and slightly curved, that of the hind toe nearly straight; tail squared, composed of ten feathers; wings moderate, fourth and fifth quills the longest; tongue very short, triquetral.

U. epops, the Hoopoe. This is the Ἔποψ of the Greeks (Aristotle, 'Hist. Anim.,' i. 1; ix. 11; ix. 15, 49; Aristophanes, 'Birds,' 228, et seq.; Pausanias, x. 4); Upupa and Epops of the Romans (Pliny, 'Nat. Hist.,' x. 29; xxx. 6; Ovid, 'Metam.,' vi.). In Ovid's lines descriptive of the transformation of Tereus, the bird is drawn to the life:—

"Tereus
Vertitur in volucrem, cui stant in vertice cristæ.
Prominet immodicum pro longâ cuspide rostrum,
Nomen *Epops* volucri, facies armata videtur."

"*Tereus*, through grief, and haste to be reveng'd,
Shares the like fate, and to a bird is chang'd.
Fix'd on his head the crested plumes appear,
Long is his beak, and sharpen'd as a spear."—*Crosall.*

It is the Buba, Upega, Gallo del Paradiso, Galleto de Magio, Pubula, Bubbola, Pupita, and Upupa, of the Italians; Hupe, Huppe, Putput, Huput, and Lupoge, of the French; El Abubilla of the Spanish; Wiedehopf of the Germans; De Hoppe of the Netherlanders; Hasfogel of the Swedes; Her-fugl of the Danes; Smerda Kaura of Scopoli; Dung-Bird of the English; Y Goppog of the Welsh.

Two parallel rows of long feathers form an arched crest upon the head; these feathers are of a ruddy buff colour, terminated with black;

Bill of Hoopoe.

head, neck, and breast, vinous buff; upper part of the back vinous gray; on the back a large transversal band; wings and tail black; on the wings are five transversal bands of yellowish-white, and on the tail is a very large white band, about the middle of the feathers; at about three-fourths of the length of the quills is a large white band; abdomen white, with some longitudinal spots on the thighs; bills flesh-colour at its base, and black towards the point; feet and iris brown. Length, 12½ inches.

The female is less than the male, her crest shorter, and the tints of her plumage less vivid.

The young when they leave the nest have the bill short, nearly straight, and slightly cylindrical towards the point; the feathers of the crest short and often terminated with black, without the white spot which is immediately below it in the adult; the white band of the tail nearer to the rump; the plumage washed, as it were, with ash-colour; the bands on the wings less distinct and more yellowish, and a greater quantity of longitudinal spots upon the belly and thighs.

This bird is found as far north in the summer as Denmark, Sweden, and Russia; and southward in continental Europe, in Germany, Holland, France, Spain, and Italy. It has been seen both at Gibraltar, Ceuta, and in Egypt (where it breeds): it is probably an inhabitant of the whole of North Africa. It has been also observed at Madeira, and at Trebisond, in Asia Minor, from which last locality it has been sent to this country.

It is generally found in the British Islands in autumn, but Hoopoes have been known to build and hatch their young with us. The flesh of the bird in autumn is said to be well flavoured.

Hoopoe (*Upupa epops*).

Mr. Yarrell has recorded the manners of a Hoopoe in the possession of Mr. Bartlett, a preserver of birds in Museum-street, London. "This bird," says Mr. Yarrell, "is quite tame, and when unexcited the high crest falls flat over the top of the head and covers the occiput; it takes a meal-worm from the hand very readily, nibbles and pinches it between the ends of the mandibles, then putting it on the ground, strikes it several blows with the point of the beak; when the insect is apparently dead or disabled it is again taken up, and by a particular motion of the head, which is thrown backward, and the beak opened, the meal-worm drops into the gape of the mouth and is swallowed. The call for another is a sharp note; but it also utters at times a sound closely resembling the word 'hoop, hoop, hoop,' but breathed out so softly, but rapidly, as to remind the hearer of the note of the Dove. This bird constantly rubs himself in the sand with which the bottom of his large cage is supplied, dusting himself like the larks, but takes great care to shake off any sand or gravel that may adhere to his food, which is raw meat chopped and boiled egg.

"At the moment of settling on the floor of the room, Mr. Bartlett's bird bends the head downwards till the point of the beak touches the floor, after which, as well as occasionally at other times, the long feathers forming the crest are alternately elevated and depressed in a slow and graceful manner, the bird assuming an appearance of great vivacity, running on the ground with a very quick step. M. Necker, in his 'Memoir on the Birds of Geneva,' says Hoopoes fight desperately, and leave the ground covered with their feathers." ('British Birds.')

Promerops, Brisa.—Bill with the under mandible, at its base, thicker than the upper; the margin acute; nostrils corneous; the aperture lateral and oval; hind claw curved; tail long, cuneated. (Sw.)

P. erythrorhynchus (*Upupa erythrorhynchus*, Lath.). The whole plumage varying with metallic blue and green; the bill coral-red.

Promerops erythrorhynchus.

This brilliant bird, the Promerops Moqueur of the French, lives in small troops in South Africa (interior of the Cape of Good Hope). It is said that there is a variety from Senegal, which has two large white stripes on the wings and on the external tail-feathers.

Epimachus, Cuv. Bill resembling that of *Promerops*, but the margins are obtuse and somewhat inflected; wings, tongue, and feet unknown; tail very long; side-feathers of the body greatly developed.

E. magnus (*Upupa magna*, Gm., *U. superba*, Lath.). Body generally black or brownish-black; tail graduated, thrice as long as the body (Lesson says three feet in length, French); feathers of the sides elongated, raised, curled, glittering on their edges with steel-blue, azure, and emerald-green, like precious stones; the head and the belly lustrous also with steel-blue, &c. In truth, language fails to convey any just idea of the magnificence of this species. It inhabits the coasts of New Guinea.

Grand Promerops (*Epimachus magnus*).

URA'NIA, a genus of Plants belonging to the natural order *Musaceæ*. The name which the plant bears in Madagascar is Ravenala. This genus has but one species, *U. speciosa*, which is a native of Madagascar. It has a superior coloured perianth, consisting of 3 petals; a 2-leaved nectary, and one of the leaves bifid; a 3-celled many-seeded capsule, and the seeds in two rows covered with an aril. The flowers are arranged upon a spadix, which are nodding, very similar to the bananas, which belong to the same family. The leaves are arranged in a fan-shape. The seeds of this plant are said to constitute a wholesome food.

URANISCODON. [IGUANIDÆ.]

URANITE. [URANIUM.]

URA'NIUM, a Metal discovered by Klaproth, in 1789, who named it after the planet Uranus, the discovery of which had previously occurred in the same year: the mineral from which it was first obtained is called Pechblende, in German.

Pitchblende, or *Oxide of Uranium*.—This Mineral occurs in amorphous and reniform masses, and also pulverulent. Structure granular, compact. Fracture uneven, conchoidal. Hardness: scratches phosphate of lime, is scratched by felspar. Colour grayish, brownish, and iron-black. Opaque. Lustre imperfect metallic. Specific gravity 6·468. Before the blow-pipe infusible per se, but colours the exterior flame green; with borax it fuses into a dull-yellow glass, which becomes green in the reducing flame. In powder, it dissolves slowly in nitric acid. Pitchblende occurs in Saxony, Bohemia, &c., and in Cornwall. The following analyses are by Klaproth and Pfaff.

	Klaproth.	Pfaff.
Oxide of Uranium	86·5	84·52
Oxide of Iron	2·5	8·24
Silica	5·0	2·02
Sulphuret of Lead	6·0	4·20
Oxide of Cobalt	—	1·42
	100	100·4

This mineral is evidently a mere mixture of Oxide of Uranium, with other substances, and, besides those above enumerated, Arfwedson found the oxides of arsenic, zinc, and copper, in the Pitchblende of Joachimsthal.

Chalcolite, Green Uranite, Cupreo-Phosphate of Uranium.—This Mineral agrees with the preceding in crystalline form, but differs in colour, it being grass- or emerald-green, owing to the presence of phosphate of copper instead of phosphate of lime. It occurs in Cornwall, was first shown to contain uranium by the Rev. Mr. Gregor, and analysed afterwards by R. Phillips and subsequently by Berzelius; the results of the experiments gave as its composition—

	Phillips.	Berzelius.
Phosphoric Acid	16·0	15·56
Oxide of Uranium	60·0	60·25
Oxide of Copper	9·0	8·44
Water	14·5	15·05
Stony Matter	0·5	0·70
	100	100

Uranite, Uran-Mica, Calcareo-Phosphate of Uranium occurs crystallised. Primary form a square prism. Cleavage parallel to the terminal planes, very distinct. Fracture foliated. Hardness: scratches sulphate of lime, and is scratched by the carbonate. Colour lemon- or golden-yellow, and yellowish-brown. Lustre adamantine. Transparent, translucent. Specific gravity 3·12 to 3·33. It is found in veins in granite at St. Symphorien near Autun, and at St. Yrieux near Limoges in France, and also in several places in Saxony. An analysis of a specimen from Autun by Berzelius gave:—

Phosphoric Acid	14·63
Oxide of Uranium	59·37
Lime	5·66
Silica and Oxide of Iron	2·85
Magnesia and Oxide of Manganese	0·19
Barytes	1·51
Water	14·90
Fluoric Acid and Ammonia	Traces
	99·11

This mineral appears essentially to consist of the phosphates of uranium and lime.

Carbonate of Uranium, Uran-Bloom, Uraconite, occurs in small indistinctly crystalline flakes. Lustre but slight. Colour bright-yellow. Occurs in silver-veins at Joachimsthal in Bohemia, forming a coating on pitchblende.

Sulphate of Uranium.—This occurs as a thin botryoidal yellow-coloured coating over the surface of the minerals on which it is found. It is friable, and soils the fingers. Partially soluble in water, and the remainder in nitric acid; both solutions contain sulphate of uranium, and are of a yellow colour. It is found at Joachimsthal in Bohemia.

Sulphate of Uranium and Copper, Johannite, occurs crystallised. Primary form an oblique rhombic prism. Crystals very minute. Fracture imperfect conchoidal. Hardness 2 to 2·5. Taste slightly bitter. Partially soluble in water. Colour deep grass-green. Streak paler. Lustre vitreous. Translucent. Specific gravity 3·19. It occurs at Joachimsthal in Bohemia, and has not been quantitively analysed.

Samarskite, Uranotantalite, Yttroilmenite, is a compound of oxide of uranium with niobic and tungstic acids. From Miask and the Ural.

URAN-BLOOM. [URANIUM.]

URAN-MICA. [URANIUM.]

URANOCENTRON. [IGUANIDÆ.]

URANO'SCOPUS, a genus of Acanthopterygious Osseous Fishes of the Perch Family, and very nearly related to the Weavers (*Trachiurus*) of the British seas. One or two species inhabit the Mediterranean. The head is nearly cubical, and the eyes placed in the flat summit, so that they look upwards: hence the name. The mouth is turned up in a similar manner. This arrangement agrees with the habits of the fish, which buries itself in sand all but the summit of the head, and thus lies in wait for its prey. Its colour resembles the sand in which it lives.

URANOTANTALITE. [URANIUM.]

URAO, a variety of Sesqui-Carbonate of Soda. [SODIUM.]

URARI. [STRYCHNOS.]

U'RCEOLA, a genus of Plants belonging to the natural order *Apocynaceæ*, so named by Dr. Roxburgh from urceolus, 'a pitcher,' in consequence of the form of its corolla. The genus *Urceola* is confined to the Malayan peninsula, and the islands of Sumatra and Penang; but as it is by some botanists considered not to differ from the *Vahea* of Madagascar, the genus may have a wider distribution. It has the calyx small, 5-partite. Corolla urceolate; tube elongated, ventricose, 5 cleft. Stamens 5, anthers sagittate. Follicles 2; seeds numerous, glabrous.

U. elastica, or Caoutchouc-Vine, is shrubby and twining, climbing over trees to a great extent, sometimes as much as 200 paces; with oval opposite leaves, and terminal panicles. From wounds made in the bark of this plant there oozes out a milky fluid, which on exposure to the open air separates into an elastic coagulum, and watery liquid apparently of no use. After the separation takes place, this coagulum is not only like American Caoutchouc, or Indian-Rubber, but possesses all the same properties as first ascertained by Dr. Roxburgh ('Asiat. Res.,' v. 171.) He states that a ball of it externally has the appearance of American Caoutchouc; when cut into, it is of a light brown colour, till the action of the air darkens it. This ball, measuring 9½ inches in circumference, and weighing 7¼ ounces, in simply falling from a height of 15 feet, rebounded about 10 or 12 times, which is of itself an indication of the goodness of the Caoutchouc. Dr. Roxburgh also found that slips of it were capable of bearing a greater degree of extension and contraction than the American. When they broke, the elasticity was so great, that each end returned to its respective mass. The least pressure with the finger and thumb united different portions as perfectly as if they had never been separated: this property of Caoutchouc has been considered a much more modern discovery. [INDIA-RUBBER.]

URCEOLA'RIA, a genus of Crustaceous Lichens, belonging to Fée's family *Lecanoreæ*. The characters of this genus are as follows:—Thallus crustaceous, spreading, adnate, uniform; the apothecia, reproductive organs, are orbicular, with the disc concave, coloured, and immersed in the crust; the border of the apothecium is formed of the crust, and has the same colour. Hooker, in his 'British Flora,' enumerates six British species of *Urceolaria*. They are generally found on rocks, stones, and walls. Two of the species *U. scruposa*, the Common Urceolaria, and *U. cinerea*, the Gray Urceolaria, are used for dyeing.

URCHIN. [ERINACEUS.]

URCHIN, SEA. [ECHINIDÆ.]

UREDINACEÆ, a family of *Fungi*, belonging to the sub-order *Sporiferi*. It includes the various forms of *Fungi* which occur on diseased vegetable tissues, and which are hence called Blights. The spores are single, often partitioned on more or less distinct sporophores, flocci of the fruit obsolete or mere peduncles. [FUNGI.]

URE'DO. [FUNGI.]

URE'NA, a genus of Plants belonging to the natural order *Malvaceæ*. Like other Malvaceous plants, the species of *Urena* abound in strong and serviceable flax-like fibres, which are well fitted for conversion into cordage. *U. lobata* and *U. sinuata* are specially mentioned as employed for this purpose in India.

URETER. [BLADDER.]

URE'THRA. [BLADDER.]

URIA. [GUILLEMOTS.]

URINARY SYSTEM. [URINE.]

URINARY ORGANS. [KIDNEYS.]

URINE is a fluid secreted from the blood by the kidneys. This fluid in a healthy person when recently voided is acid, transparent, usually of a pale amber or straw-colour, of a brackish taste, peculiar odour, and of a specific gravity varying from 1·010 to 1·030. The character of the urine however is apt to be altered by a variety of circumstances: it differs, for instance, according to the time of the day at which it is passed, whether before or after a meal, and according to the quantity and quality of the food and drink consumed. Urine has therefore been divided into two kinds, that of assimilation, and that of the blood. The urine of the blood is that voided at a considerable time after food has been taken, when the process of digestion is complete, and the chyle has entered the blood: it has the properties of urine in an eminent degree, and from it we are enabled to learn the state of the kidneys and system in general. The urine of assimilation varies, being sometimes limpid and colourless, when a great quantity of fluids has been taken; at other times, after a full and solid meal, of a deep colour, and becoming turbid on cooling.

The character of the urine is affected by the seasons; in winter the kidneys are excited to greater activity than in summer, nor is the reason of this difficult of explanation. All the emunctories of the body act, as occasion may require, as mutual suppeditories. Now, in cold weather the perspiration is more or less suppressed; and were it not that the action of the kidneys was increased, we should be liable to plethoras, or repletions of the most dangerous nature. Hence it happens that when the perspiration is abundant, the urine is scanty and high coloured, and contains a strong impregnation of saline ingredients; when the perspiration is checked by any cause, the urine is copious, limpid, and its proper salts more diluted. The state of the mind has also a great influence on the urine: any sudden shock usually increases the quantity of this fluid, and it is then almost without odour or flavour, like water.

The colour of the urine of persons in health is usually of a pale amber colour, becoming slightly turbid towards the centre, seven or eight hours after having been passed, and shortly depositing a sediment, that rises up in the form of a cone from the centre of the This deposition, which at first is in small quantity, increase putrefaction renders the whole of the urine turbid. The co

urine varies. It becomes almost colourless if much drink has been swallowed; red after long fasting, the use of water-cresses, beet, sorrel, and madder; it is tinged blackish by chalybeates; yellow by saffron, turmeric, and rhubarb: the astringent principle of galls and other substances containing tannin is detected in the urine by this fluid assuming a bluish or greenish tint on any of the salts of iron being added to it.

The odour of healthy urine is somewhat aromatic, without acidity, ammoniacal smell, or fetid taint, and resembles in a great degree the odour of the perspiration of a healthy man. The urine of persons affected with stone in the bladder often acquires a highly offensive odour, and the urine of diabetic patients has usually a sweet wheyey smell. Certain substances when eaten, or even when respired, impart a peculiar odour to the urine. Garlic and other strong-smelling substances impart their peculiar odour to the urine, and the odorous principles of asparagus, cauliflowers, fennel, juniper berries, valerian, castor, balsam of Peru, copaiba, cubebs, and many other substances, likewise pass through the blood into the urine.

Healthy urine almost always gives an acid reaction; it becomes ammoniacal only by a prolonged exposure to the atmosphere, for it remains perfectly unchanged if kept in a vessel well stopped. Its ammoniacal transformation is owing to the spontaneous decomposition of the urea. It appears that this conversion may even take place in the kidneys under the influence of disease, especially in putrid and other adynamic fevers: then the urine is alkaline as it passes from the bladder, and proportionally so as it contains less urea.

In health the quantity of urine passed in 24 hours is subject to variation from temperature, the diet, and exercise of the individual, as well as other circumstances, and it is therefore impossible to fix a standard applicable to every case. Haller estimated the quantity voided in 24 hours to be as high as 49 ounces; Rye considered 40 ounces an average quantity in the same time; whilst Dr. Prout says that, if we consider that the quantity varies in this country from 30 ounces in the summer to 40 ounces in the winter, we should probably be very near the truth as regards a person in good health, and who does not drink more than nature requires. Lehmann gives 54 ounces as an average occuring in the case of nine healthy young men on whom he experimented.

The specific gravity of healthy urine varies in different individuals from 1·010 to 1·030. The late Dr. James Crawford Gregory found the mean specific gravity of urine in 50 apparently healthy subjects in Edinburgh, during the months of September, October, and November, at 2 o'clock in the day, to be 1·02246. Dr. Prout considers the average specific gravity to range from 1·015 in the winter to 1·025 in the summer. The specific gravity is liable however to change according to circumstances. According to Vogel it is greatest after the principal meal, dinner. It is least when liquids are being drunk.

The following table was constructed by Dr. Henry for ascertaining, without the trouble of evaporation, the quantity of solid extract contained in the pint (16 ounces) of urine of different specific gravities from 1·020 to 1·050:—

Specific Gravity at 60° F.	Solid Extract in a wine pint, in grains.	Solid Extract in a wine pint, in ounces. os. drs. sc. grs.
1·020	382·4	0 6 1 2
1·021	401·6	0 6 2 1
1·022	420·8	0 7 0 0
1·023	440·0	0 7 1 0
1·024	459·2	0 7 1 19
1·025	478·4	0 7 2 18
1·026	497·6	1 0 0 17
1·027	516·8	1 0 1 16
1·028	536·0	1 0 2 16
1·029	555·2	1 1 0 15
1·030	574·4	1 1 1 14
1·031	593·6	1 1 2 13
1 032	612·8	1 2 0 12
1 033	632·0	1 2 1 12
1·034	651·2	1 2 2 11
1·035	670·4	1 3 0 10
1·036	689·6	1 3 1 9
1·037	708·8	1 3 2 8
1·038	728·0	1 4 0 8
1·039	747·2	1 4 1 7
1·040	766·4	1 4 2 6
1·041	785·6	1 5 0 5
1·042	804·8	1 5 1 4
1·043	824·0	1 5 2 3
1·044	843·2	1 6 0 3
1·045	862·4	1 6 1 2
1·046	881·6	1 6 2 1
1·047	900·8	1 7 0 0
1·048	920·0	1 7 1 0
1·049	939·2	1 7 1 19
1·050	958·4	1 7 2 18

In order to ascertain the quantity of solid matter in 16 fluid ounces of urine of a given specific gravity, it is only necessary to refer to the above table. The following table gives the composition of the urine as given by various chemists:—

		Berzelius.	Simon.	Müller.	Marchand.
Animal and destructible principles.	1. Water	933·00	956·000	956·8000	933·199
	2. Urea	30·10	14·578	14·2300	32·673
	3. Lithic Acid	1·00	0·710	0·3700	1·065
	4. Free lactic acid, lactate of ammonia, and animal matters not separable from them	17·14	12·940	14·1326	14·280
	5. Mucus of the bladder	0·32		0·1650	0·283
Alkaline and earthy salts.	6. Sulphate of potash	3·71	3·508		3·527
	Sulphate of soda	3·16			3·213
	7. Phosphate of soda	2·94	2·330		3·056
	Phosphate of ammonia	1·65			1·552
	8. Chloride of sodium	4·45	7·280		4·218
	Muriate of Ammonia	1·50		14·0734	1·653
	9. Earthy phosphates, with a trace of fluate of lime	1·00	0·654		1.210
	Silex	0·03	a trace.		
	Total	1000·00	998·000	999·7710	1000·00

In addition to these matters, which constantly exist in healthy urine, this fluid occasionally contains the following substances:—

10. Albumen; fibrin; red particles.
11. Various acids, colouring-matters, &c., formed from or accompanying the lithic acid; nitric acid.
12. Xanthic oxide.
13. Cystic oxide.
14. Sugar; oxalic acid; oxalate of lime; carbonic acid.
15. Hippuric acid; benzoic acid.
16. Kiestine.
17. Biliary matter.
18. Fat and chylous matter.
19. Spermatozoa.
20. Foreign matters.

We shall proceed to notice most of those substances separately which are found in healthy urine.

Water is the basis of all animal fluids, and forms a very large proportion of urine. Sometimes an increase of the watery portion takes place, whilst the other principles remain the same, or become diminished. In this state of the urine, the urea and the salts bear to each other nearly their ordinary proportion, but are considerably deficient in their absolute quantity. Sometimes the increased flow of urine involves an increased proportion of a natural ingredient, as of urea, or of unnatural ingredients, as of albumen or sugar. On the other hand, the proportion of water is not unfrequently diminished below the natural standard, as in various forms of urinary suppressions; and sometimes, when the cause of this suppression is mechanical, the urine is simply diminished in quantity, while its composition remains the same. At other times the suppression is connected with deranged action of the kidneys, and while the proportion of water is diminished, the other ingredients are relatively much increased, as in various forms of gravel and calculus. Drinking water and liquids containing water increases the quantity in the urine. Becker says that drinking pure water increases the quantity of solid matters carried off by the kidneys, but that tea, coffee, beers, and wines, though containing an equal quantity of water, diminish the quantity of solid matters excreted by the urine.

Urea is the principal solid element of the urine of *Mammalia*. It may be obtained in several ways. Liebig recommends the urine to be evaporated at 200° to a thin syrup, then adding an equal volume of colourless nitric acid (specific gravity 1·35): nitrate of urea is thus obtained, while the colouring matter is destroyed with brisk effervescence. The nitrate of urea which is formed is dissolved in water, re-crystallised, and neutralised by potash or baryta. The whole is then to be gently evaporated to dryness after separating as much nitrate of potash or baryta as possible, and the dry mass digested in alcohol, which dissolves only the urea, and by spontaneous evaporation yields it in large transparent prismatic crystals. Urea has been artificially obtained from cyanate of ammonia by Wohler. It forms 4-sided prisms, resembling nitre in appearance. It is soluble in both alcohol and water. When heated it melts, gives off ammonia, and finally solidifies, being in a great measure converted into cyanic acid and ammonia. It readily unites with nitric, oxalic, and acetic acids. By the addition of nitric acid to urine, crystals of nitrate of urea may be detected under the microscope. Urea is composed of the four organic elements, carbon, hydrogen, oxygen, and nitrogen, according to the formula, C_2, N_2, H_4, O_2. These elements arranged thus, C, N O, H O, N H_2, form cyanate of ammonia. When urine is left in contact with the mucus usually suspended in it, the mucus begins to decompose, and excites in the urea such a reaction with the elements of

water, as to convert the urea into carbonate of ammonia. This is the reason why urine speedily becomes alkaline, though acid when voided. If the urine is filtered from the mucus as soon as passed, it remains for a long time unchanged.

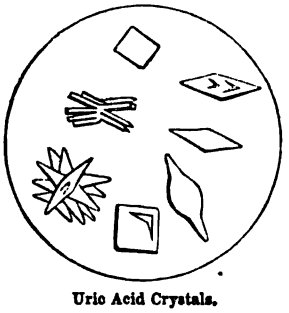
The ultimate source of urea in the urine is undoubtedly the metamorphosis of the muscular and nervous tissues of the body. It has been found, that in proportion to the muscular exercise taken, is the urea increased in the urine. Urea is also found in greater quantities in the urine of children, in whom the vital processes are more active than in the urine of adults. A question has arisen, as to whether urea is formed by the secreting energies of the kidney, or is merely separated from the blood by this organ. The fact of urea having been detected in the blood by Strahl, Lehmann, and others, would lead us to the conclusion that the latter is the fact. Another question then occurs, as to whether the urea in the blood is the result of the immediate metamorphosis of the tissues, or is formed by the intervention of other compounds. It appears that urine is easily formed from creatin, a substance that is the result of the decomposition of flesh, and it is not improbable that creatin is the source of urea in the blood. Although it has been generally supposed from the effect of arresting the function of the kidney that urea in the blood is a deadly poison, recent experiments have shown that a considerable quantity of urea may be injected into the blood without the destruction of life. It is probable that urea destroys life by becoming converted in the blood into carbonate of ammonia.

The quantity of urea secreted depends, as stated above, on age and muscular exertion, but these are not the only conditions which affect the quantity of urea in the urine. The quality of the food has an especial influence on this substance. Bischoff found, in a course of experiments on dogs, that one dog when taking 4000 grammes of beef discharged 190 grammes of urea daily, and when living on 500 grammes of potatoes and 250 grammes of fat excreted not more than from 6 to 8 grammes. Siegmund also, in a series of experiments performed on rabbits, found that the quantity of urea gradually diminishes with the quantity of the food.

Uric Acid invariably exists in healthy urine, and can be easily precipitated by the addition of any acid. As the production of this acid in the system is intimately connected with the nature of the food and the powers of digestion, deposits of this acid, as might be expected, are of frequent occurrence. This acid is either deposited in the form of powder (or, as it is usually called, amorphous sediment), or in the form of crystals and large concretions. The amorphous sediment varies extremely in its colour, from snow-white to fawn colour or reddish-brown, occasionally assuming a series of beautiful tints, varying from the most delicate pink to the brightest carmine, or very nearly to the deepest crimson. These varieties of colour depend on the greater or less proportion of the colouring-matter of urine, and a peculiar principle (phosphate of ammonia) developed in the kidneys. In this form the uric acid is usually in combination with ammonia. Healthy urine contains urate of ammonia to the amount of about 1-800th part, and the salt requires about 480 times its weight of cold water to dissolve it. We see therefore that if by any derangement in the digestive organs the quantity of urate of ammonia should be increased in the urine, a portion of it would of necessity be thrown down, as the urine would not be sufficient to hold the whole of it in solution. Urine containing this amorphous deposit varies in colour according to its sediment. It is always acid, and usually of high specific gravity, and is rendered transparent by the application of heat, unless the urine be albuminous or contain mucus.

When a deposit of urate of ammonia is examined under the microscope, it is found to be made up of a series of amorphous granules, presenting no approach to a crystalline arrangement, unless, as very frequently occurs, free uric acid be present. On gently warming the drop of urine submitted to examination the deposit vanishes, and then any crystals of uric acid.

Uric Acid is often deposited in a crystalline form, and is found most generally of a yellow, orange-red, or brick-dust colour never however



Uric Acid Crystals.

presenting the beautiful carmine tints occasionally possessed by urate of ammonia. It is sometimes met with isolated and unmixed with any amorphous deposits, but more generally is found in company with the urate of ammonia. On being allowed to subside two distinct layers are formed, the lowest consisting of uric acid, often in crystals

sufficiently large to be distinguished by the unassisted eye; and above this a dense stratum of amorphous urate. Under the microscope uric acid presents a number of forms, but the rhomboid of a tolerably distinct lozenge-shape is the most frequent form. Several secondary forms, probably depending on a variable portion of colouring-matter being present, frequently occur; among these are the table, the flattened cylinder, sharply serrated lozenges, and stella formed by the cohering of elongated rhombs.

Uric Acid appears to be formed in the system under the same circumstances as urea; but its formation in the blood seems to be anterior to the urea. Uric acid appears to be converted into urea by the process of oxidation, hence its development is increased by sedentary pursuits, and arrested by active exercise. The acidity of urine does not depend so much on uric acid as on acid phosphate of soda, which is formed by some acid uniting with the soda of the phosphate and converting it into a superphosphate. The formula of Uric Acid is C_{10}, N_4, H_4, O_6.

Although lactic acid is said to be present in human urine, it does not appear that it occurs in healthy human urine; it is very soon developed in the urine when the oxidation in the blood is to any extent impeded. Hence it is found when fever is present, and in those disturbances of the respiratory and digestive organs which lead to a deficient oxidation of the blood.

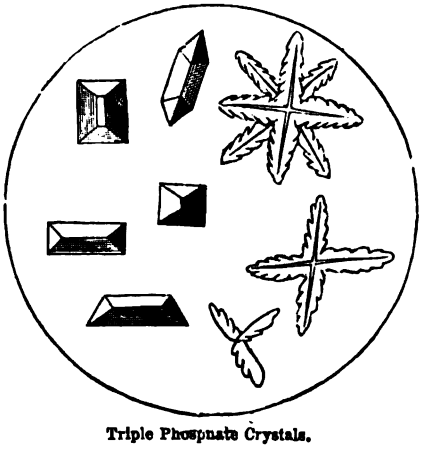
The extractive matters of the urine referred to in the analyses consist of substances of which our knowledge is daily increasing. Thus, creatin and creatinin are found in normal urine, although their quantity and relations have not been well made out. We may also refer to this head hippuric acid. It is well known that when animals take food containing benzoic acid, that their urine contains hippuric acid. Particular kinds of diet favour the development of hippuric acid at the expense of uric acid, whilst a mixed diet is unfavourable to the development of hippuric acid. Formic acid may be also mentioned here as a substance recently detected in healthy urine, and probably included in extractive matters.

The colouring matters of the urine are not specially named in chemical analyses. That some one substance, accordingly as it abounds or is absent, produces the various shades of yellow, red, and brown observed in urine, is not improbable. Vogel, who has devoted much attention to this subject, is of opinion that the urine-pigment is formed from the hæmatin of the blood, and is produced by a decomposition of the blood-corpuscles. On this ground he regards the amount of pigment in the urine as an index to the amount of disintegration of the blood-cells in a given time.

Mucus always exists in healthy urine in minute quantities, and the following are the appearances which it assumes:—After the urine has stood for some time in a tall glass vessel, the lower strata of the fluid will be found to have lost their transparency, and an exceedingly light nebulous-looking substance will be found floating in the vessel. If collected in a filter, mucus, when moist, is always more or less transparent; and when dried, it has a shining appearance. Mucus is not coagulated by boiling, which distinguishes it from albumen; it is in great part soluble in the acetic and nitric acids, but not in the sulphuric acid; it is also soluble in caustic potass. Under the microscope it presents cells larger than those of the blood, and delicately granulated on their surface. With these will be found, in the transparent liquid, a number of minute granular points.

Sulphuric Acid and Sulphates.—These are formed by the oxidation of the sulphur of the protein-compounds; and it has been shown by Dr. Bence Jones, that they are abundant in proportion to the destruction of the tissues and the oxidation of the sulphur.

Phosphoric Acid and Phosphates.—These appear to be derived as the sulphates from the disintegration of the tissues containing phosphorus, which is more especially the case with the nervous. The



Triple Phosphate Crystals.

phosphates of the alkalies are found to be increased in diseases in which the activity of the nervous system is increased. The phosphates

of lime and magnesia are naturally found in the urine, arising from the disintegration of the osseous tissue. Their deposit so as to form calculi depends on the absence of the acid phosphate of soda in which they are soluble, and not to their redundance in the system. During the deposit of the ammoniaco-magnesian phosphate, the urine is sometimes neutral, often acid, and never alkaline, unless the deposited phosphate is really a secondary result. On exposing to heat urine of this kind, the triple salt is deposited, the precipitation often being attended with an evident evolution of carbonic acid. Dr. Bird has figured two distinct forms of triple phosphate, each containing a different proportion of ammonia, and readily distinguishable by the shape of their crystals. The first appears under the microscope of a weak magnifying power as a series of beautifully-defined transparent crystals, being either prisms or some modifications of them. The second forms elegant stellar crystals, or thin crystalline laminæ, resembling foliage.

Where this salt exists in combination with phosphate of lime, forming the well-known fusible compound, the characters of the urine scarcely differ from those met with in simply phosphatic secretion.

Chloride of Sodium.—This substance seems to result from the kind of food rather than the disintegration of the tissues, and thus it is found varying in quantity according to the nature of the food.

Soda, Potash, Ammonia.—The two fixed alkalies exist in the urine in combination with the sulphuric, phosphoric, muriatic, and lactic acids; whilst ammonia is found in combination only with the hydrochloric, phosphoric, and uric acids.

Lime.—If to urine, deprived by filtration of its vesical mucus, an excess of caustic ammonia be added, a very bulky precipitate is thrown down. This precipitate (besides a minute quantity of ammonio-phosphate of magnesia) contains the lime in union with phosphoric acid.

Magnesia, like lime, in combination with phosphoric acid, is one of the constituents of bone earth; but it forms a very small part. It is also a principal ingredient of certain urinary calculi, into two species of which it enters.

Silica, or Silicic Acid, is reckoned by Berzelius amongst the constituents of healthy urine, and it has been occasionally detected in urinary calculi.

For an account of the products only occasionally found in the urine, see the article URINE, PATHOLOGY OF, in ARTS AND SC. DIV.

On examining the sediment of urine under the microscope, a number of substances presenting definite forms will be seen. The mucus-corpuscles have been referred to above, but there are other morphological elements which probably supply the chemist with the quantity of matter placed under the head of extractive matters and mucus. These are as follows:—

1. The pavement-epithelium of the urinary passages and bladder, cells of which are never wholly absent.

2. Tube-like or cylindrical bodies. These are casts of the tubes in the kidneys, and are frequently found in large quantities in diseased conditions of the organs.

3. Spermatozoa, which are often found in normal urine, arising from natural causes.

4. Filamentous *Fungi* are developed in urine after it has been kept some time, and arises under the same circumstances as the various forms of ferment *Fungus*.

5. *Infusoria*, especially those called *Vibrio*, are found present in decomposing urine.

The foreign substances which are accidentally found in the urine are referred to in the article MICROSCOPE, USES OF THE.

(Bowman, *Medical Chemistry*; Beale, *The Microscope in its Applications to Chemical Medicine*; Gregory, *Handbook of Inorganic Chemistry*; Bence Jones, *On Animal Chemistry in its Application to Stomach and Renal Diseases*; G. E. Day, *Contributions to Urology*; *British and Foreign Medico-Chirurgical Review*, July, 1855.)

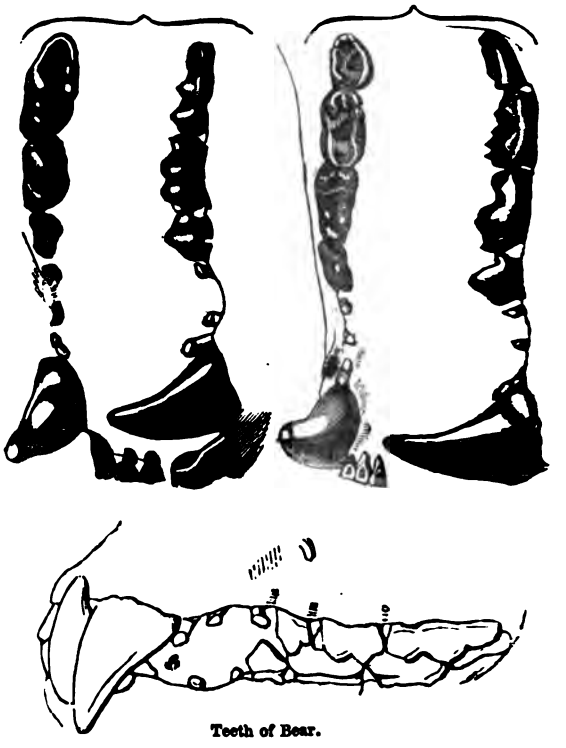
UROMASTIX. [DRACONINA.]

URSIDÆ. Under the article BEAR will be found a full account of the species of the genus *Ursus*. This is a genus placed in the last edition of the 'Systema Naturæ' that underwent the revision of Linnæus, between *Mustela* and *Didelphis*, and includes the following species—*arctos*, *meles*, *lotor*, and *luscus*: in other words, it consists of the True Bears, the Badger, the Raccoon, and the Wolverene or Glutton.

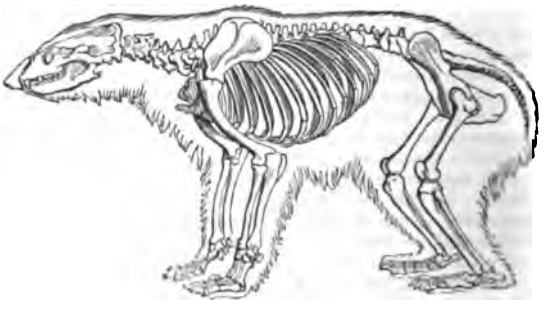
We shall here give an account of the other genera of *Ursidæ*, and illustrations of the organisation of the genus *Ursus* (Linn.):—

The cylindrical bones of bears come nearer to those of man than the same bones in any other quadruped: the femur especially, although there is but a slight depression for the ligamentum teres, is closely approximated to the same bone in the human skeleton; and hence the faculty possessed by the bear of rearing itself on its hind-legs and dancing. The caudal vertebræ in every well-preserved skeleton—those in the Museum of the College of Surgeons for instance—extend beyond the pelvis.

Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{7-7} = 42$.



Teeth of Bear.

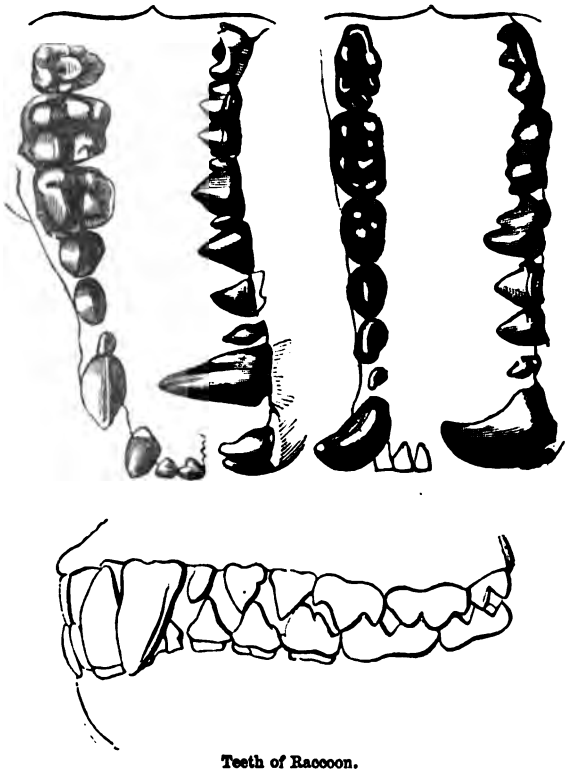


Skeleton of Polar Bear (*Ursus arctos*, *Thalarctos maritimus*).

Procyon (Storr.), the Racoons, have the three last molars with blunt tubercles on their crowns. Muzzle pointed. Ears small. Tail very long and hairy. No anal follicles. Six ventral mammæ. Feet pentadactyle: claws sharp; the entire sole of the foot applied to the ground, when the animal is stationary only; in progression the heel is raised.

Raccoon (*Procyon lotor*; *Ursus lotor*, Linn.). (E. T. Bennett.)

Dental Formula :—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6} = 40$.



Teeth of Raccoon.

P. lotor (*Ursus lotor*, Linn.), is the Raton of the French; Raccoon ('Coon in clipped language) of the Anglo-Americans; Mapach, Yllamaton, Maxile, and Cioatlamacazque of the Mexicans; and Raccoon Bear of Pennant.

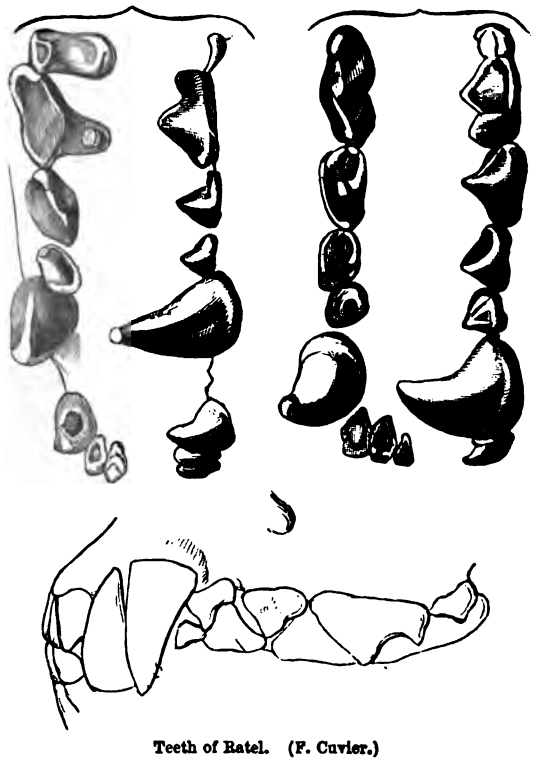
The head is round, with a narrow tapering nose projecting beyond the mouth, black at the end, and flexible: the lips black. Eyes moderately large and round, with a circular pupil. Elliptical ears low, but erect, with rounded tips, dirty white. Whiskers strong. Short-haired muzzle, dirty white, the colour extending round the cheek and over the eyes. A dark brown mark across the eyes and cheek, and another between the eyes, extending from the forehead. Back grizzled. Belly paler than the back. Tail bushy, not unlike a fox's brush, dirty white, annulated with dark rings. Length of head and body, 2 feet; of tail (vertebræ) 9½ inches.

It is a native of the North of America. Several specimens are to be seen in the Gardens of the Zoological Society, Regent's Park.

Mellivora (Storr.).—General characters corresponding with those of *Gulo*. [GULO.] Feet pentadactyle.

Dental Formula :—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{4-4}{4-4} = 32$.

Ratel (*Mellivora Capensis*).



Teeth of Ratel. (F. Cuvier.)

In some points this genus approximates to the Hyænas: in others, to the Polecats, Zorillas, and Martins.

M. Capensis.—This appears to be the *Viverra Capensis* of Schreber, *Gulo Capensis* of Desmarest, *Mellivora Capensis* of F. Cuvier, *Viverra mellivora* and *Ursus mellivorus* of Blumenbach, *Taxus mellivorus* of Tiedemann, *Meles mellivora* of Thunberg, Stinkbinksen of Kolbe (?), Ratel of Sparrmann, Fizzler Weesel and Ratel of Pennant, Honey Weesel of Shaw, Honig Freter of the Dutch Cape Colonists, and Blaireau Puant of La Caille.

The head is rather smooth, but stiff and wiry. Body above from the top of the head to the root of the tail dull ash-gray, whitest towards the head. Muzzle, space round the eyes and ears, limbs, all the under parts, and rest of the tail, black. Claws on the fore-feet long, the middle three longest, the internal claw placed much more backward than the rest. Bulk about that of a Badger. Total length three feet, the tail about a sixth of the length. Height about 10 or 12 inches.

The hide of this quadruped is so tough and loose, that, according to Sparrmann, if anybody catches hold of it by the back part of the neck, it is able to turn round, so to speak, in its skin, and bite the offending arm. The claws of the fore feet are longest, and well formed for grubbing. The bees, according to the description of the author last quoted, who drew his information from the Hottentots, furnish the principal means of subsistence to the Ratel. These insects, in that part of South Africa where the Ratel is found, usually inhabit the deserted lairs and burrows of the Ethiopian Boar, the Porcupine, &c., and, according to the accounts given, the Ratel, which preys in the evening, ascends to the highest parts of the deserts to look out, and will then raise its paw before its eyes to prevent their being dazzled by the sun. Here he watches and listens for the Honey-Guide Cuckoo [INDICATORINÆ], which serves both the Hottentot and quadruped as a conductor to the bees' store, or for the flight of the bees themselves. If the beast have luck to trace the guide or the insect it follows, and if the nest be on the ground or near it, he undermines it with his natural digging instruments, and secures the contents. If the nest be in the tree, the Ratel, which cannot climb, gnaws the trunk in its unavailing rage, leaving marks which the Hottentot well knows as indicative of the treasure above.

Mr. Bennett well observes that the dentition of the Ratel is much at variance with the diet above attributed to him, and that the accuracy of these accounts may be doubted. "It requires," says he, "the most positive evidence to convince us that an animal, the number and disposition of whose teeth correspond more closely with those of the cats than any other quadruped with which we are acquainted, and exhibit a carnivorous character scarcely, if at all, inferior to that which is evidenced by the same organs in the hyænas, should subsist entirely, as from these accounts we are left to believe, upon the petty rapine of a hive of bees and the honied produce of their comb. Still, there exist such decisive marks of a diminished capacity for preying on animal food, in the thickset and clumsy form of its body, the short-

ness of its limbs, its partially plantigrade walk, the structure of its muzzle, and even in the form of the teeth themselves, as to induce us to pause before we determine to reject the popular testimony as unworthy of credit, although we must regard it as doubtful on some particular points, and insufficient and imperfect on the whole."

It inhabits the Cape of Good Hope.

Meles (Brisson), the Badger, has the following—

Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{4-4}{6-6} = 36$.

Teeth of Badger.

[BEAR; BADGER; PANDA; ICTIDES; GULO; VIVERRIDÆ.]

URSUS. [BEAR; URSIDÆ.]

URTI'CA (from 'uro'), a genus of Plants known under the common name of Nettle. Nettle is the same word as the Anglo-Saxon 'netel,' or 'nædl,' a needle, which is applied to these plants on account of their possessing small bristles or prickles which have a stinging property. This genus is the type of the natural order *Urticaceæ*. The flowers are either monœcious or dicœcious. The staminiferous flowers have a single perianth of 4 leaves, containing the rudiment of a pistil. The pistilliferous flowers have a single perianth of 2 leaves; a sessile stigma, and a dry fruit containing a single seed. Most of the species are herbaceous plants or under-shrubs, and are found in Europe, Asia, and America. Three of the species, of which there are about 40, are British.

U. pilulifera, the Roman Nettle, has opposite ovate serrated leaves, with transverse nerves, and the pistilliferous flowers pedunculated, and arranged in globose spikes. This plant is found in England, under walls and amongst rubbish, principally near the sea, in the counties of Norfolk and Suffolk. It has also been found in the south of Ireland. This is the most virulent of our native nettles.

U. dioica, the Great Nettle, has ovate-acuminate leaves, cordate at the base: the flowers are dicœcious in clusters, much branched, and the clusters in pairs. This is a very common plant throughout Europe, in waste places, under walls and hedge-banks. The tops of this plant, when young in spring, are sometimes eaten as a potherb, especially among the humbler classes in Scotland.

U. urens, Small or Garden-Nettle, has opposite elliptical leaves with about 5 nearly parallel ribs, with nearly simple clusters of flowers.

U. tenacissima, like some of the other nettles, as well as the hop and the hemp, belonging to the same natural family, abounds in ligneous fibre, which may be converted into very strong cordage. This is the Caloee of Marsden, Rami of the Malays, a native of Sumatra, also of Rungpore, where it is called Kunkamis, and which Dr. Roxburgh found one of the strongest of all the vegetable fibres which he subjected to experiment.

The woody fibres of other species of *Urtica* are employed in making linen. The *U.* (*Boehmeria*) *nivea* yields a remarkably fine fibre, with which delicate fabrics are made in India.

URTICA'CEÆ, *Nettles*, or *Nettleworts*, a natural order of Plants. The plants belonging to this order are trees, shrubs, and herbs, yielding in some instances a milky juice. The leaves are alternate, and usually covered with asperities or with hairs furnished with a stinging secretion; the stipules are membranaceous, and are deciduous or convolute in vernation. The flowers are monœcious or dicœcious, either scattered or collected together in catkins or in close heads. The calyx is membranous, lobed, or persistent. The stamens are definite in number, not united, and inserted into the calyx opposite its lobes; the anthers during æstivation are curved inwards, but are turned backwards with elasticity after bursting. The ovary is superior, containing a solitary erect or suspended ovule with a simple stigma. The fruit is either a simple indehiscent nut, surrounded by a membranous or fleshy calyx, as in *Boehmeria* (*fig.* 1); or it is a fleshy receptacle, either

Fig. 1.

Boehmeria cordata.

a, branch, with flowers; *b*, single flower; *c*, collection of fruits; *d*, section of fruit, lying in which is seen the seed and embryo.

covered by numerous nuts lying among the persistent fleshy calyces, as in *Dorstenia*, or the nuts are inclosed in the cavity of the receptacle, as in the Common Fig (*fig.* 2); or it may consist of a single nut covered

Fig. 2.

Common Fig (*Ficus Carica.*)

a, branch, with leaves and figs; *b*, section of a fig, showing the flowers inclosed within the fleshy receptacle; *c*, male flowers separated; *d*, section of ovary; *e*, section of seed, showing curved embryo.

by a succulent involucre. The embryo is straight, curved, or spiral, sometimes without albumen; the cotyledons are flat, and the radicle points to the hilum.

The order, as thus defined, includes several groups of plants which are frequently separated, as the *Artocarpeæ* of Robert Brown, the *Batideæ* of Martius, and the *Moreæ* of Endlicher.

This order brings together plants growing all over the world, possessing very different properties, and yielding very various and useful products. The Stinging Nettles [URTICA] form the type of the order. To it belongs also the deadly Upas. [ANTIARIS.] The wholesome Fig, the celebrated Banyan, and species yielding deadly poisons belong to the genus *Ficus*. [FICUS.] The Bitter Hop [HUMULUS], the Acid Mulberry [MORUS], and the Narcotic Hemp [CANNABIS], and famous Cow-Tree [COW-TREE], all belong here. The sap of many of the species, especially those belonging to the division *Artocarpeæ* is milky. [ARTOCARPACEÆ; MORACEÆ; ARTOCARPUS; BŒHMERIA; DORSTENIA.]

URUS. [BISON; BOVIDÆ.]

U'SNEA, a genus of Plants belonging to the natural order of Lichens. The *Usnea plicata*, in common with the *Roccella tinctoria* and other Lichens, is used as a dye.

UTRICULA'RIA, a genus of Plants belonging to the natural order *Lentibulariaceæ*. It has the calyx with two equal leaves, a personate spurred corolla, a 2-lipped stigma, a globose capsule of one cell, and several seeds fixed to a central receptacle. There are only three species, *U. intermedia*, *U. vulgaris*, and *U. minor*. They are all inhabitants of Great Britain. The metamorphosed leaves attached to the roots of all the species are furnished with little bladders, which, when the plant is growing at the bottom of a ditch or pond, are filled with water.

UTRI'CULUS, in Botany, a form of Fruit. [FRUIT.]

UVARIA. [*See* SUPPLEMENT.]

U'VULA. [PALATE.]

UWAROWITE, *Chromium Garnet*, a Mineral occurring crystallised in Rhombic Dodecahedrons. Colour emerald green. Hardness 7·5. Lustre vitreous. Nearly transparent. Specific gravity 3·41. It is found at Bessersk, in the Ural Mountains. Its analysis by Komonen gives—

Silica	37·11
Alumina	5·88
Oxide of Chromium	22·54
Protoxide of Iron	2·44
Lime	30·34
Magnesia	1·10
Water	1·01
	——100·42

V

VACCINA'CEÆ, *Cranberries*, a natural order of Exogenous Plants. The species of this order are shrubby plants, with round irregularly angled stems and branches; simple entire alternate coriaceous leaves, with a solitary or racemose inflorescence. The calyx is superior and entire, or with 4, 5, or 6 lobes, sometimes deciduous. The corolla is monopetalous, and its lobes correspond to those of the calyx, and are alternate with them. The stamens are free, and are generally double the number of the lobes of the calyx, and are inserted into an epigynous disc; the anthers are terminal, 2-celled, bursting by pores, and furnished with two horns. The ovary is inferior, surmounted by the epigynous disc, 4-5-celled, with one or many seeds in each cell; the style and stigma are both simple. The seeds are very small, with a straight embryo in the midst of a fleshy albumen; the cotyledons are very short, and the radicle is long. This order is made by many botanists a section of *Ericaceæ*. It differs from *Ericaceæ* in possessing an inferior ovary and a succulent fruit. It was placed by Richard in *Escalloniaceæ*, but it differs from this order in being monopetalous, and its anthers bursting by pores.

Common Bilberry (*Vaccinium Myrtillus*).

1, branch, with fruit; 2, stamen, showing horned and porous anthers; 3, stamens seated on disc; 4, section of fruit; 5, seed with embryo.

The plants of this order are not common in Europe, but they are abundant in North America, extending to very high northern latitudes, and are not uncommon on high land in the Sandwich Islands. [ERICACEÆ; VACCINIUM.]

VACCI'NIUM, a genus of Plants, the type of the natural order *Vaccinaceæ*. This genus consists of shrubby plants with alternate membraneous leaves, often beset with resinous dots, and are either permanent or deciduous. The flowers are seated on pedicels, and are either solitary or arranged in simple racemes, generally drooping, without any odour, and tinted with various shades of red or pink. The calyx is 4-5-toothed; the corolla urceolate or campanulate, more or less deeply 4-5-cleft, with the limb reflexed; the stamens are 8 or 10, not attached to the corolla, with 2-horned anthers dehiscing at the summits, and sometimes furnished at the back with two spreading spurs or bristles; the style is longer than the stamens, and the stigma obtuse; the fruit is a berry, globose, depressed at the top, 4- or 5-celled, many-seeded, of a black purple, bluish, or red colour, generally eatable, though not always pleasant or wholesome in an uncooked state. The genus consists of about 50 species, which are known by the common names of Bilberries, Whortleberries, Bleaberries, &c.

V. Myrtillus, the Common Bilberry or Bleaberry, has solitary pedicels, 1-flowered, the leaves are serrated, ovate, smooth, the stem is acutely angular, and the calyx hardly divided. It is a small shrub about a foot high, and is a native of heaths, stony moors, and mountain-woods throughout Europe. It is abundant in Great Britain. In the north of England and Scotland the berries are gathered and used for making tarts; in Devonshire and in Poland they are eaten with clotted cream.

V. uliginosum, Great Bilberry, or Bog Whortleberry, has 1-flowered peduncles, with obovate, entire, veined, and deciduous leaves, with rounded stems. Like the last it is a small shrub, and attains a height of two feet. It is a native of Great Britain, and is found in mountainous bogs in Cumberland and Westmorland, but is more frequent in the Highlands of Scotland, being found nearly on the summits of the highest mountains. Its berries are very similar to those of the common whortleberry, but their flavour is not so agreeable.

V. Vitis-idæa, Red Whortleberry, or Cowberry, has terminal racemes of drooping campanulate flowers, with evergreen obovate leaves, dotted beneath, and their margins slightly revolute, and nearly entire. It is a low straggling shrub, with leaves resembling those of the Box, and pale flesh-coloured flowers. It is a native of dry places on heaths, mountains, and in woods, throughout Europe. It is plentiful in the north of England, Westmorland, Derbyshire, and Wales. This plant is the badge of the clan Macleod. The berries have a red colour, and possess acid and astringent properties. They are hardly eatable raw.

V. stamineum, the Green-Wooded American Whortleberry; *V. corymbosum*, the Naked Flowering Whortleberry; and *V. frondosum*, the Blunt-Leaved Whortleberry, or Blue Tangles, are American species.

V. Arctostaphylos, Oriental Bearberry, or Bear's-Grape Whortleberry, is a native of the coast of the Black Sea, where it was originally gathered by Tournefort, who was of opinion that it was the Ἀρκτοστάφυλος, or Bear's-Grape of Galen.

VACHELLIA, a genus of Plants belonging to the natural order *Leguminosæ*.

V. Farnesiana, a native of the East and West Indies, exudes from its bark a considerable quantity of gum. The flowers when distilled yield a delicious perfume.

VAGI'NULUS. [LIMAX.]

VALERIAN. [VALERIANA.]

VALERIAN, GREEK. [POLEMONIUM.]

VALERIA'NA, a genus of Plants, the type of the natural order *Valerianaceæ*. The species of this genus are herbs or undershrubs, with very variable leaves, and mostly reddish-white corymbose flowers. The limb of the calyx is involute during flowering, but it at last

unfolds itself in the form of a feathery pappus, which is seated on the inferior ovary, the corolla is infundibuliform, gibbous at the base, and 5-cleft; the stamens are 3, and the fruit is indehiscent, 1-celled, and 1-seeded. This genus presents many diversities of form, although its species are obviously closely related.

V. officinalis, the Officinal or Great Wild Valerian, is a smooth erect plant, with furrowed stems, with all the leaves pinnated, the leaflets being serrated and lanceolate, in 7 or 8 pairs, with an odd one; the inflorescence is at first a corymb, but by growth becomes a panicle; the fruit is glabrous. This plant is a native of Europe, and by the sides of rivers and in ditches and moist woods is abundant in Great Britain. This plant was introduced into medicine, and admitted into the Pharmacopœia, on account of its being supposed to be the Phu (Φοῦ of Dioscorides). The *V. Phu* of Linnæus was afterwards supposed to be the genuine Phu, but Dr. Sibthorp discovered another species of Valerian in Greece, which Smith has named *V. Dioscoridis*, and which is probably the plant of Dioscorides. The root has a very strong smell, which is dependent on a volatile oil. It is very attractive to cats, and also to rats, and is employed by rat-catchers to decoy rats. It is much employed also in medicine at the present day. [VALERIAN, in ARTS AND SC. DIV.]

V. rubra, the Red Valerian, is often referred to the genus *Centranthus*. [CENTRANTHUS.]

V. dioica, the Small Marsh Valerian, is a glabrous erect plant, with a striated stem; the radical leaves ovate, undivided; those of the stem pinnatifid, with linear oblong leaflets; the stamens and pistils are on separate flowers in different plants, the corymbs of staminiferous flowers are loose, those of pistilliferous flowers are contracted; the lobes of the stigma are almost united; the fruit is smooth. This plant is a deciduous herbaceous perennial, very common in moist meadows, by the sides of rivers, and in ditches, throughout Europe. It is abundant in some parts of Great Britain.

Valeriana dioica.

1, cutting, with pistilliferous flowers; 2, ditto, with staminiferous flowers; 3, section of pistilliferous flower with fertile cell; 4, section of staminiferous flower; 5, section of sterile cell; 6, fruit with permanent feathery calyx.

V. Dioscoridis, the ancient Grecian Valerian, was first described by Smith, in the 'Flora Græca,' Dr. Sibthorp having discovered it near the river Limyrus in Lycia. Professor Edward Forbes, in his travels in Lycia, met with this plant in great abundance over a large district.

V. Phu, the Garden Valerian, is an erect glabrous plant with square smooth stems; the root-leaves entire, oblong or elliptic; those of the stem pinnatifid, with oblong lobes; the corymbs panicled; lobes of the stigma 3; fruit smooth, except in two hairy lines. This plant is a native of Europe, in Belgium, France, Switzerland, Silesia, &c. [CENTRANTHUS.]

VALERIANA'CEÆ, *Valerian Worts*, a natural order of Exogenous Plants, belonging to Lindley's Aggregose group of Monopetalous Exogens. The order is composed of annual or perennial herbs or undershrubs with opposite exstipulate leaves. All the perennial species have roots more or less strongly scented; the annual are mostly inodorous. The flowers are either corymbose, panicled, or in heads, sometimes changing from one form into the other; the calyx is superior, the limb either membranous or forming a feathery pappus; the corolla is tubular, 3-6-lobed, regular or irregular, and sometimes spurred at the base; the stamens vary in number from 1 to 5, and are inserted into the tube of the corolla alternately with its lobes; the ovary is inferior and 1-celled, with sometimes 2 imperfect and aborted cells; the ovule is solitary and pendulous, the style simple, and from 1 to 3 stigmas; the embryo is straight and without albumen, with a superior radicle. These plants are most nearly allied to *Dipsaceæ*, from which they are distinguished by their looser inflorescence, sensible properties, want of albumen, and the absence of an involucellum. They are more remotely related to *Rubiaceæ*. They are natives of temperate climates or elevated positions in both the Old and New World. They are more abundant in the north of Asia, Europe, and South America, than in Africa or North America. [VALERIANA; VALERIANELLA; SPIKENARD; NARDOSTACHYS.]

VALERIANELLA, a genus of Plants belonging to the natural order *Valerianaceæ*. This name is a diminutive of *Valeriana*, but was rejected by Smith, Hooker, and others, as not being in accordance with the Linnæan laws of nomenclature; and accordingly they have described its species under the Adansonian genus *Fedia*. De Candolle, Lindley, and other systematic botanists however still retain *Valerianella*, and confine the genus *Fedia* to a single species, the *F. cornucopiæ*.

Valerianella consists of annual herbs, with oblong or linear undivided toothed or pinnatifid leaves, and small white solitary or corymbose flowers. The limb of the calyx is toothed and permanent; corolla regular, 5-lobed; stamens 3; stigma nearly entire or trifid; fruit 3-celled, membranous, indehiscent. It includes about 25 species. Their distinctions are not easily made out, on account of the variable character of the different parts of the plant. De Candolle has divided them into four sub-genera, depending on differences existing between the structure of the fruit, which is sometimes 2-celled and sometimes 3-celled; but only one of the cells ever contains the seed. Varieties in the structure and form of the fertile and sterile cells are the foundation of De Candolle's sub-genera. Koch, in his 'Flora Germanica,' divides the German and Swiss species, which are only eight in number, into four sections, depending principally on the structure of the calyx. Four of the species are British, belonging to three of De Candolle's sub-genera.

V. olitoria, Common Corn-Salad, or Lamb's Lettuce, has globose, compressed, inflated, glabrous, oblique, 2-lobed fruit; the limb of the calyx almost wanting; the two sterile cells of the fruit in one produced by an incomplete dissepiment; the flowers capitate; leaves linear, and angles of stem scabrous. This plant is an annual, from four inches to a foot high. It is a native of Europe, in corn-fields and cultivated ground, and is found abundantly in such situations, especially in a light soil in Great Britain. In France and Germany it is much eaten as a salad, and is frequently cultivated for that purpose in this country.

The other British species of the genus are—*V. dentata*, Smooth Narrow-Fruited Corn-Salad; *V. mixta*, Sharp Rough-Fruited Corn-Salad; *V. eriocarpa*, Blunt Rough-Fruited Corn-Salad. All the species are innocuous, and may be eaten as salads.

VALLA'RIS, a genus of Plants belonging to the natural order *Apocynaceæ*. The species consist of a few twining shrubs, which are found in China, the Indian Islands, and the plains of India. Of these *V. Pergulana*, called *Echites hircosa* by Roxburgh, and common in the Indian Peninsula and Archipelago, is remarkable for its offensive goat-like smell; while *V. dichotoma*, indigenous in the North-Western Provinces, is remarkable for its agreeable odour. Its leaves are employed there as poultices.

VALLEY, LILY OF THE, a common name for the *Convallaria majalis*. This plant is too well known to need description. The genus *Convallaria* has a bell-shaped 6-parted deciduous perianth; a 3-celled 2-ovalled ovary; a blunt trigonous stigma; berry with 1-seeded cells; flowers jointed to the pedicel.

C. majalis, the Lily of the Valley, is about a foot high, with two ovate-lanceolate radical leaves. The flowers are racemose, nodding, pure white, globose, bell-shaped, and fragrant.

VALLISNE'RIA, a genus of Plants belonging to the natural order *Hydrocharaceæ*. The species of this genus are all water-plants. They are dioecious: the male flowers are seated on a spadix; the corolla is monopetalous with three segments. The female flowers are included singly in a spathe, and are seated upon a spiral peduncle; the calyx is composed of a single leaf; the corolla is polypetalous; the capsules are 1-celled, many-seeded; the seeds parietal. Several species of *Vallisneria* have been recorded as growing in Europe, Australia, and America. The economy of these plants is exceedingly interesting in a physiological point of view. They are plants growing at the bottom of the water, and yet the male and female flowers are separated, and the mode by which they are brought together affords a singular instance of adaptation. These plants generally grow in running waters, and thus render the difficulty of the contact of their flowers greater. This is effected by the elongated peduncles of the pistilliferous flowers reaching the surface of the water when the staminiferous flowers are floating along. The *V. spiralis* is found in Italy, in ditches near Pisa, and in the Rhône. There are two Australian species, and also an American and East Indian species. The latter is the *Hydrillus* of Dr. Hamilton, and is used in Hindustan under the name of Jangi, for the purpose of supplying water mechanically to sugar during the process of refining. [MOTIONS OF PLANTS.]

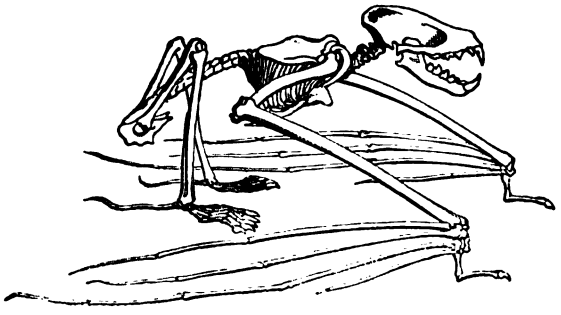
VALONIA. [QUERCUS.]

VALVATA. [PALUDINIDÆ.]

VALVE, in Botany, is a term applied to several parts of plants.

Its most common application is to the parts of dehiscent fruits, these parts being in most cases the representative of the carpellary leaf.

VAMPIRE. We subjoin a cut of the common Vampire-Bat. [CHEIROPTERA.]



Skeleton of Vampire. (De Blainville.)

VAMPIRUS. [CHEIROPTERA.]

VANA'DIUM, a metal discovered in 1830 by Sefström, and named from Vanadis, a Scandinavian divinity; it has since been found by Professor Johnston: the former obtained it from the iron of Taberg in Sweden, and from the slag of the ore; the latter from a new mineral occurring at Wanlock Head, which he found to be Vanadiate of Lead. The metal is obtained from the native Vanadiate of Lead. [LEAD.]

VANADURITE. [LEAD.]

VANDA, a genus of Plants, the type of the tribe *Vandeæ*, of the natural order *Orchidaceæ*.

VANDE'LLIA, a genus of Plants belonging to the natural order *Scrophulariaceæ*. The species are natives of warm parts of the world, such as India, Birma, China, and Brazil, forming smooth or hairy herbs, with tetragonal stems; leaves opposite, usually toothed.

V. diffusa, a native of Brazil, thought to be found also in the peninsula of India. It is the Canetaica of Pison, and described by Dr. Hancock as emetic, and its decoction as useful in fevers and liver complaints. It is called Bitter-Blain by the Dutch.

VANELLUS. [CHARADRIADÆ.]

VANGA. [LANIADÆ.]

VANGUE'RIA, a genus of Plants belonging to the natural order *Rubiaceæ*. The species are few in number, of which the principal are *V. edulis* of Madagascar, and the Indian *V. spinosa*. Both species form small trees or shrubs, having ovate or oblong petiolate leaves, with lanceolate stipules, solitary on both sides. The fruit of *V. edulis* is eaten by the natives of Madagascar and of Mauritius, where it has been introduced, as well as into the peninsula of India. *V. spinosa*, the Mayna of the natives of Bengal, but which is found in many parts of the plains of India, is a distinct species, though united to the above by Sprengel in his 'Syst. Vegetabilium.' It is said to be also found in China. The fruit is eaten by the natives of India.

VANILLA, a genus of Plants, the type of Lindley's natural order *Vanillaceæ*. The name is derived from 'vaynilla,' a diminutive of 'vayna,' which in Spanish signifies a knife or scissor-case, the fruit being long and cylindrical, and like the sheath of a knife. The species are generally supposed to be confined to Brazil, Guyana, and the West Indies, but several have been described by Schiede from Mexico. Species have also been found in Penang, Singapore, and Java.

The species of this genus are climbing plants, but are not epiphytic, as many of the *Orchidaceæ*, although in climbing up trees they put forth roots as holdfasts, which are capable of absorbing nutriment for the plant when other modes of supply are cut off. The leaves are fleshy, sub-cordate at the base, and articulated with the stem; the stem is square, and frequently climbs to a height of 20 or 30 feet; the flowers are fleshy; the perianthium is articulated with the ovarium, and frequently caliculated; the sepals and petals are nearly equal, conformed and free at the base; the labellum is entire, connate with the column, concave and barbed in the middle; the column is elongated and apterous; the anthers are terminal and opercular; the pollen-masses are two, bilobed and granulose; the fruit is siliquiform, fleshy, and dehiscing at the side; the placentæ, from 3-6, covered with seeds; the seeds are globose, and covered with a closely adnate testa.

Lindley enumerates eight species as belonging to this genus, two of which have been found in Asia and six in America. The fruits of most of them are aromatic, and on this account have formed a considerable article of commerce from their consumption as a luxury.

V. aromatica, Aromatic Vanilla, has ovate-oblong acuminate sessile leaves; perianth campanulate, with five undulated acuminated laciniæ; the labellum acuminate, cucullate at the base, with an elevated naked middle line. This species is the *Epidendrum Vanilla* of Linnæus, and is a native of Brazil, and was supposed at one time to yield all the vanilla of commerce. Under this name have been included two or three species of *Vanilla*, one of which is probably the only species that yields vanilla. The vanilla which is added to chocolate, custards, and many kinds of confectionary, to give them a pleasant flavour, is the produce of *V. aromatica*. [VANILLA, in ARTS AND SC. DIV.]

Vanilla aromatica.

1, branch with flowers; 2, branch with fruit; 3, section of fruit showing the three placentæ and indefinite seeds.

VANILLA'CEÆ, a natural order of Plants, formerly regarded by Lindley as a distinct order, but now embraced in the sub-order *Arethuseæ*, of the order *Orchidaceæ*.

VARA'NIDÆ, *Varanians*, a family of Lizards, designated by Messrs. Duméril and Bibron as Platynote or Broad-Backed Saurians, and thus characterised by them:—Body very much elongated, rounded, and without a dorsal crest, supported on strong legs and feet, with distinct and very long but unequal toes. Tail slightly compressed, at least twice longer than the trunk. Skin furnished with enchased scales, which are tuberculous, projecting, rounded upon the head as well as upon the back and sides, always distributed in rings or circular bands, parallel under the belly and round the tail. Tongue protractile, fleshy, similar to that of the serpents, that is to say, capable of elongation and of being withdrawn into a sheath, narrow, and flattened at the base, and deeply divided and separated into two points which can be divaricated as in the Ophidians.

Linnæus arranged these Saurians under the great genus *Lacerta*. Daudin separated the larger portion of the species under the generic appellation of *Tupinambis*.

Dr. J. E. Gray, in his 'Synopsis' (1827), arranged under his family *Varanidæ* the genera *Varanus* and *Dracæna* of Merrem, which he very well characterised. No such family as the *Varanidæ* appears in Dr. Gray's Table, published in the British Museum Synopsis (1842), and the British Museum Catalogue (1845); but the *Monitoridæ* (which are the first family of the *Leptoglossæ*, the first group of his *Sauria*) consist of the genera *Psammosaurus*, *Monitor*, *Polydædalus*, *Empagusia*, and *Hydrosaurus*. [MONITORIDÆ.]

Next to the *Crocodilidæ*, the *Varanidæ* attain the greatest size of any of the Saurians; indeed Herodotus, Ælian, and others regarded them as terrestrial crocodiles.

The *Varanidæ* are divisible into two distinct groups: the eminently terrestrial group, whose abode is far from the waters, in desert and sandy places; and the aquatic group, consisting of those which inhabit the banks of rivers and lakes.

The first have the tail entirely conical and nearly rounded, and it would appear at first sight to be useless, if not in the animal's way: but as Nature makes nothing in vain, Wagler's notion that it acts as a necessary counterpoise to the trunk is probably, so far as it goes,

correct. The multitudinous bones which form the tail of the second are very well developed, particularly in their transverse processes, and offer strong points of attachment for the muscles: the upper and lower apophyses are comparatively greatly increased. Compressed throughout its entire length, this tail becomes a powerful organ of motion when the animal is in the water, particularly as it is often surmounted with a crest formed by one or two rows of flattened scales, a fit propelling oar for the body rendered buoyant by the air with which the lungs are filled.

On land they run with rapidity, but their motion is always serpentine, a mode of progression due to their long tail, which helps to push them forward, and aids them in their leaps upon the prey which they pursue.

Their food consists of animal matters, and especially large insects, such as *Blattæ*, locusts, crickets, and beetles. It is asserted that they hunt after the eggs of birds and crocodiles, and that chameleons, small tortoises, and fish have been found in their stomachs. M. Leschenault de Latour relates that they unite on the banks of rivers and lakes to attack quadrupeds which come to quench their thirst, and that he has seen them attack a young stag as he attempted to swim across a river, in order to drown him. He even declares that he found the thigh-bone of a sheep in the stomach of one which he dissected.

Such are the animals which in certain parts of their organisation come nearest to the great extinct Saurians of old. If the habits ascribed to these Varanians bore any relation to those of the great carnivorous Saurians now swept away from the face of the earth, we should have in those annihilated giants no bad representatives of the dragons of our wildest legends.

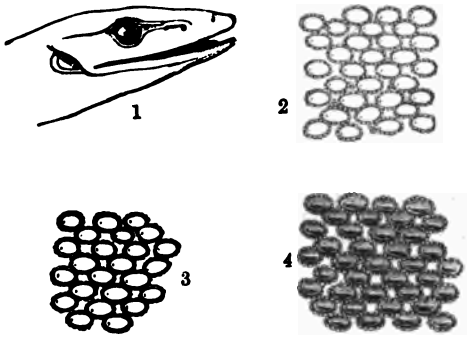
Geographical Distribution.—The family of Varanians, as modified by Messrs. Duméril and Bibron, exist in all parts of the world, with the exception of Europe.

America claims one only,—that on which the genus *Heloderma* is founded.

In Asia there are four *Varani* properly so called; three in Africa; and four in Oceania. Of these four, two have been observed in Australia, one in the isles of the Papuan Archipelago, and the fourth in the Isle of Timor.

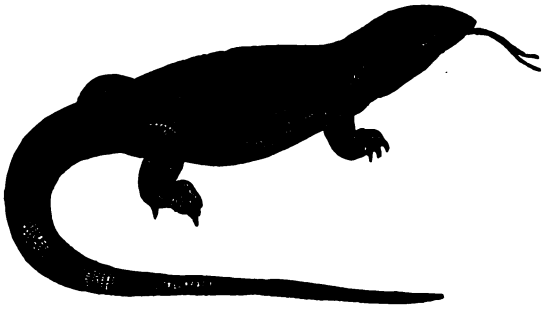
Messrs. Duméril and Bibron state that the locality of one species, *Varanus albogularis*, is unknown, but Dr. Smith obtained it in South Africa; it thus makes a fourth African species.

The species of the genus *Varanus*, or *Haranus*, are distinguished by the form assumed by the scales upon the back.



1, Head of *Varanus nebulosus*; 2, dorsal scales of the same; 3, dorsal scales of *Varanus Nilotious*; 4, dorsal scales of *Varanus Picquotii*.

V. albogularis is an example of the terrestrial species. It is the *Tupinambis gularis* of Daudin; *Varanus ornatus*, Merr.; *Tupinambis albogularis*, Kuhl; *Polydædalus albogularis*, Wagl., and *Monitor albogularis* of Gray. It is a native of Africa.

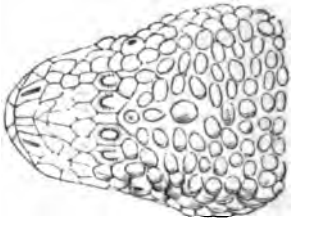


Varanus albogularis. (Smith.)

V. Bellii is an example of the aquatic species. It is a native of Australia.

Varanus Bellii.

Heloderma horridum is another aquatic species. It is a native of Mexico, where there is an erroneous but general belief that the bite of this species is fatal.



Head of *Heloderma*.

Heloderma horridum.

VARA'NUS. [MONITORIDÆ; VARANIDÆ.]

VARI, Buffon's name for the *Lemur Macaco* of Linnæus.

VARIETIES, in Botany, are groups of individual plants subordinate to species. The character of the Species is found in its capability of reproducing by seed a plant which is more like itself than it is like anything else; and this under all circumstances in which the offspring is capable of being produced. The Variety differs from the Species in

points of structure which are developed only under certain circumstances, and which are not essential to the species. This may be illustrated by an example—as, for instance, the common apple (*Pyrus malus*). If the seeds of the wild apple, or any of the cultivated varieties of apples, are sown under any circumstances, the plants that spring from these seeds will, in the great mass of their characters, be more like all other apple-trees than they will be like pear, plum, or any other trees. This then illustrates the idea of a species. If, on the other hand, the seeds of some of the sorts of apples, known under the names of Golden Pippin, Nonpareil, &c., be sown under different circumstances from that in which the plant from which they are taken was grown, the plants produced will differ in many respects from their parent in the characters that constitute the variety, but not in those of the species. The characters on which the definition of a species is founded ought to be such that no circumstances can alter them, whilst the essence of a variety consists in its having characters which are altered and produced by circumstances. Buds propagate the character of the variety, but seeds continue the species.

The natural varieties of plants are nothing like so numerous as those which arise from cultivation. Almost the entire object in view in the kitchen- and fruit-gardens is the developing of some property in plants which they do not exhibit in their natural state, and this is mostly attended with a corresponding change of structure. All the varieties of apples are produced by cultivation from the common crab (*Pyrus malus*); all the pears from *Pyrus communis;* the cherries from *Prunus Cerasus;* peaches, apricots, nectarines, from *Amygdalus Persica;* and plums from the *Prunus domestica.* The same is true of vegetables: all the varieties of cabbages are produced by cultivation from the same species; so also with turnips, potatoes, radishes, &c. This is also the case with flowers: the great majority of tulips, roses, anemones, *Ranunculi*, &c., found in gardens, are the result of changed characters dependent on cultivation. Although many of the varieties of fruits, vegetables, and flowers, retain the same names for a great length of time, there is nothing permanent in their characters but those which belong to the species.

VARIOLA'RIA, a genus of Plants belonging to the natural order of *Lichenes.* This name is derived from 'variolæ,' because the apothecia resemble the pustules of small-pox. The thallus of the plants belonging to this genus is crustaceous, membranaceous, adnate, spreading, uniform. The apothecium is a suborbicular scutelliform cup, formed of the thallus, and filled with a powdery or flocculose substance which covers an immersed waxy disc containing imbedded thecæ. The species are of an ash-gray or white colour, and are found on the back of the trunks of various trees, on rocks, walls, or on the ground. About 13 species are found in Great Britain.

V. faginea, the Bitter-zoned Variolaria, has an orbicular crust, surrounded by a zonate border of various colours; the apothecia are very abundant, convex, with an obsolete border, and filled with a snowy white powder. This is one of the species included in the *Lichen fagineus* of Linnæus. It is common on the bark of trees, especially of old beech-trees, and on pales. This species is distinguished from all others of the genus, as well as of the order, by its intensely bitter taste. It is for this reason that Turner and Borrer have separated the *V. discoida* from this species, although it has only a very slight structural dissimilarity; but it has no bitter taste at all. Braconnot found that the *V. faginea*, as well as several other crustaceous lichens, contained oxalic acid. The quantity yielded by 100 parts of this plant was 29·4 of oxalic acid, combined with 18 of lime. It is at the present time employed in France, on a very extensive scale, for the purpose of obtaining oxalic acid.

V. lactea, Milky-White Variolaria, is one of the lichens that are collected for the purpose of being used in dyeing.

V. globulifera, Vesicle-Fruited Variolaria, is found only rarely, growing on the bark of old oaks and beech-trees. It was gathered by Dr. Sibthorp in Greece; and, on account of the form of the reproductive organs, is the most remarkable-looking species of the genus.

V. vitiligo, Leprous Variolaria, has an elliptical, very thin, almost filmy, whitish crust, with very numerous, minute, oblong, confluent apothecia, having a very narrow elevated margin, and containing a lead-coloured powder. This is one of the most common species of the genus, and is common on old rails and gate-posts, giving them the appearance of having been imperfectly daubed over with white paint.

VARNISH-TREE. [MELANORRHŒA.]

VARVICITE. [MANGANESE.]

VASCULAR TISSUES. [TISSUES, VEGETABLE.]

VASCULARES, in Botany, applied to the two principal classes of plants, Exogens and Endogens, on account of their highly-developed vascular tissues, in opposition to the class of Acrogens, the tissues of which are principally cellular, and hence they are called Cellulares. [EXOGENS; ENDOGENS; ACROGENS.]

VATE'RIA, a genus of Plants belonging to the natural order *Dipterocarpaceæ.* It is characterised by having the calyx 5-cleft; segments at length reflexed; petals 5, oval, emarginate, twisted in the bud; stamens 40 to 50, short, inserted between the petals and the base of the germ; anthers long, linear; capsule 3-valved, 1-celled, and 1-seeded; cotyledons stalked.

The species are two in number, *V. Indica*, which grows all along the Malabar coast and in Canara; and *V. lanceæfolia*, which is common in Silhet. Both species form large trees with entire smooth coriaceous leaves, and terminal panicles of white flowers; and both are valuable not only as timber-trees, but for yielding valuable, almost unique products. *V. Indica* grows to the height of about 60 feet, and yields valuable timber, which is much employed in ship-building, and is not liable to be attacked by the teredo. When the bark is wounded, a pellucid, fragrant, acrid, bitter, resinous fluid exudes, which in the rays of the sun becomes yellow and fragile like glass. This resin is well known in commerce, and is usually called Copal in India, but when imported into England receives the name of Gum Anime. The fluid resin also makes a good varnish, which is called Pundum, or Liquid Copal; on the Malabar coast it is often called Piney Varnish, and the tree Piney Varnish-Tree, or Piney Marum. The dry resin, boiled with more or less oil, is used for the purposes of tar and resin; it is also employed by the natives instead of frankincense. Besides these, another very valuable product is yielded by this tree, and that is a fatty substance, which is known by the name of the Piney Tallow, or Vegetable Tallow, of Canara. This is obtained by boiling the seeds, when the fatty substance floats to the surface, and on cooling down becomes of the consistence of tallow. In colour the different specimens vary from pale yellow, or fawn, to perfect white. Its general properties, such as its hardness, colour, combustibility, and fusibility, place it between wax and tallow; but it is far superior to the latter, having no disagreeable smell, either when burning or at common temperatures.

V. lanceæfolia is the other species, which was described by Dr. Roxburgh from Silhet, where it is called Moal. Like its congener, this also exudes a clear liquid from wounds, &c., in the bark, which soon hardens into an amber-coloured resin. From this the natives distil a dark-coloured and strong-smelling resin called Chooa, and Chova and Gond by the Brahmins, who use it as incense.

VAUCHE'RIA, a genus of Plants belonging to the inarticulate *Algæ*, named after Professor Vaucher of Geneva. This genus belongs to the tribe *Siphoneæ*, and was formed by De Candolle from Vaucher's genus *Ectosperma.* The fronds or filaments are aggregated, tubular, continuous, capillary, and coloured by an internal green coloured mass. The fructification consists of dark green homogeneous vesicles, which are attached to the filaments. The species are found in pools and ditches and stagnant waters, on damp ground, and on the mud of salt-water rivers and in the sea.

V. dichotoma, Large Dichotomous Vaucheria, has dichotomous filaments, with solitary globose sessile vesicles. This is one of the most common of the species, and is found, in spring and autumn, in pools and ditches of fresh water, and Mr. Berkeley has found a variety in the sea. It is one of the largest of this genus, its filaments being often more than a foot long, and filling up the ditches on account of their number.

V. Dillwynii, Dillwyn's Vaucheria, has branched flexuose filaments, with globose lateral sessile vesicles. This species is common on the ground in damp situations, forming a thin intricate fleece of a green colour.

V. clavata, Clubbed Vaucheria, has short filaments terminating with a vesicle, which contained the sporules. This species does not appear to be an inhabitant of Great Britain. It inhabits ditches of clear water, and is interesting on account of the observations made upon it by Unger. Whilst examining this plant, he found that the vesicular summits had the power of contraction, and that by this process they expelled the contained sporules, which after their expulsion ascended to the surface of the water. "As I continued my observation," says Unger, "I happened to look at the surface of the water, and was not a little astonished to find it covered, especially towards the side of the vase, with minute globules, unequal both in colour and size. Many of them swam freely here and there, moving at their option in one way or another, retiring and approaching one another, gliding round globules that were motionless, stopping and again setting themselves in motion, exactly like animated beings. Conjecturing the identity of the green globules that possessed motion with those that had none, I immediately began to examine whence these infusory animalcules derived their origin, and what relation they bore to the green globule and the fructification of the *Conferva.* The next day I perceived a great number of globules aggregated around the bubbles of gas disengaged from the *Conferva*, and floating at the surface. There were some of them of a dark green colour, and either round or elongated; others more transparent, humid, and with one or two appendages diverging from or at right angles with each other: these were evidently plants in a state of germination. Other globules again were oval, very dark at one extremity, and almost transparent at the other; these swam about freely. Within the space of one hour I succeeded in tracing not only the diminution of vitality and death of the *Infusoria*, but also the subsequent development of the dead animals into germinating plants, in such a manner as to establish the truth of the fact." ('Mag. of Nat. Hist.,' vol. i.) There are 9 species of the genus *Vaucheria* found in Great Britain.

VAUQUELINITE. [CHROMIUM; LEAD.]

VEGETABLE BUTTERS. [BUTTERS, VEGETABLE.]

VEGETABLE IVORY. [PHYTELEPHAS.]

VEGETABLE KINGDOM. This term is applied collectively to

the various forms of Plants, as the terms Animal and Mineral Kingdoms are applied to Animals and Minerals. The distinctions which are supposed to limit these three kingdoms are treated of in the article ANIMAL KINGDOM. We shall here speak of the uses, general features, and distribution of Plants.

The Vegetable Kingdom performs important offices in the economy of creation. It stands between the mineral and animal kingdoms, disposing and arranging the elements of the first in order to fit them for the purposes of the last. Each of the three kingdoms of nature is composed of matter as its basis; but the animal kingdom directly appropriates no portion of the elements of the inorganic world to its uses, but derives them all from the vegetable kingdom. The researches of chemists show that the proximate principles of animal bodies are identical with those of vegetables, and that consequently, as these principles do not exist in the inorganic kingdom, they must have been formed in plants. Thus we must regard the vegetable kingdom as one vast chemical laboratory, in which the food of animals is being prepared. Without vegetables animals would perish, and although some animals live on the flesh of others, yet that flesh is always originally derived from the vegetable kingdom. The proximate principles of plants are not numerous, and are composed of hydrogen, oxygen, nitrogen, and carbon; those containing nitrogen are directly appropriated by animals to the formation of their tissues, whilst those containing no nitrogen are either consumed in generating animal heat or deposited in the form of fat. When animal bodies cease to exist, their tissues become resolved into their primitive elements, a process which is constantly going on in animal bodies during life. These elements, in the state of various compounds, are carried off into the atmosphere when gaseous; or assist in forming the soil on the surface of the earth when solid. The principal compounds which are thus generated are carbonic acid and ammonia; and if accumulation of these gases took place to any extent in the atmosphere the consequences would be a cessation of vitality in both the animal and vegetable kingdoms; but here again plants perform an important office, for these very compounds combined with water are the principal sources of the elements which plants elaborate into so many secretions necessary to the existence of animals. There is thus a relation established between the animal and vegetable kingdoms, of which man has extensively availed himself in the application of manures to the artificial production of food. In this relation too are involved the laws of the production of plants for food in communities with circumscribed districts, to the investigation of which comparatively little attention has been given.

In addition to supplying food and purifying the atmosphere for animals, the vegetable kingdom is made use of extensively by man. The larger forms of plants are used for the building of houses and ships, the construction of furniture, and a thousand implements necessary in the arts of life. The various secretions of plants, their oils, resins, acids, neutral and alkaline principles, all exert a powerful agency on the human system, and are employed for the purpose of controlling, changing, and interrupting the diseased actions to which man is subject. Another large class of plants furnishes him with luxuries, as tobacco, tea, coffee, spices, perfumes, and fruits of various kinds; and to these must be added fermented liquors, which are all produced from the fermentation of the saccharine juices of plants. A great part of the clothing of man is the produce of the vegetable kingdom: cotton, flax, and hemp are of vegetable origin, and when the fabrics which are made from them are worn, they are mostly coloured with the secretions of the turmeric, indigo, orchil, catechu, and others.

Climate is also modified by the vegetable kingdom. The presence of thick forests intercepts the rays of the sun, and the earth has a lower temperature in consequence. On the other hand, the heat of the surface of the earth is changed by the difference of radiating power between plants and the soil on which they grow. The constant absorption and exhalation also of a large body of plants will affect the humidity of the atmosphere according to the circumstances in which they may be placed. Another consequence of the existence of plants is the production of malaria during their decay. There is perhaps no fact better proved than that decaying vegetable matter is the source of the most dreadful pestilences that affect human beings. The direct agency by which this is effected is unknown; it is called malaria, and is alike produced by decaying plants in the swamps of Africa, the jungles of India, the savannahs of America, and the ditches of Europe. No part of the world where vegetables are produced is free from its influence; and even in large cities, perhaps the only places susceptible of being made a refuge from its scourge, needless accumulations of decomposing vegetable matter are allowed to become the source of disease and death.

Plants also give peculiar features to the surface of the earth, and by their distribution the life of the animal kingdom is regulated. Although each plant appears to have a special constitution, by which its existence in particular parts of the earth is determined, certain external agents exercise a controlling influence, and to these we shall now refer.

Of the agents that determine the distribution and character of plants none have more influence than light. Wherever plants have a large supply of light, there will the vegetation be prolific, and all the secretions of plants will abound. It is by this agent that the functions of absorption, exhalation, and the decomposition of carbonic acid and other compounds are effected by plants. It is, in fact, a powerful stimulant of vegetation, and it acts as all stimulants do on organic bodies. If a plant is withdrawn from its influence, it becomes weak, its tissues soften and are filled with water, and few or no secretions are deposited; on the contrary, if plants are supplied with continued light, they become overstimulated, they decompose carbonic acid rapidly, and become stunted in their growth on account of the rapid development of solid secretions. The influence of this agent is seen remarkably in the vegetation of the surface of the earth. In the tropics the direct rays of the sun are felt by plants, and under their influence a prolific and gigantic vegetation is developed, but this arises from the alternate withdrawal and presence of this agent during every 24 hours, and as this is constantly the case, vegetation remains the same throughout the year. On the other hand, at the poles, only the oblique rays of light are felt, and consequently its influence is comparatively feeble. The gradations of vegetation may be seen, under the influence of this agent, in passing from the tropics to the poles. From the magnificent baobabs, banyans, and palms of the tropics, we pass through the regions of oaks, elms, and firs, of temperate climates, till in polar regions the only representatives of trees are a few brambles, and the majority of plants are mosses and lichens.

Another agent is heat. By some this has been supposed to have more influence than light on the distribution of plants, but it is difficult in nature to separate its influence from that of light, since it is derived from the same source at the same time. However experiments on a large scale are constantly going on in European hothouses, in which it is proved, that although tropical plants be supplied with their natural temperature, nothing will make up for the want of light, and many of them seldom produce their flowers and less seldom their fruit, and after a languishing existence soon die. The influence of heat on vegetation is seen in those climates where there is a great difference of temperature between summer and winter. The plants of such districts that live throughout the winter are so constructed that they are enabled to bear the cold of winter. They have frequently thick barks, in which are deposited resinous secretions, and are thus enabled to withstand the decrease of temperature. It is also found, for this reason, that those plants which thrive in hot summers are best adapted to withstand the cold of winter, on account of the greater amount of solid secretions deposited in their bark, and many plants which flourish in districts where there are hot summers and severe winters will perish in climates where the extremes of heat and cold are not so great. Thus many plants will grow around Paris, where the extremes of heat and cold are great, which will not grow around London, where these extremes are less; and the same holds good with regard to London and Edinburgh, and the floras of the south of England and the north of Scotland afford abundant evidence of the truth of this position.

Water, as an agent affecting vegetation, must be regarded in two points of view: first, as existing in the atmosphere as vapour, modifying temperature, and controlling the function of exhalation and absorption in plants; and, secondly, as existing on the surface of the earth in the form of oceans, rivers, lakes, swamps, &c. The composition of the waters of these last also, or rather the substances which may be dissolved or suspended in the water, produce considerable effect upon vegetation. Many *Orchidaceæ* are only found in the humid forests of the tropics. The vegetation of seas and lakes varies with the circumstances of the ingredients they contain in solution, and with the comparatively restless or quiet condition of their waters. Swamps produced by overflowings of the sea produce different plants from those produced by accumulations of fresh waters from mountain sides.

The characters of the soil influence the vegetation of particular districts. The previous agents exert an influence on vegetation which is most evident in the characters of the great mass of plants of a district; but the soil produces effects on almost every individual plant. The influence of soil arises from its mechanical character and chemical composition. The mechanical character of most importance is its amount of disintegration. Some plants, as lichens, grow on the surface of rocks and large stones, and are not found in districts where these are not present. Some require a loose soil for the free passage of their roots, and are only found growing in sands. Others again will only exist in tenacious soils, and are found growing in clays. The mechanical character of soils also greatly influences their relation to the absorption and radiation of heat, and thus affects the temperature of the soil.

The last influence to which we shall refer is the atmosphere. Chemically it remains in its great constituents, oxygen and nitrogen, constantly the same. But the quantity of the vapour of water which it contains, and whatever salts that vapour may be capable of containing, cause it to vary much. The influence of these agents in the air however is not different from the same in the soil. The agitation of the air by constant winds has often an important influence on vegetation, and the barren hills and coasts of many countries are owing to the impossibility of plants withstanding the influence of strong winds. The density of the atmosphere is a point of importance, and seems to disturb the relation between elevation and latitude.

Several methods have been proposed by De Candolle and other botanists for giving an idea of the distribution of vegetation over the

surface of the globe. In the following remarks we have followed that of Professor Schouw, in his 'Notes for a Course of Lectures on the Distribution of Plants.'

1. Region of Saxifrages and Mosses, or the Alpine Arctic Flora: temperature 1·75° to 41° Fahr. This corresponds with the hyperborean region of De Candolle and other writers, and comprehends all countries within the polar circle, namely, Lapland, the north of Russia and Siberia, Kamtchatka, Labrador, Greenland, and Iceland, and also part of the Scottish and Scandinavian mountains, as well as the mountains of the southern and central parts of Europe, which have sufficient elevation to possess an alpine vegetation. This region is characterised by the abundance of mosses and lichens, and of the families *Saxifragaceæ*, *Gentianaceæ*, *Alsinaceæ*, *Salicaceæ*, and *Cyperaceæ*. There is an entire absence of tropical families, and only a few plants of the temperate zone. The beech and fir occur in forests, or there is a destitution of trees. Annuals are also scarce, and the blossoms of the flower are larger in proportion to the root of the plant, and of a pure colour.

2. Region of the *Umbelliferæ* and *Cruciferæ*: temperature 27·5° to 56·75°. This comprehends the whole of Europe, except those districts which belong to the preceding region, from the Pyrenees, the mountains of the south of France, of Switzerland, and the north of Greece, to the greater part of Siberia, and the country about Mount Caucasus. This region is particularly distinguished from that of the same parallel in North America by the presence of cruciferous and umbelliferous plants. It is not easily distinguished from the next region, but the *Fungi* abound more, and it approaches the last region in the abundance of *Cyperaceæ*. Nearly all its trees are deciduous, and its meadows are exceedingly flourishing. There is a division of the *Compositæ*; the plants belonging to the Cichoraceous division of that order being found in the northern districts, whilst those belonging to the Cynarocephalous are found in the south of it. The predominating trees are the Scotch Fir, the Alder, the Beech, the Birch, the Poplar, the Elm, and Lime. The shrubs are the Heaths, the Sloe, &c. The principal cultivated plants are the Wheat, Barley, Oats, Maize, Potatoes, &c.; Apple, Pear, Gooseberry, Currant, Vine, Strawberry, Cucumber, Melon, the Cabbage, Turnip, Peas, Beans, and other forms of *Leguminosæ*; Carrots, Hops, Hemp, Flax, &c.

3. The Region of *Labiatæ* and *Caryophyllaceæ*, or the Mediterranean kingdom: temperature 54·5° to 72·5°. This includes the region of the Mediterranean Sea, limited on the north by the Pyrenees, the Alps, the Balkan, the Caucasus; on the south by the Atlas and the deserts of North Africa; on the east by Taurus. It contains more or less of the orders belonging to the last region; but *Labiatæ*, *Caryophyllaceæ*, *Boraginaceæ*, *Cistaceæ*, and *Liliaceæ* abound. A few tropical plants now and then appear amongst them, belonging to the orders *Palmaceæ*, *Terebintaceæ*, and *Lauraceæ*. *Solanaceæ* and *Leguminosæ* are more abundant than in the last, evergreens increase, and the vegetation never entirely ceases; but verdant meadows are more rare than in the last. Madeira, Azores, and the Canary Islands, belong to this region, and their Flora approaches to that of tropical Africa. The cultivated plants are similar to the last, to which are added the Olive, Orange, Lemon, Mulberry, Fig, Rice, &c.

4. The Region of *Asteraceæ* and *Solidaginaceæ*, or North North-American kingdom: temperature 9·5° to 59°. It embraces North America from the southern limits of the first kingdom to 36° N. lat. There are a greater number of *Coniferæ* than in the second kingdom, and there are but few *Umbelliferæ*, *Cruciferæ*, *Cichoraceæ*, and *Cynarocephalaceæ*. There is but little cultivation: where there is any it resembles that of the second kingdom. Whortleberries, Oaks, Firs, Michaelmas Daisies, and Golden Rods are its great characteristics.

5. The Region of *Magnoliaceæ*, or Southern North-American kingdom, between 36° and 30° N. lat.: temperature 59° to 72·5°. There is here an approximation to tropical vegetation, as seen in the frequent appearance of the genera *Canna*, *Chamærops*, *Yucca*, *Zamia*, *Laurus*, *Bignonia*, *Passiflora*, *Cassia*, *Sapindus*, &c. There are comparatively few plants that are characteristic of the two preceding kingdoms. The Magnolias predominate, and are accompanied with other genera bearing broad shining leaves and large flowers. The cultivated plants are those of the third region, with the exception of the Olive: Rice is more abundant, and in the southern districts the Sugar-Cane is grown.

6. The Region of Camellias, and *Celastraceæ*, or Chino-Japanese kingdom. It embraces Japan and Northern China from 30° to 40° N. lat.: temperature 54·5° to 68°. Too little is known of this region to enable us to state positively what are its characteristics. Its vegetation is more tropical than European. With Zamas, Ginger, Bananas, and Custard-Apples, are found Buckthorns and Honeysuckles, thus giving this region a mixed character. Its cultivated plants, in addition to those of the previous regions, are the *Cycas* for Sago, the Tea-Plant, the Caladium, &c.

7. The Region of *Zingiberaceæ*, or Indian kingdom: temperature 65·75° to 81·5°. This includes the Indian peninsulas east and west of the Ganges, together with the islands between India and Australia. Tropical orders are numerous in this region, as *Palmaceæ*, *Araceæ*, *Euphorbiaceæ*, *Bignoniaceæ*, *Buttneriaceæ*, &c. Very few plants belonging to *Cyperaceæ*, *Coniferæ*, *Labiatæ*, *Rosaceæ*, *Ranunculaceæ*, or *Cruciferæ* are seen. The trees never lose their leaves, and produce large magnificent flowers, and are covered frequently with climbing and parasitical plants. Ginger, Zedoary, Cardamom, Arrowroot, Catechu, Cassia, Cinnamon, Caoutchouc, Tamarinds, Sago, Rice, Cocoa-Nut, Coffee, Cubebs, Cloves, Pepper, Oranges, and Gamboge, are the cultivated and natural productions of this prolific region.

8. The Region of the Himalaya: temperature 36·5° to 65·75°. It includes the highlands of India, or the mountain terraces lying on the south of the Himalayan range, Kumaon, Nepaul, Bootan, having an elevation of from 4000 to 10,000 feet. The tropical forms of the last kingdom decrease manifestly here, such as *Scitaniaceæ*, *Palmaceæ*, *Cycadaceæ*, &c. European forms are not unfrequent, as *Cyperaceæ*, *Amentaceæ*, *Coniferæ*, *Primulaceæ*, *Rosaceæ*, *Cruciferæ*, &c. The Ferns and *Orchidaceæ* are abundant. The cultivated plants are the corn and fruit of Europe, varying with more tropical productions according to elevation.

9. The Region of *Polynesia* includes the islands between Hindustan and Australia, and has a temperature from 65·75° to 83·75°. This region is similar to the Indian kingdom, and is sometimes included in it. The cultivated plants, in addition to those of the Indian kingdom, are the Bread-Fruit-Tree, the Nutmeg, the Camphor-Tree, and the Cotton-Tree.

10. The Region of Java is little known, and has a vegetation probably similar to the Himalayan region.

11. The Oceanic Region, or South Sea Island kingdom, includes all the islands of the South Sea within the tropics, and has a temperature of 72·5° to 81·5°. The flora of these islands is poor, and approximates more closely to that of Asia than to that of Africa, and has some relation to that of Australia. The bread-fruit is the most characteristic production of these islands, but is not confined to them.

12. The Region of *Balsomodendra*, or the Arabian kingdom, includes the south-westerly mountainous part of the Arabian peninsula. The temperature cannot be stated, but the character of its vegetation is generally tropical, assuming the forms of that of India. The cultivated plants are also principally those of India.

13. The Desert Region includes North Africa south of the Atlas, and the Mediterranean Sea between 15° and 30° N. lat., and the northern part of Arabia. The mean temperature is 72·5° to 86°. It has necessarily a very poor flora, having but few even characteristic genera. It is only cultivated in the oases, where the *Phœnix dactylifera*, the *Sorghum vulgare*, with Wheat and Barley, and some of the fruits of Europe and India, constitute the prominent plants.

14. The Region of tropical Africa includes Africa from 15° N. lat. to the tropic of Capricorn. Temperature 72·5° to 86°. This flora is neither rich nor rare; it abounds in *Leguminosæ*, *Rubiaceæ*, and *Cyperaceæ*. The *Adansonia* is a characteristic genus.

15. The Region of *Cacti* and *Piperaceæ* includes Mexico and South America to the Amazon River, and to a height of 5000 feet above the level of the sea. Temperature 68° to 83·75°. The orders which characterise this region are *Bromeliaceæ*, *Piperaceæ*, *Passifloraceæ*, and *Cactaceæ*. The orders which are mostly tropical are here less numerous, whilst extra-tropical orders are more abundant. The most abundant genera are *Phytelephas*, *Kunthia*, *Thouinia*, *Theobroma*, *Guazuma*, &c. The cultivated plants of this district are the Maize, *Sorghum vulgare*, *Dioscorea alata*, *Convolvulus Batatas*; also the Plantain, Cocoa-Nut, Pine-Apple, Tamarind, Cacao, Vanilla, Coffee, Sugar, Tobacco, Cotton, &c.

16. The Region of the Mexican Highlands includes the mountains of Mexico above 5000 feet elevation. Temperature from 65·75° to 79·25°. In this district the more tropical forms of vegetation, as the Tree-Ferns, the Palms, Passion-Flowers, Euphorbiums, and Pepper, decrease, or altogether disappear. The extra-tropical forms are more numerous, as the Willow, Oak, Fir, Cypress, Sage, Horehound, Whortleberry, Heath, and various forms of *Umbelliferæ*, *Rosaceæ*, *Caryophyllaceæ*, *Cruciferæ*, and *Ranunculaceæ*. The cultivated plants are the Maize, the European *Cerealia*, and fruits. In the highest mountain-ranges the vegetation has an alpine aspect.

17. The Region of *Cinchonaceæ*. This embraces the Andes from 5000 to 9000 feet in elevation, and between 20° S. lat., and 5° N. lat., having a temperature from 59° to 68°. The extra-tropical forms become very frequent in this region, and only a few tropical forms remain. Some of the most common genera are the *Cinchona*, *Gay-Lussacia*, *Loasa*, *Lilæa*, *Cervantesia*, &c. The cultivated plants are very seldom tropical. Maize and coffee are sometimes grown, with European *Cerealia*, and fruits, Potatoes, and *Chenopodium Quinoa*.

18. The Region of Escallonias and Calceolarias includes the Andes at more than 9000 feet above the level of the sea, between 20° S. lat. and 5° N. lat. Temperature 34·25° to 59°. Tropical plants almost entirely disappear in this region, only now and then a straggler appearing; whilst the forms which distinguish the colder and polar regions become frequent, such as the Lichens, Mosses, Sorrels, Plantagos, Gentians, Currant, Brambles, &c. The most prevalent orders are the Grasses, Heaths, and *Synantheraceæ*. There are no large trees, and a great many shrubs.

19. The West Indian Region, including the West India Islands, with a temperature of 59° to 79·25°. The vegetation of these islands bears the same relation to the continent which that of the Polynesian islands does to China. It is chiefly distinguished by the greater quantity of Ferns and *Orchidaceæ*. The cultivated plants are the same as those of Mexico.

20. The Region of Palms and *Melastomaceæ*, or Brasilian kingdom, including Brazil, or South America, on the east of the Andes, between the equator, and the tropic of Capricorn; temperature 59° to 83·7°. This region is remarkable for the number of its genera and species, the size of individual trees, the dense forests, and the numerous climbing and parasitical plants. Vegetation seems here to attain its greatest activity and energy. The orders which abound most are *Palmaceæ*, *Hæmadoraceæ*, *Gemeriaceæ*, *Melastomaceæ*, *Sapindaceæ*, and, altogether confined to this region, *Vochyaceæ*. The cultivation is very similar to that of Mexico.

21. The Region of Woody *Compositæ*. In South America, on the east of the Andes from the tropic of Capricorn to 40° S. lat.: temperature 59° to 74·75°. There are but few tropical plants in this region, and extra-tropical plants, especially European forms, are abundant, more than half being common to this region and Europe. The Woody *Compositæ* abound. This region consists chiefly of plains (pampas), which for hundreds of miles present almost the same vegetation, consisting chiefly of Thistles and Grasses. Wheat, the Vine, and the Peach, are cultivated.

22. The Antarctic Region includes the south-westerly part of Patagonia, Tierra del Fuego, between 50° and 55° S. lat.: temperature 41° to 47·5°. In this region there are no tropical plants, and its vegetation resembles in a great measure the North-European flora (region 2). In some of the genera there is an approach to the South African and Australian flora.

23. The Region of Stapelias and Mesembryanthemums. This embraces South Africa from the tropic to 35° S. lat.: temperature 54·5° to 72·5°. The vegetation of this region is not luxuriant, but it is very rich in forms. There are no dense forests nor climbers, but many succulent plants. The orders *Restiaceæ*, *Iridaceæ*, *Proteaceæ*, *Ericaceæ*, *Ficoidaceæ*, *Bruniaceæ*, *Diosmaceæ*, *Geraniaceæ*, *Oxalidaceæ*, and *Polygalaceæ*, embrace its characteristic vegetation. On the sandy coasts the genera *Stapelia*, *Mesembryanthemum*, and *Diosma*, are found, and on the mountains *Protea*, *Erica*, and *Crassula*. The cultivated plants are those of Europe, with the *Musa Paradisiaca*, *Convolvulus Batatas*, the Tamarind, and *Sorghum Caffrorum*.

24. The Region of *Eucalypti* and *Epacridaceæ*. It includes extra-tropical Australia and Van Diemen's Land: temperature 52·25° to 72·5°. Vegetation is not abundant in this region; but this deficiency is compensated by the variety and peculiarity of its forms. The most abundant of the trees are the *Eucalypti*, which form three-fourths of all the woods. Next come the genera of *Proteaceæ*, *Banksia*, *Hakea*, *Dryandra*, *Grevillæa*, &c.: and next to these follow *Epacridaceæ*, *Diosmaceæ*, and *Casuaraceæ*. Its cultivated plants are all European.

25. The Region of New Zealand includes the two New Zealand isles: temperate. One-half of the species are European. The vegetation is not characterised by the prevalence of large groups. Some of the genera approximate the South African flora, and some the Australian.

(The following works should be consulted on the geography of plants:—Linnæus, *Stationes Plantarum;* Humboldt and Bonpland, *Essai sur la Géographie des Plantes;* Humboldt, *De Distributione Geographica Plantarum;* Brown, *General Remarks on the Botany of Terra Australis;* Schouw, *Grundzüge einer Allgemeinen Pflanzen-Geographie;* Meyen, *Grundriss der Pflanzen-Geographie;* Bischoff, *Lehrbuch der Botanik;* Hooker, in Murray's *Dictionary of Geography;* De Candolle, art. *Géographie des Plantes—Dict. des Sciences Naturelles;* Lindley, *Int. Bot.*, 2nd. ed.; Meyen, *Geography of Plants*, translated for Ray Society by Miss Johnston; Balfour, *Class-Book of Botany;* Johnston, *Physical Atlas.*)

VEGETABLE MORPHOLOGY. [METAMORPHOSIS.]

VEINS, a part of the vascular system of the higher animals. The veins return the blood which has been brought by the arteries into the capillaries to the right side of the heart. [ARTERY; CAPILLARIES.] The veins, like the arteries, are elastic tubes, which ramify throughout the body. They are generally placed more superficially than the arteries, but some of them are deep-seated. They anastomose more frequently than the arteries.

The veins have much thinner coats than the arteries, and collapse when cut across or emptied. In most veins of tolerable size three coats may be seen, which have been named External, Middle, and Internal. The External Coat is strong and tough, but thin, and is composed of fibres of the same nature as those of areolar tissue. The Internal Coat is very like that of arteries. It consists of a membrane of fine elastic fibres, which are covered over with a layer of epithelial cells. Between these two coats is a layer of fibres, which in some places is more distinct than at others, and is then called a Middle Coat. The coats of the veins are supplied with nutrient arteries, the so-called Vasa Vasorum.

The veins are provided with valves, by means of which the blood is prevented from returning in the direction in which it is moving. The valves are formed of semilunar folds of the lining membrane, which are strengthened by the deposit of fibres of white and yellow areolar tissue. These flaps, or folds, are usually placed opposite each other, and are so placed as to offer no obstruction to the onward flow of the blood, but when from pressure or any other cause it is driven backwards, the reflex current will press the valves inwards until their edges meet in the middle and block the channel entirely up. In many veins these valves are absent, nor are they observed in the veins of reptiles and fishes; and there are but few in those of birds. It was the circumstance however of the occurrence of these valves that arrested the attention of Harvey, and led him to pursue the course of the blood from one side of the heart to the other. [HEART.]

VEINS, MINERAL. [MINERAL VEINS.]

VELELLA. [ACALEPHÆ.]

VELIA. [HYDROMETRIDÆ.]

VELLA (Latinised from Velcor, the Celtic name of the Cress), a genus of plants belonging to the natural order *Cruciferæ*. It has an ovate pouch, with a dilated winged leafy flat style, longer than the convex valves. The flowers are yellow, and are, as well as the pod, erect.

V. annua was found in the time of Ray on Salisbury Plain, but has not since been noticed. It has doubly pinnatifid leaves and deflexed pouches.

V. pseudocytisus, False Cytisus, or Cress-Rocket, is a native of Spain; it has yellow petals with long dark-purple claws; the larger stamens are connate by pairs; the seeds two in each cell.

VELUTI'NA, Lamarck's name for a genus of his family *Macrostomata*, from the rest of which however *Velutina* remarkably differs. The shell is subglobose; spire short, composed of two rapidly enlarged ventricose whorls; aperture large, subovate; peritreme thin, entire, separated from the last whorl; columella twisted and thin; epidermis velvety.

Dr. J. E. Gray places the *Velutinidæ*, with the single genus *Velutina*, between the *Truncatellidæ* and the *Paludinidæ*.

Ex. *Velutina lævigata.*

Velutina lævigata.

VENERICA'RDIA. [SUBMYTILACEA.]

VENE'RIDÆ, a family of Conchiferous *Mollusca*.

The genus *Venus* of Linnæus was arranged by him in the second section (*Bivalvia: Conchæ*) of his *Testacea Mollusca Simplicia, obtecta Testa Calcarea*, between *Donax* and *Spondylus*.

He divided the genus into the following sections:—

* *Pubentes.*

Species:—*Dione, Paphia, marica, dysera.*

** *Impuberes Subcordatæ.*

Species:—*Venus verrucosa, casina, cancellata, gallina, petulca, flexuosa, erycina, mercenaria, Islandica, chione, maculata, meretrix, læta, castrensis, Phryne, Meröe, deflorata, fimbriata, reticulata, squamosa.*

*** *Impuberes Orbiculatæ.*

Species:—*V. tigerina, prostrata, Pennsylvanica, incrustata, punctata, exoleta, borealis, pectinata, scripta, edentula.*

**** *Impuberes Ovales*, supra rimam subangulatæ.

Species:—*V. literata, rotundata, decussata*, and *virginea.*

Such is the arrangement of Linnæus in his last edition of the 'Systema Naturæ,' and he characterises the hinge of the genus as consisting of three teeth, all approximate, the lateral teeth diverging at the apex.

The *Cardiacea* of Cuvier consist of the genera *Cardium* (with the sub-genus *Hemicardium*), *Donax*, *Cyclas* (with the sub-genera *Cyrena*, *Cyprina*, and *Galathea*), *Corbis*, *Tellina*, *Loripes*, *Lucina*, *Ungulina*, *Venus*, *Corbula*, and *Mactra* (including the true *Mactræ* and the Lavignons).

The genus *Venus* he divides into the true *Veneres*, *Astarte* or *Crassina*, *Cytherea*, *Capsa*, and *Petricola;* and he defines this great genus *Venus* as comprising a multitude of shells whose common character is to have the teeth and laminæ of the hinge approximated under the umbo in a single group. They are, he remarks, in general more flattened and more elongated parallelly to the hinge than the *Cardia*. Their ribs, when they have any, are nearly always parallel to the borders, which is the opposite of the *Cardia*. The ligament often leaves behind the umbones an elliptical impression named by modern zoologists the Coralet; and there is nearly always in front of the umbones an oval impression designated as the Lunule.

The animal has always two tubes susceptible of more or less projection, but sometimes united to each other, and a compressed foot which serves for creeping.

Dr. J. E. Gray places the *Veneridæ* as the first family of his order *Phillopoda*, with the following genera:—*Artemis, Cytherea, Meroe, Gratelupia, Trigona, Chione, Circe, Dosina, Mercenaria, Anomalocardia, Cyprina, Venus, Tapes, Venerupis*, and *Clementia.*

The *Veneridæ* are immediately followed in Dr. Gray's arrangement by the *Cyrenidæ*, which comprise the following genera:—*Cyrena, Geloina, Velorita, Cyclas*, and *Pisidium.*

The *Cardiadæ* immediately follow. Woodward, in his 'Manual,' places the *Veneridæ* between the *Cyprinidæ* and *Mactridæ*, and includes

in it the following genera:—*Venus, Cytherea, Meroe, Trigona, Artemis, Lucinopsis, Tapes, Venerupis, Petricola,* and *Glaucomya.*

Our limits will only permit the illustration of this family by the notice of a few genera.

Cyrena.—M. Deshayes, in his last edition of the 'Animaux sans Vertèbres,' remarks of the genus *Cyrena* that there exists a passage between the two genera, but a point is arrived at where the species become very distinct from *Cyclas* by reason of their thickness and having one tooth more in the hinge. The animal of the *Cyrenæ* which M. Deshayes had seen did not differ essentially from that of *Cyclas,* and approached nearly to that of *Venus.* It has the two lobes of the mantle united in their posterior third, and prolonged on that side by two siphons, which are separated to the base. They are furnished with a small retractor muscle, which leaves a particular impression in the shell.

The number of species of *Cyrena* is about 25. They are mostly found in tropical seas. There are about 75 fossil species found from the Wealden upwards.

C. fuscata is brownish-green, with numerous transverse subimbricate furrows; violet within and at the umbones; the lateral teeth very much elongated transversely and dentilated. It is a native of the Chinese rivers and those of the Levant.

Cyrena fuscata.

Megadesma.—Shell equivalve, subtrigonal, covered with a greenish epidermis. Hinge-teeth furrowed; two in the right valves connivent at their base; three in the other valve, the intermediate one advanced and separated. Lateral teeth distant. Ligament external, short, projecting, convex. Nymphæ prominent. (Lam.) Animal with a thick subtrigonal body; the mantle large, simple, open below and in front, closed posteriorly, and prolonged on that side into two equal tubes separated at the base; two unequal branchiæ, the upper one folded double; four triangular buccal appendages; mouth large; foot large, oblong, compressed, subangular anteriorly. (Deshayes.)

M. radiatum (*Galathea radiata,* Lam.; *Potamophila radiata,* Sow.). Under the epidermis milk-white, marked with violet towards its base, and ornamented with violet rays, generally from two to four in number. It is found in the rivers of Ceylon and of India.

Cyprina.—Shell equivalve, inequilateral, obliquely cordate; umbones obiquely curved; hinge with three unequal teeth, approximated at the base, subdivaricate above; lateral tooth distant from the hinge, on the anterior side, sometimes obsolete; nymphal callosities large, arched, terminated near the umbones with an ovate lunule. Ligament external, often partly immersed under the umbones.

The species are generally found in sandy mud.

C. Islandica has the shell cordate, transversely striated, covered with an epidermis; the anterior side subangulate. It is a native of the Northern Ocean, at the mouths of rivers.

Cyprina Islandica.

Cyprina occurs below the Chalk. Ninety fossil species have been described.

Cytherea.—Shell equivalve, inequilateral, suborbicular, trigonal, or transverse. Four cardinal teeth in the right valve, of which three are divergent, approximated at their base, and one is entirely isolated, situated under the lunule. Three divergent cardinal teeth in the other valve, and a fosset at a little distance parallel to the border. No lateral teeth. (Lam.)

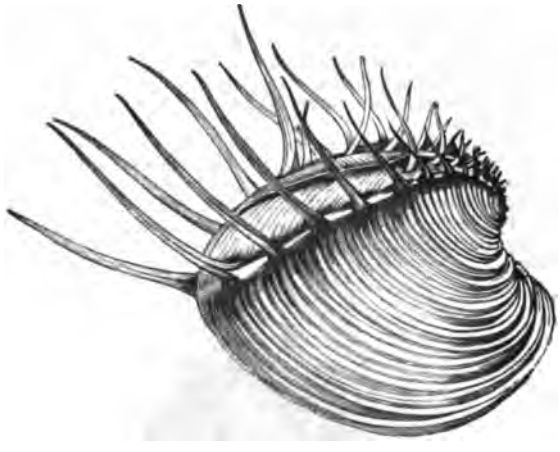
Lamarck states that in *Cytherea* there are constantly four teeth in the hinge. The fourth tooth is very oblique, and always set in that part of the border which comprises the lunule. This tooth is in fact constant in a considerable number of species; but in more than twelve, living as well as fossil, which M. Deshayes had carefully examined, he saw this tooth diminish by little and little, and become so rudimentary that, it having sometimes escaped Lamarck's notice, the latter comprised many of this species in his genus *Venus,* and placed the others among the *Cytherea.* If, says M. Deshayes in continuation, these observations are just—and it will be very easy to verify them in a large collection of living and fossil species of the two genera—one may ask where the line is to be drawn, and what reasonable ground exists for their separation?

The number of species noted in the Tables of M. Deshayes is 85 recent and 59 fossil (tertiary). Of these *C. erycina, C. chione, C. nitidula, C. citrina, C. exoleta, C. concentrica, C. lincta, C. rufescens, C. multilamella,* and *C. venetiana* are stated as occurring both recent and fossil (tertiary).

In the last edition of Lamarck the number of recent species recorded is 78; and the number of fossil species is 9. Mr. Lea, in his 'Contributions to Geology,' adds 6 species from the Claiborne Beds (tertiary of Alabama).

One of the most remarkable species is *C. dione* (*Venus dione,* Linn.). This remarkable shell, of which there are many varieties, is obliquely cordate in shape, of a rosy, rosy-purpurescent, purpurescent, or vinous colour, transversely furrowed with elevated lamellæ; the posterior borders of the shell are beset with spines, very long and distant in some varieties, and short and close-set in others.

It is a native of the seas of America.



Venus (Cytherea) dione.

C. meretrix has the shell trigonal, smooth, white; the umbones spotted; posterior surfaces olivaceous cærulescent, anterior side angulate.

Venus (Cytherea) meretrix.

There is a variety zoned with chestnut, with the sides and margins white.

Cytherea occurs fossil below the Chalk.

Venus.—Shell equivalve, inequilateral, transverse, or suborbicular. Three cardinal teeth, approximated, in each valve; the lateral ones diverging at the umbo. External ligament covering the external anterior fissure.

The number of species recorded by M. Deshayes in his Tables is 101 recent and 43 fossil (tertiary). Of these *V. verrucosa*, *V. plicata*, *V. gallina*, *V. decussata*, *V. radiata*, *V. Brongniarti*, *V. dysera*, *V. geographica*, and *V. paphia* are noted as recent and fossil (tertiary).

In the last edition of Lamarck the number of recent species recorded is 96, and the number of fossil 13. Woodward gives 176 recent and 160 fossil species.

Although species of *Venus* are to be found in most seas, they are most numerous in those of warm countries, and generally at a moderate distance from the shore.

V. cancellata has the shell cordate, longitudinally sulcate, girt with elevated remote transverse belts; white, spotted with bay or brown; lunule cordate.

It is a native of the seas of America.

M. Deshayes thinks it evident that Lamarck's species is identical with *Venus dysera*, Chemn., that it ought to be suppressed, and that a new name should be given to Chemnitz's variety, which is very distinct. The reader will find the synonyms collected, and the confusion learnedly unravelled, in the last edition of the 'Animaux sans Vertèbres.'

Venus concellata.

V. (Pullastra) textile. Shell ovate oblong, very smooth, pale-yellow, ornamented with angulate-flexuous, purplish, or cærulescent lines.

It is a native of the Malabar coast.

Venus (Pullastra) textile.

We subjoin a representation of *Venus* (*Pullastra*? *Venerupis*?) *vulgaris.* [LITHOPHAGIDÆ.]

Venus (Pullastra Venerupis) vulgaris.

Venus occurs fossil below the chalk.

VENERU'PIS, or VENERIRUPIS. [LITHOPHAGIDÆ.]

VENICE WHITE. [BARYTES.]

VENOM-FANGS. [OPHIDIA; VIPERIDÆ.]

VENTILA'GO, a genus of Plants consisting of only a single species, belonging to the natural order *Rhamnaceæ*. The calyx is 5-parted; the corolla 5-petalled; stamens 5; germ 2-celled, hid in the crenulated flat disc; style 2-cleft. Samara half superior, globose, long-winged, 1-seeded; embryo erect with perisperm. The species *V. maderaspatana* is common in different parts of India, from the peninsula to the north-western provinces; it is also found in the Indian islands, as it is figured and described (Rumph., 'Herb. Amb.,' 5. t. 2) by the name of *Funis viminalis*. It forms a large climbing shrub with stiff branches; is often dicecious, with flowers having an offensive smell, not unlike that of *Sterculia fœtida*.

VENTRICLE. [HEART.]

VENTRICULITES, a genus of Spongoid *Zoophyta*, proposed by Dr. Mantell for species found in the Cretaceous System, whose porous tissue is penetrated by distinct often large foramina, arranged with more or less of regularity. *V. radiatus* (Mantell, 'Geol. of Sussex,' pl. 10) and *V. Bennettiæ* (pl. 15 of the same work) are examples frequently found in chalk and the flint nodules imbedded in it.

VENUS. [VENERIDÆ.]

VENUS'S FLY-TRAP. [DIONÆA.]

VERA'TRUM, a genus of Plants belonging to the natural order *Melanthaceæ*. The name *Veratrum* occurs both in Pliny and Lucretius, but whether these were the same plants as the modern genus it is now impossible to say. It is also supposed to be the 'Ελλέβορος λευκός of Dioscorides; and the name White Hellebore, which is given to one of the species, seems to confirm this view. The genus is characterised as follows:—Perianth composed of six permanent, sessile, equal parts, to which are attached 6 stamens; styles 3, permanent, with simple spreading stigmas; capsules 3, bursting at their inner margins, by which they are originally united; seeds numerous, compressed, imbricated, winged at each end: several of the flowers have only the rudiment of an ovary.

V. album, Common White Hellebore, has a thrice compound panicle with ascending elliptical pieces of the perianth; the bracts of the branches oblong, partial, as long as the downy peduncle. It is a native of moist alpine meadows in the southern, central, and northern parts of Europe, but is not a native of Britain. In company with the *Gentiana lutea* it is one of the most prominent features in the rich pastures of the Alps of Switzerland and Savoy. The stem, which is from two to four or five feet in height, proceeds from a black, fleshy, wrinkled fusiform rhizoma, or rootstock, which is beset with a number of small radicles. [VERATRIA, in ARTS AND SC. DIV.]

V. viride, Green-Flowered Veratrum, has panicled racemes, with the bracts of the branches oblong-lanceolate, partial, longer than the downy petiole. This is a North American species, and is found in swamps and bogs from Canada to the Carolinas. It is found, according to Dr. Bigelow, in the swamps around Boston, where it is called Poke-Root, or Swamp Hellebore.

V. nigrum, Dark-Flowered Veratrum, has dense cylindrical panicled racemes with the bracts of the branches linear-lanceolate, and very long, pieces of the perianth obovate, widely spreading, and at length reflexed. It is a native of dry mountainous situations in Siberia, Hungary, Austria, and Greece. It will grow freely in gardens in Britain, especially in a light soil.

V. Sabadilla, Caustic Veratrum, at one time supposed to yield the

Cebadilla of commerce, and from which the poisonous alkaloid Veratrine of the Pharmacopœia is directed to be prepared, has broad ovate plantagineous leaves, dark purplish-black flowers, and capsules situated on only one-half of the circumference of the stem. This plant appears to be a native of the West Indies and Mexico, whence also the true Cebadilla plant comes to this country. The true Cebadilla plant has been stated by David Don to be the *Helonias officinalis*, and more recently, by Lindley, *Asagræa officinalis*. Previous to this however Schiede, who travelled in Mexico, sent home specimens of plants of Cebadilla, agreeing more with *Veratrum* than any other genus, and which Schlechtendal named *Veratrum officinale*. Dr. Christison, after an examination of the fragments of racemes, which occur in commerce as Cebadilla, is inclined to think that Schiede's plant supplies the greatest quantity to the market, although it is not improbable that this and several allied species are frequently substituted for one another, as the quantity of Veratrine they contain is much the same. [CEBADILLA.]

VERBASCUM, a genus of Plants belonging to the natural order *Scrophulariaceæ*. It derives its name from 'barbascum,' which was applied to some of the species on account of the bearded filaments: hence also the Italian name 'barbasso.' It has a 5-parted calyx; rotate funnel-shaped corolla; 5 stamens, all bearing anthers, which are only occasionally not all lunate in the same flower; a 2-valved capsule with seeds attached to the central placenta. There are about 70 species: they have strong erect stems, with broad decurrent leaves, and yellow, white, or purple flowers, disposed in dense or loose racemes or spikes.

V. Thapsus, Great Mullein, has crenated decurrent oblongo-lanceolate tomentose leaves; dense racemose spikes; pedicels of the flowers shorter than the calyx; the segments of the calyx lanceolate, acute, and tomentose above, and equal in length to the fruit; the corolla with the anther nearly equal. This plant is a native of waste sterile places, especially of chalky and gravelly soils, throughout Europe. It is also found in Siberia, Taurus, and Caucasus, and in Nepaul and Kumaon. The leaves are remarkable for their woolly character, from which the English name Mullein seems to have been applied to the whole genus. Mullein (French, Molène) is said to be a corruption of Woollen, and in German the plants are called Wollkräuter. In different districts in England this plant has very various names. In the northern counties it is called Hag-Taper, from some supposed efficacy in sorcery: in many places this has been corrupted into Hig-Taper and High-Taper. Torches, Bullock's Lung-Wort, Hare's Beard, Ladies' Fox-Glove, Murrain-Grass, Shepherd's-Club, &c., are other names. The specific name *Thapsus*, has been given to it on account of its growing in great abundance at Thapsos in Africa. It is also abundant in Greece, and appears to have been the Φλόμος λευκὸς ἄβρην of Dioscorides. This plant was formerly much used in medicine, and was considered to possess emollient and narcotic properties, and on this account it still occupies a place in the Dublin Pharmacopœia. The French call this plant Bouillon Blanc, and use an infusion of the flowers as a remedy in coughs. When dried in the sun the flowers are said to give out a fatty matter, which in Alsace is used as an application to hæmorrhoids.

V. Blattaria, Moth Mullein, has glabrous leaves, the lower ones obovate-oblong, attenuated at the base, and somewhat sinuated; those of the stem oblong, acute, crenated, sessile; the racemes terminal, elongated; the pedicels solitary, twice as long as the bracts. It is a native of the middle and south of Europe, some parts of Asia, and North America. It is not a common plant in Great Britain, although in some places it is abundant. It is called *Blattaria*, because it is said to drive away the *Blatta*, or Cockroach.

V. pulverulentum, Yellow Hoary Mullein, has ovato-oblong subserrated leaves, pulverulento-tomentose on both sides; racemes panicled; pedicels equal in length to the calyces; stem rounded. This plant is a native of Dauphiny and of Great Britain, especially in the counties of Norfolk and Suffolk.

V. nigrum, Dark Mullein, has oblongo-cordate petiolate crenated leaves, nearly smooth above, but clothed with fine tomentum beneath; racemes elongated; pedicels twice as long as the calyx. It is a native throughout Europe and in Siberia, and is common on banks and waysides in gravelly and chalky soils in England.

V. Lychnitis, White Mullein, has oblong wedge-shaped leaves, nearly glabrous above, but clothed with tomentum below; racemes panicled; pedicels twice as long as the calyx. It is found amongst rubbish and in waste places throughout Europe, in the north of Asia, and in North America, and is not uncommon in Great Britain. The powdery tomentum is used as tinder, and for making wicks for lamps, and hence its specific name from λύχνος, a lamp. The other British species are *V. thapsiforme*, *V. floccosum*, and *V. virgatum*.

VERBE'NA, a genus of Plants, the type of the natural order *Verbenaceæ*. Most of the species of this genus are weeds, and are generally inhabitants of Europe and North America. The genus is known by a tubular calyx with 5 teeth, one of them generally shorter than the rest; a tubular corolla with the limb rather unequal, 5-cleft; the stamens included, and sometimes only 2; the seeds 2 or 4, inclosed in a thin evanescent pericarp.

V. officinalis, Common Vervain, has 4 stamens with an erect somewhat hispid stem; the leaves lanceolate, inciso-serrate, or trifid, with the segments cut rough; the spikes filiform, somewhat panicled, and the flowers rather remote. This plant is common in England. It is not found in Ireland. It is an inhabitant also of Australia. This is the *ἱερὰ βοτάνη*, 'holy herb,' of Dioscorides, who ascribed great powers to it, especially in incantations. In most countries where it grows it seems to have been invested with extraordinary powers. It at one time entered into the composition of various charms and love-philters, and has even now a popular reputation for predisposing persons favourably towards those who administer a dose to them. The ancient Druids revered it next to the mistletoe, and gathered it with religious ceremonies.

V. Aubletia, Rose-Coloured Vervain, is a native of North America, in Georgia and the Carolinas, and was first brought to Europe in 1774. It is known by its fine pink or crimson flowers.

V. triphylla, Lemon-Scented Vervain, has panicled spikes, with minutely distantly-toothed leaves, three in a whorl; stem shrubby. This plant is a native of Chili. It is used on the continent for making an infusion, which, when cold, is administered as a cooling drink in fevers, slight catarrhs, &c.

VERBENA'CEÆ, *Verbens*, a natural order of Exogenous Plants. The species are trees or shrubs, sometimes only herbaceous plants, with generally opposite, simple, or compound leaves without stipules. The flowers are in opposite corymbs or spiked alternately, sometimes in dense heads, and very seldom axillary or solitary. The calyx is tubular, persistent, inferior; the corolla is hypogynous, monopetalous, tubular, deciduous, generally with an irregular limb; the stamens 4, didynamous, seldom equal, occasionally 2; ovary 2-4-celled; ovules erect or pendulous, solitary or twin; style 1; stigma bifid or undivided; fruit nucamentaceous, sometimes berried, composed of two or four nucules in a state of adhesion; seeds erect or pendulous, albumen none, or in very small quantity; embryo always erect. (Lindley.)

The great difference between these plants and those of *Lamiaceæ* or *Labiatæ* consists in their concrete carpels, terminal style, and the absence of oil-glands from their leaves.

Verbena mutabilis.

1, cutting with flowers; 2, corolla opened with didynamous stamens; 3, calyx opened with nucamentose fruit; 4, section of single fruit; 5, single carpel.

The plants of this order are rare in Europe, in the north of Asia, and in the north of America; they are common in the tropics of both hemispheres, and in the temperate districts of South America.

The plants belonging to this order have no very active properties; those attributed to the Vervain [VERBENA] appear to have been imaginary. The *Lantana pseudothea* is said, by Geoffroy St. Hilaire, to be used in Brazil as a substitute for tea, and is vulgarly called Capitaõ do Matto, or Cha de Pedreste. [LANTANA.] The Teak-Tree [TECTONA],

also the Brazilian Tea-Tree [STACHYTARPHA], and the Chaste-Tree (*Vitex agnus castus*) [VITEX], belong to this order.

VERD-ANTIQUE. [MARBLE.]

VERDITER. [COPPER, ARTS & SCI. DIV.]

VERMES. Ancient naturalists designated by this name all lower animals resembling in form the Earth-Worm. Linnæus adopted it as the title of a class, including all animals which he could not arrange under the *Vertebrata* and *Insecta*.

VERME'TUS. [TUBULIBRANCHIATA.]

VERMICULITE, a Mineral, described by Dr. Thomson as composed of micaceous-looking plates cemented together by a whitish matter. Lustre soapy. Feel greasy. Sectile. Hardness 1. Specific gravity 2·5252. When heated nearly to redness it projects out with a vermicular motion, as if it were a mass of small worms: hence the name. By ignition it becomes of a silvery aspect, with a shade of red or yellow. Infusible per se before the blow-pipe. With carbonate of soda in the reducing flame gives a greenish, in the oxidising flame an amethyst coloured glass. Dr. Thomson's analysis gave:—

Silica	49·080
Magnesia	16·964
Peroxide of Iron	16·120
Alumina	7·280
Water	10·276
Manganese	a trace
	99·72.

VERMI'LIA, a genus of *Serpulidæ* [TUBICOLÆ], composed of species of *Serpula* which are attached by the whole length of the shell, such as *Serpula* (*Vermilia*) *triquetra*, the shell of which is repent and flexuous, with a simple dorsal carination: there is a variety with a red line on each side of the carination. It is a native of European and Mediterranean seas, on stones, shells, and other submerged marine bodies.

Vermilia triquetra.

VERMILIO. [LEPTIDES.]

VERMILION. [MERCURY.]

VERNAL GRASS, SWEET. [ANTHOXANTHUM.]

VERNATION. [LEAF.]

VERNI'CIA, a name applied by Loureiro to a Plant of Cochin-China, which is well known as yielding an oil, and which belongs to the same genus as another plant, also yielding an oil, in China and Japan. By Thunberg the latter plant was called *Dryandra*, but that name being appropriated to a genus of *Proteaceæ*, these oil-trees are now referred to the genus *Elæococca* of Commerson. This genus belongs to the natural order *Euphorbiaceæ*. *E. verrucosa* the *Dryandra oleifera* of Lamarck, and the *D. cordata* of Thunberg, is a native of Japan, where, he states, it is called Abrassin: the oil expressed from its seeds is used both as an article of diet and for affording light. The Chinese are said to call the oil Mouyeou, and the fruit from which it is obtained Mouyou. The tree cultivated in Bourbon is there called Arbre d'Huile, where an oil is likewise obtained by submitting the almonds of the seeds to pressure. *E. montana*, the *Vernicia montana* of Loureiro, is a native of China and Cochin-China: it yields a clear yellowish fatty oil, which is employed to protect wood from the influence of air and water. It is sometimes mixed with the real varnish of these countries, which it makes more liquid, but less valuable as a resin.

VERNO'NIA, named after W. Vernon, a genus of Plants belonging to the natural order *Compositæ*. *Vernonia* (*Serratula*, Roxb.) *anthelmintica* is a pretty, large, erect, annual species, common on dry uncultivated ground and rubbish in different parts of India, flowering during the cold season. The dark-coloured seeds are extremely bitter, and considered powerfully anthelmintic. They are also employed as an ingredient in compounds prescribed in snake-bites.

VERNONIA'CEÆ, a tribe of Plants belonging to the natural order *Compositæ*. They are distinguished from *Lactuceæ* by their corolla, which is not ligulate, and from every other tribe by their style, which is the same as that possessed by *Lactuceæ*. There are several genera of plants belonging to this tribe, which are chiefly inhabitants of America: there are a few in Asia and Africa, but none in Europe.

VERO'NICA, a genus of Plants belonging to the natural order *Scrophulariaceæ*. The species consist of herbs, undershrubs, or shrubs, with opposite, alternate, or verticillate leaves. The flowers are of a blue, white, or red colour, and are arranged in spikes or racemes; the calyx is campanulate or compressed, 4-5-parted; the corolla rotate, with a very short tube, a 4-parted spreading limb; all the segments entire, the upper one the broadest; the stamens are 2, situated at the sides of the upper segment of the corolla, diverging; anthers 2-celled; stigmas hardly thickened. The fruit a capsule, with a septum in the middle or bipartible. The species of this genus are exceedingly numerous; they are distributed over all parts of the world, and are especially abundant in temperate climates. The flora of Great Britain contains about 20 species.

V. spicata, Spiked Speedwell, has its flowers on a spiked raceme; the leaves crenated, the radicle ones ovate or obovate, and running into the petioles; the cauline leaves are lanceolate or oblongo-lanceolate, sessile, toothed, and entire at the top; the whole plant downy, canescent, and rather clammy. It is a native of Germany, France, and Switzerland, and is found in England, in some parts of the county of Suffolk.

V. officinalis, Common Speedwell, has spicate flowers, with leaves broadly ovate, serrated, and rough with pubescence; stem very downy, procumbent; the capsule obovate, deeply notched; the bracts longer than the pedicles of the flowers. It is a native of Europe and North America, in woods and on dry sandy banks, and is plentiful in Great Britain. It has pale blue-coloured corollas, with veins of a deeper blue. Paullix, an old Danish botanist, endeavoured to prove that this plant was identical with the Tea-Plant of China, and it was once extensively used as a substitute for tea.

V. Beccabunga, Brooklime, is a glabrous shining plant, with procumbent stems, and elliptic oval or oblong leaves, seated on short petioles, serrated or entire. It is a native of every country in Europe, and is also found in North America and Nepaul, and is abundant in Great Britain.

V. montana, Mountain Speedwell, has lax few-flowered racemes, with ovato-cordate serrated petiolate leaves; a stem hairy all round; and an orbicular 2-lobed membranous capsule much larger than the calyx. It is a native of Europe, but is not very common in Great Britain.

V. Chamædrys, Germander Speedwell, has the whole plant hairy; the leaves deeply and unequally serrated; the racemes elongated and many-flowered; the capsule obcordate and shorter than the calyx. It is common throughout Europe.

V. Teucrium, Germander-Leaved Speedwell, is a downy plant, with the lower leaves ovate oblong, half-clasping the stem, obtuse, and coarsely serrated, the upper ones sessile, narrower, and serrated; the racemes axillary, opposite, on long peduncles, and the stems ascending or prostrate. It is a native of Italy, Switzerland, and Germany, in clayey soils.

The other British species are *V. scutellata*, *V. Anagallis*, *V. saxatilis*, *V. alpina*, *V. serpyllifolia*, *V. arvensis*, *V. verna*, *V. triphyllos*, *V. agrestis*, *V. polita*, *V. Buxbaumii*, and *V. hederifolia*.

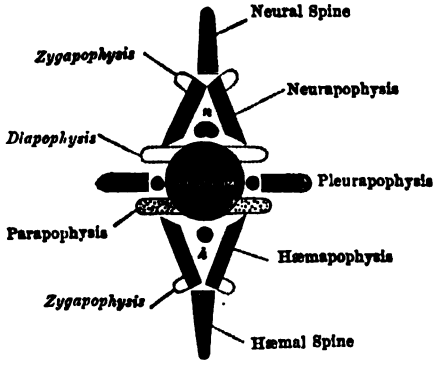
VERRU'CA. [CIRRIPEDIA.]

VERRUCA'RIA, a genus of Plants belonging to the natural order of Lichens. The species of this genus are found on rocks and flints and the bark of trees, and are abundant inhabitants of Great Britain.

VERTEBRA is the name given to each of the separate bones of which the spinal column of the skeleton of the *Mammalia* is composed. [SKELETON.] Although in technical anatomy the term is thus restricted, it has recently received a much more extended signification. Professor Owen defines a vertebra as "one of those segments of the endo-skeleton which constitute the axis of the body and the protecting canals of the nervous and vascular trunk; such a segment may also support diverging appendages." According to this definition, the vertebra becomes the type or plan on which all the bones of the skeleton of vertebrate animals are constructed. It is not only a portion of the spinal column, but the elementary form to which all the parts of the skeleton may be reduced. The bones of the head, of the thorax, the pelvis, and the limbs, however complicated, are reducible to the plan of the typical vertebra. In the history of the development of this interesting branch of anatomical inquiry a variety of opinions have been expressed, as to what may be regarded as the true elements of a typical vertebra, since in no instance do we find all the parts of the vertebra developed in exactly the same manner.

The diagram in next page exhibits a typical vertebra, according to the plan of Professor Owen.

This plan does not include the parts which constitute the diverging appendages. Of this plan Professor Owen says, "The names printed in Roman type signify those parts which, being usually developed from distinct and independent centres, I have termed 'autogenous elements. The italics denote the parts more properly called processes, which shoot out as continuations from some of the preceding elements, and are termed 'exogenous;' e. g., the diapophyses, or upper transverse processes, and the zygapophyses, or the 'oblique' or 'articular processes' of human anatomy."



Ideal Typical Vertebra.

The autogenous processes generally circumscribe holes about the centrum, which in the chain of vertebræ form canals. The most constant and extensive canal is that formed by the neurapophyses for the lodgment of the trunk of the nervous system, and marked *n* in the diagram. The second canal is formed by the hæmapophyses, and is below the centrum, and embraces the central circulating organ (*h*), the heart, and the large trunks of the vascular system. At the sides of the centrum, most commonly seen in the cervical region, rise two other canals, formed by the three lateral elements of the vertebra, and these often embrace an artery and a nerve. Thus a typical or perfect vertebra, with all its elements, presents four canals or perforations about a common centre; such a vertebra is seen in the thorax of man, and most of the higher forms of vertebrate animals, as in the neck of many birds. In the tails of most reptiles and *Mammalia* the hæmapophyses are articulated or anchylosed to the under part of the centrum, space being needed there only for the caudal artery and vein. But where the heart is to be lodged an expansion of the hæmal arch takes place, analogous to that which occurs in the neural arches when the nervous trunk assumes the form of a brain.

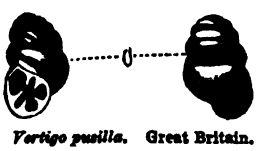
In the same manner that the parts of the thorax, spinal column, and skull may be traced to the elements above referred to, the parts of the two pairs of locomotive organs with which all vertebrate animals are endowed may be traced to a common plan in the diverging appendages. These parts of all others are most subject to change,—now developed to an enormous extent, and again almost entirely disappearing, according to the necessity of adapting the animal to its special habits. With the exception of the posterior and anterior extremities, these organs are developed only to a limited degree. It is through the study of these appendages that the pectoral fins are seen to be the homologues of the anterior extremities in the Reptiles, of the wings in the Birds, of the fore legs in the majority of the *Mammalia*, the flippers of Seals and Whales, and of the arms in Man. In like manner the abdominal fins of Fishes are the homologues of the legs in Birds, and of the posterior extremities of the Reptiles and *Mammalia*, and the legs in Man. These homologues include not only the totality of these organs, but the individual parts, and the scapula, clavicle, coracoid process, humerus, radius, ulna, carpal and metacarpal bones, and phalanges, in the higher *Mammalia* and Man have their homologues in the lower form of vertebrate animals. So with the pelvic arch, with its ilium, ischium, pubis, femur, fibula, tibia, tarsal and metatarsal bones, and phalanges.

We have not space here to enter into the details of the application of this general plan to the structure of the skeleton of the various forms of vertebrate animals, but this has been done in a most masterly manner by Professor Owen, in his 'Report on the Homologies of the Vertebrate Skeleton,' published in the 'Transactions of the British Association' for 1846, and also subsequently in an independent volume devoted to the same subject. This department of anatomical inquiry is no longer a matter of ingenious hypothesis and verbal speculation, but has been placed by this inquirer, through the unerring principles of comparative anatomy and development, upon the firmest basis, and may be regarded as an essential part of scientific truth.

VERTEBRA'TA. [Mammalia.]

VERTICILLUS. [Inflorescence.]

VERTI'GO, a genus of Gasteropodous *Mollusca*. The shell is cylindrically fusiform, sinistral, hyaline; the aperture margined, sinuous, and denticulate on the inner edge; the peristome somewhat reflected.



Vertigo pusilla. Great Britain.

This terrestrial genus is minute, and bears some resemblance to *Pupa*; but the shells are sinistral, or left-handed, to use the collector's term, and of a glassy transparency. [Helicidæ.]

VERUNA. [Grapsidæ.]

VERVAIN. [Verbena.]

VESPERTILIO. [Cheiroptera.]

VESPERTILIO'NIDÆ. [Cheiroptera.]

VE'SPIDÆ, a family of Insects belonging to the order *Hymenoptera*. It comprises the species of the genus *Vespa* of Linnæus, of which the common Wasp and the Hornet are familiar examples. They were formed into a family by Latreille, under the name of *Diploptera*, afterwards changed into *Diplopteryga* by Kirby. They form the third and last division of the first sub-section (*Prædones*), of the second section (*Aculeata*) of *Hymenoptera*, in Westwood's revision of Latreille's arrangement. When at rest they fold their wings throughout their entire length, whence their distinctive appellation. The wings of all the insects of the family have a similar neuration, their eyes are lunate, and there are glands at the extremity of the labrum. The fore wings have one marginal and three perfect submarginal cells, with an incomplete terminal submarginal cell.

Whilst some of these characters are so peculiarly distinctive of the *Diplopteryga* that they are not to be seen in any other insects of the order, they, strange to say, do not at all indicate a community of habits. Among the Wasps are insects of the most dissimilar habits; some solitary, others living in societies, some phytophagous, others carnivorous. Such as are social rival the bees in the complicated instincts which regulate their societies. At first sight these great differences of manners would seem to point to a classification superior to that founded on such unimportant characters as the folding of the wings, &c. But when we find on further inquiry that the latter apparently insignificant distinctions correspond to essential modifications of structure common to all the insects of the family, we are led to conclude that among the Wasps, structure, and not economy, is the real source of essential character. Some authors, laying greater stress on habit than on structure, have been inclined to separate far apart the Social from the Solitary Wasps; but the utmost to which a separation can be admitted is that arrangement adopted by Mr. Westwood, namely, the division of the *Diplopteryga* into two families, the *Eumenidæ* and the *Vespidæ*.

Besides the characters already mentioned, the Wasps are distinguished by the form of the antennæ, which are usually angled and somewhat clavate at their extremities. Their tongues are trifid and laciniated at the tips; the palpi are short and filiform; the maxillæ long and compressed; their eyes are notched; the thorax is entire. The bodies of the Wasps are usually black, with yellow markings, the males differing from the females in having the clypeus not marked with yellow spots. They are naked, or but slightly hairy. The abdomen is often pedunculated, and the females and neuters are provided with a powerful sting. Their legs are unprovided with apparatus for the collection of pollen.

The Solitary Wasps, each species of which comprises males and females only, constitute the family *Eumenidæ*. The genera *Eumenes* and *Odynerus* belong to it. Their peculiarities of organisation are adaptations to their peculiarities of habit. Thus the mandibles form a kind of rostrum, resembling that of the *Fossores*, for the purpose of seizing and carrying off the insects on which they prey. The antennæ are composed of 12 or 13 distinct joints, according to the sex, and are pointed. The labrum is divided into four pilose setæ, with glands at their extremities; the lateral ones narrow and pointed, the intermediate longer. The clypeus is oval or heart-shaped, and anteriorly more or less truncate. The basal segment of the abdomen in the typical species is elongated into a peduncle. Their larvæ are fleshy grubs, with tubercles serving instead of feet.

The habits of the Solitary Wasps are interesting. Réaumur informs us that the *Odynerus murarius* (*Vespa muraria*) of Linnæus makes a hole several inches deep in the sand, or in the sides of walls, constructing a tube of earthy paste, at first straight, and then curved at its entrance. In this burrow it constructs its cells, and deposits in the cavity of the interior cell from 8 to 12 little green caterpillars, arranging them spirally in layers above each other. In the midst of these it deposits its eggs, then closes the mouth of the hole with the materials of the tube, which it had used as a sort of scaffold. The larvæ when hatched feed upon the caterpillars. Mr. Westwood states that the *Odynerus Antilope* lines its cells with mud, of which it carries small round pellets into its burrow under its breast. Bouché observes that *Odynerus Parietum* stores up flies and other perfect insects, along with caterpillars, for the food of its young. In the 'Gardener's Magazine' for 1837 a most remarkable instinct, displayed by a species of *Odynerus*, is related by Mr. Westwood. The insect he describes stores in its nest the leaf-rolling larva of a *Tortrix*, which it obtains by introducing its sting into the rolls of leaves, and then running to the end of the roll to catch the larva, which it finds endeavouring to make its escape from its unknown enemy. According to Geoffroy, the *Eumenes coarctata* constructs upon stems of heaths and other plants a spherical nest of fine earth, which it fills with honey, and there deposits an egg. In the first volume of the new series of the 'Magazine of Natural History,' Mr. Shuckard gives an interesting history of a new British *Odynerus*, *O. lævipes*, which builds its nest in excavations made in the

pith of dead bramble-sticks. In this case there was no appearance of any food having been laid up with the grub.

The genus *Ceramius* is an exception to its family, since its upper wings are not folded longitudinally, and are furnished with only two submarginal cells. It differs also in some other characters. In its habits it resembles the *Odyneri*. The species inhabit Europe and South Africa. The genus *Masaris*, constituting Latreille's family of *Masaridæ*, is also anomalous in some of its characters, but agrees with *Eumenes* in the manner of folding its wings.

The Social Wasps constitute the restricted family of *Vespidæ* of Westwood, the *Polistides* of Saint Fargeau. They live in numerous societies, consisting of males, females, and neuters, which are temporary, being dissolved at the approach of winter. The mandibles of the *Vespidæ* proper are not longer than broad, and are broadly and obliquely truncated at their extremities. The labrum is short and but slightly elongated, and the clypeus is nearly square. They are voracious insects, preying upon others, and on meat, honey, fruit, &c. The winged insects prepare the food in their stomachs for their young, which they feed daily. The males are drones, and do not work, leaving all labour to the females and neuters. The larvæ are fleshy grubs, destitute of feet, but furnished with lateral tubercles. Some of the species, as the Hornet (*Vespa crabro*), are of considerable size. Such as belong to the genus *Vespa* build a covering to their nests. The nests of *Polistes* have the cells undefended. The nests are constructed of a papyraceous substance made from wood or the bark of trees, and those of some species include an immense number of cells of an hexagonal form, arranged in tiers with their mouths downwards; sometimes as many as 16,000. A Brazilian species makes honey. A Demerara wasp suspends its nest by a ring from the uppermost branches of trees, so as to be out of the reach of monkeys. In the collection of the Zoological Society is a wasp's nest from Ceylon, built inside a great palm-leaf, and not less than 6 feet in length. In the British Museum may be seen some curious nests of exotic species. The hornet constructs its nest of a coarser substance than that used by the common wasp, and builds it in the trunks of trees and in old walls.

Of the indigenous species, the *Vespa vulgaris* is the most common. It is a ground-wasp, as is also the *V. rufa*, a rarer species, making smaller nests and associated in less populous societies. Of Tree-Wasps we have *V. holsatica* of Linnæus, which is the *V. Anglica* of Leach, and the *V. Britannica* of the last-named author.

Wasps live in societies, composed of females, males, and neuters, or workers, which are essentially females, but have the reproductive organs undeveloped or passive. The females are usually largest, but of them there are two sizes—one very much larger than the neuters, and laying eggs which produce two sexes, while the other is about the same size, and lays only male eggs. The larger kind are produced later than the workers, and come forth to be queens and to found new colonies in the following spring. Destined to become the monarch of a populous state, the queen-mother is at first an outcast and alone. Industry effects her greatness. With instinctive ambition, ere her subjects are born, she lays the foundations of the metropolis of her kingdom, building the first houses herself. She then gives birth to their first inhabitants, whom she feeds and nurses without assistance. "At length she receives the reward of her perseverance and labour, and, from being a solitary unconnected individual, in the autumn is enabled to rival the queen of the hive in the number of her children and subjects, and in the edifice which they inhabit—the number of cells in a vespiary, sometimes amounting to more than 16,000, almost all of which contain either an egg, a grub, or a pupa, and each cell serving for three generations in a year; which, after making every allowance for failures and casualties, will give a population of at least 80,000. Even at this time, when she has so numerous an army of coadjutors, the industry of this creature does not cease, but she continues to set an example of diligence to the rest of the community. If by any accident, before the other females are hatched, the queen-mother perishes, the neuters cease their labours, lose their instincts, and die." (Kirby and Spence.)

The community of wasps and its nest are called a vespiary. There are several hundred females in a large vespiary, few of which survive the winter. The survivors fly about in spring actively engaged in preparations for their future colonies. Once established, they never quit the nest. In their youth they emerge from the pupa towards the end of August, and at the same time with the males. They pair in September and October. The males are about equal in number with the females. Their habits are industrious, and not, like those of drones, luxurious and lazy. They are the street-sweepers and undertakers of their city. They carry off the rubbish and the bodies of the dead, which, if too heavy for their strength, they quarter and carry away piecemeal. Their lives are peaceful, and they die a natural death at the close of the year, when the cold destroys both them and the workers.

The neuters are the most numerous and busiest class of the vespine community. They are the architects, soldiers, and commissaries of the state. They build the nest, gather provisions, regulate the nurseries, and revenge insults. They ramble everywhere with impunity, and all provisions are to their taste. They levy contributions wherever they can, and fight for their spoil if disturbed. Robbers and ferocious enemies of the rest of the world, they are faithful servants of the commonwealth of which they are members. The food they collect is shared among all with impartial justice. The worker having brought home his spoil, perches on the top of the nest amid his assembled compatriots, and disgorging the sweets he has collected, fairly distributes them. When not occupied on foraging expeditions, the neuters are employed in the enlargement and repair of the nest. Celerity and order prevail in all their operations. Each of the masons has his allotted space, an inch or an inch and a half in extent, wherein he conducts his plastering occupation, his mouth serving as a hod, carrying a ball of ligneous fibre, previously torn by his powerful jaws from gate-posts, wood-blocks, and neighbouring trees. This fibre, kneaded together and moistened with saliva, is made into a paper, of which are constructed the combs, each made up of a number of hexagonal cells opening downwards. The outside of the whole nest is coated with foliaceous layers. It is probable that the substance of the comb is made from the scrapings of sound wood; that of the envelope from a mixture of sound and decayed. The nests of Tree-Wasps are finest and closest in texture, which is necessary, since they are so much more exposed to the vicissitudes of the weather than those which are buried in the ground. Some foreign species construct their nests of a solid and thick pasteboard, impenetrable to the rain; others diversify the outside of their habitations with conical knobs of various shapes and sizes, supposed to be defences against their larger enemies, and construct pent-roofs to protect the entrance from the wet, the entrance-hall being so twisted as to prevent the invasion of hostile insects. The cells of the comb of the common English Wasp are brown, and coarse in texture; but where the larvæ have spun their cocoons, they are found lined with a white and semi-transparent paper, fashioned on the mould of the cell, and probably made by the larvæ themselves.

Wasps have sentinels placed at the entrances of their nest to give an alarm in case of danger. If these guards are seized and destroyed, the rest do not attack. Mr. Knight observed that if a nest of wasps be approached without alarming the inhabitants, and all communication be suddenly cut off between those out of the nest and those within it, no provocation will induce the former to defend it and themselves. But if one escapes from within, it comes out angrily, as if commissioned to avenge the wrong, and will sacrifice its life in defence of the community.

(Westwood, *Modern Classification of Insects; Introduction to Entomology.*)

VESUVIAN. [IDOCRASE.]

VETCH. [VICIA.]

VETCH, HORSE-SHOE. [HIPPOCREPIS.]

VIBRIO. [INFUSORIA.]

VIBURNUM, a genus of Plants belonging to the natural order *Caprifoliaceæ*. The species consist of shrubs with opposite petiolate leaves and corymbose flowers. The limb of the calyx is 5-cleft, permanent; the corolla rotate, subcampanulate, and tubular; the fruit a berry, ovate or globose, with 1 seed by abortion, and crowned by the calycine teeth. The species are natives of Europe, America, and Asia, and are of easy culture in British gardens. Some of them were known to the Greeks and Romans, though the species have not been always identified.

V. Tinus, the Laurustinus, has ovate-oblong quite entire permanent leaves, with the veins beneath furnished with glandular hairs; the corymbs flat; the flowers white, rose-coloured before expansion; berries dark-blue. This plant, now so common throughout Europe, and the most general inhabitant of the gardens of Great Britain, is a native of the south of Europe and the north of Africa.

All the varieties of Laurustinus are hardy shrubs, are evergreen, and bear the climate of Great Britain well; most of them blossom from November till April, and sometimes during May and June.

V. Lentago, the Lentago, or Tree-Viburnum, has broad ovate-acuminate sharply serrated glabrous leaves; petioles with narrow curled margins; terminal sessile corymbs; white flowers, and black fruit. It is a native of North America, and is found in hedges and on the borders of woods from New England to the Carolinas and also in Canada.

V. Lantana, the Wayfaring-Tree, has cordate-rounded finely-serrated leaves, clothed beneath, but more sparingly above, with a stellate mealy pubescence; the cymes pedunculate, broad, flat, consisting of numerous white flowers. This plant forms a shrub or low tree, and is a native of Europe and the west of Asia, in low woods and hedges, and chiefly on calcareous soils. It is not uncommon in Great Britain.

V. Opulus, the Guelder Rose, or Snow-Ball, is a glabrous plant, with broad 3-lobed acuminate unequally serrated veiny leaves; petioles beset with glands towards the top, and several oblong leafy appendages lower down; flowers of a white colour arranged in cymes, the lateral flowers dilated, flat, and without stamens or pistils; the berries elliptical, bright-red, very juicy, bitter, and nauseous. It is a native throughout Europe, and is especially frequent in Britain and Sweden.

V. Oxycoccos, the Cranberry Gualder Rose, has 3-lobed acute 3-nerved leaves; the lobes divaricate, are acuminate, and coarsely and distantly serrated; the petioles glandular; the cymes of white flowers radiant; the berries sub-globose, red, and very much resembling cran-

berries. This plant is a native of North America, on the mountains of New York and New Jersey, and throughout Canada to the arctic circle.

(Loudon, *Arboretum et Fruticetum Britannicum.*)

VI'CIA, a genus of Plants belonging to the natural order *Leguminosæ*. The species are usually climbing herbs with abruptly pinnate leaves, with many pairs of leaflets; the common petiole terminating in a tendril at the apex, which is mostly branched; the stipules are semisagittate in form, and the peduncles axillary, 1- or many-flowered; the calyx is tubular, 5-cleft or 5-toothed, the two upper teeth shortest; the corolla papilionaceous; the stamens diadelphous; the style filiform, being at right angles with the ovary, villous on the upper side, and on the under side beneath the apex; the legume 1-celled, many-seeded, oblong; the seeds with a lateral oval or linear hilum. The species of this genus are very numerous.

V. sativa, Common Vetch, or Tare, has leaves with tendrils; the leaflets 6-10, obovate, mucronate; flowers usually twin, sessile,; calyx cylindrical; a style bearded at the apex; compressed oblong somewhat torulose reticulated erect legumes, with smooth globose seeds. This plant is a native throughout Europe, and its extensive cultivation diffuses it more abundantly. It is also found in North America, about Fort Vancouver.

V. biennis, Biennial Vetch, has about 12 lanceolate glabrous leaflets, furrowed petioles, and many-flowered peduncles hardly longer than the leaves. This plant is a native of Siberia, and is very hardy, continuing green throughout the winter, and furnishing an early fodder.

V. Cracca, Tufted Vetch, has many-flowered peduncles longer than the leaves; flowers imbricate, crowded, of a fine purple colour, and nearly entire semi-sagittate stipules. It is a native of Europe, and is common in Great Britain in bushy places.

V. pisiformis, Pea-like Vetch, is a quite smooth plant with 3-4 pairs of ovate leaflets; ovate semi-sagittate toothed stipules, with many-flowered peduncles; and oblong reticulately-veined legumes. It is a native of the south of Europe, in woods, and is cultivated on account of its seeds.

V. sepium, Bush-Vetch, has flowers mostly in fours, somewhat stalked; upright glabrous legumes; ovate obtuse leaflets. It is a native of Europe, and is common in Great Britain in woods and shady places. It shoots early in the spring, and would answer for feeding cattle; but an objection to its cultivation exists, as its seeds are liable to the attacks of the larvæ of a species of *Attelabus*. It has been recommended to be sown among clover for mowing.

V. sylvatica, the Wood Vetch, has many-flowered peduncles longer than the leaves, elliptico-oblong mucronate leaflets, and lunate stipules deeply toothed at their base. It is a native of Europe in mountain woods, and is abundant in the north of England and Scotland. It has numerous large white flowers streaked with bluish veins, and is the handsomest of the British species. Its stems are from 3 to 6 feet high, climbing by means of its branching tendrils. It has been recommended as a valuable plant for fodder.

V. lutea, Rough-Podded Yellow Vetch, has sessile solitary flowers; the standard glabrous; the legumes reflexed, hairy; the stems diffuse; the stipules coloured. It is a native of the south of Europe. In Great Britain it is occasionally found on stony ground, especially near the sea. Its stems are from 6 to 12 inches high, and it has long yellow flowers.

V. Bithynica, Rough-Podded Purple Vetch, has stalked mostly solitary flowers, with rough upright legumes; petioles with two pairs of lanceolate leaflets, and toothed stipules. It is a native of the south of Europe. It occurs occasionally in Great Britain, in gravelly soils, more especially near the sea. It is a prostrate plant with purple and white flowers.

VICO'A, a genus of Plants belonging to the natural order *Compositæ*, and sub-tribe *Inuleæ*.

VICUGNA, or VICUÑA. [Llama.]

VIDUA. [Plocheinæ.]

VILLA'RSIA, a genus of Plants belonging to the natural order *Gentianaceæ*, named after Villars, a French botanist. It has a 5-parted calyx; a subrotate corolla with spreading limb, the segments with a flat disc; 2-lobed stigmas, the lobes toothed; 5 hypogynous glands; a 1-celled 2-valved or valveless capsule; seeds naked, or girded with a membranous margin. There are about 16 species of this genus. They are either aquatic or marsh plants, with alternate entire leaves and yellow flowers. They are inhabitants of all parts of the world. One only is a native of Europe.

V. Nymphæoides, Nymphæa-like Villarsia, is a floating plant, with orbicular-cordate leaves; the peduncles single-flowered, and aggregate; the segments of the corolla ciliate. It is a native of Denmark, Holland, Sweden, Germany, Piedmont, and of Siberia. It is found in ditches and slow-running streams. It is also a native of Great Britain, though comparatively a rare plant. It is found in the Thames, in the recesses of the shores near Walton Bridge, near Botley Bridge, Godstow Bridge, and Hinksey Ferry. It occurs also in the fens of Lincolnshire and in Yorkshire. It is a beautiful plant, and may be easily cultivated. It has a large yellow flower, which is curiously plaited. It is a very abundant plant in Holland, frequently covering large tracts of the canals with its beautiful yellow flowers and dark-green leaves.

VILLARSITE, a Mineral whose primary form is a rhombic prism. Colour yellowish-green. Fracture granular. Hardness 3·0 to 3·5. Subtransparent. It is found at Traversella in Piedmont. It contains silica, magnesia, protoxide of iron, protoxide of manganese, lime, potash, and water.

VINA'GO. [Columbidæ.]

VINCA (from 'vinco,' to bind), a genus of Plants belonging to the natural order *Apocynaceæ*. It has a salver-shaped corolla, with the tube longer than the calyx, and the throat bearded; the segments of the limb flat, oblique, 5-lobed, truncate at the apex; 5 stamens inserted in the throat, inclosed with short filaments. Five or six species of this genus have been described; they are creeping, suffruticose, or herbaceous plants, with smooth shining opposite leaves, with blue, purple, or white flowers, seated on solitary axillary alternate peduncles. They are natives of Europe, in shady places.

V. major, Greater Periwinkle, has stems rather erect, ovato-acute ciliated leaves; teeth of the calyx linear, subulate, ciliated, and usually with a smaller tooth on each side at the base; the segments of the corolla are broad and ovate. It is a native of the middle and southern parts of Europe, and is apparently wild in many parts of Great Britain, but it may be doubted whether it is an original native of this island. Its flowers are of a fine purple-blue colour, and are larger than those of any other species. The English name, Periwinkle, seems to be derived from the French, Pervenche. In Chaucer's time it was called Perwinke:—

> "There sprang the violet al newe,
> And fresh perwinkè rich of hewe."

The flowers appear early in spring, and continue open all the summer. It is well adapted for growing on the ground of shrubberies, as well as on the banks of hedgerows, or in any shady place. In olden times great virtues were attributed to the Periwinkle; amongst other things, Culpepper says, "the leaves of the Periwinkle eaten by man and wife together do cause love between them." In Italy this plant is called Fiore di Morte, from the practice of making garlands of it in which to bury dead children. It was at one time much used in sorceries and incantations, hence the French still call it Violette des Sorciers.

V. minor, Lesser Periwinkle, has procumbent stems; the flowering stems usually erect. It is a native of Europe, in the same situations as the last, and is often found in Great Britain.

VINCULARIA. [Polyzoa.]

VINE. [Vitis.]

VI'OLA, a genus of Plants, the type of the natural order *Violaceæ*. The sepals are unequal, 5, all more or less drawn out downwards into ear-like appendages, erect after flowering; petals 5, unequal, convolute in æstivation, with 3-nerved claws, the lower one drawn downwards into a hollow spur; stamens 5, approximate or coarctate, inserted on the top of the teeth of a pentagonal 5-toothed torus; the filaments dilated at the base, oblong or triangular, bearing the anthers low down; lobes of anthers spreading at the base; the two anterior stamens bearing on their back two nectariferous lancet-shaped round or linear appendages, which are drawn in within the spur. The species of this genus are exceedingly numerous.

V. odorata, Common Sweet Violet, has no stem; a hooked naked stigma; crenated smoothish roundish-cordate leaves; ovate obtuse sepals, the two lateral petals with a hairy line; the spur very blunt; the capsules turgid, hairy; the seeds turbinate, whitish; the stoles creeping, long, rooting. This plant is a native throughout the whole of Europe, and in Siberia and China. It is common in England, but is a rare plant in Scotland and Ireland. Wherever this plant grows its delicious scent has made it a great favourite.

V. hirta, the Hairy Violet, has no stem, the whole plant villous or pubescent. It is found throughout Europe, and is not uncommon in England, though rare in Scotland.

V. canina, Dog's Violet, has an herbaceous ascending channelled stem and cordate acute leaves. The flowers are blue and scentless. It is a native of Europe and America.

V. palustris, the Marsh Violet, has jointed scaly roots; a marginate stigma; smooth cordately kidney-shaped leaves; broad ovato-acuminate stipules. It is more abundant in Scotland than England.

V. lactea, Cream-Coloured Violet, has an ascending stem, with ovato-lanceolate glabrous leaves, dentate stipules, and acuminate bracts. It is a native of boggy heaths in Switzerland, France, and Britain. It is by some considered only a variety of *V. palustris*. *V. biflora* is a native of Europe and North America, and has a 2-flowered stem with small yellow flowers, the lip being streaked with black.

V. tricolor, Three-Coloured Violet, Heart's-Ease, or Pansy, has a somewhat fusiform root; diffuse branched stems; lower leaves ovato-cordate, deeply crenate; runcinately pinnatifid stipules, with the middle lobe crenated; spur thick, obtuse; nectaries linear. This plant is a native of cultivated fields and gardens throughout Europe, Siberia, and North America. The petals vary exceedingly in colour and size, and this tendency has been taken advantage of by the floriculturist for producing varieties of this flower, and there is no flower that has received more attention than the Pansy. [Pansy, in Arts and Sc. Div.]

V. lutea, Yellow Mountain-Violet, or Yellow Pansy, has a fibrous slender root; simple triangular stems; ovate oblong crenate fringed

leaves; lyrate subpalmato-pinnatifid leaflets. This plant is a native of moist mountainous pastures in Wales, the north of England, and Scotland. The other British species are *V. sylvatica* and *V. stagnina*.

In their geographical distribution the species of violet are materially influenced by climate. "The species from tropical countries," says Professor E. Forbes, "are mostly from localities where the influence of elevation has neutralised or modified the climatical influence. The various sections of the genus have geographic centres, as may be seen in the congregations of the allies of *V. hirta* in North America, and of those of *V. tricolor* in alpine Europe. North America may be looked upon as the capital of the whole genus, since we find there representatives of all its subdivisions. In the following table the distribution of 75 species, according to the form of their nectaries, is exhibited:—

Nectaries.	Europe.	Asia.	Africa.	America: North.	America: South.	Australia.	Total.
Lancet-Shaped .	19	4	1	22	1	1	48
Rotund . . .	2	0	0	1	0	1	4
Linear . .	12	4	1	6	0	0	23

VIOLA'CEÆ, *Violet-Worts*, a natural order of Exogenous Plants. It has the following essential characters:—Sepals 5, persistent, with an imbricate æstivation, usually elongated at the base. Petals 5, hypogynous, equal or unequal, usually withering, and with an obliquely convolute æstivation. Stamens 5, alternate, with the petals occasionally opposite them, inserted on a hypogynous disc, often unequal; anthers bilocular, bursting inwards, either separate or cohering, and lying close upon the ovary; filaments dilated, elongated beyond the anthers; two in the irregular flowers, generally furnished with an appendage or gland at their base. Ovary 1-celled, many-seeded, or rarely 1-seeded, with 3 parietal placentæ opposite the three outer sepals; style single, usually declinate, with an oblique hooded stigma. Capsule of 3 valves, bearing the placentæ in their axis. Seeds often with a tumour at their base; embryo straight, erect in the axis of fleshy albumen. (Lindley.) The species are herbs, undershrubs, or shrubs with alternate rarely opposite leaves, simple, usually involute before expansion, and all furnished with stipules. The flowers are erect or drooping, axillary, seated on peduncles, which are 1-flowered, solitary, or numerous, sometimes branched.

Violaceæ are related to *Polygalaceæ*, *Droseraceæ*, and *Passifloraceæ*. The order is divided into two tribes, *Violeæ* and *Alsodineæ*. The former chiefly inhabit Europe and America; the latter, with the exception of the genus *Pentaloba*, are natives of South America and Africa. This order embraces 11 genera and 300 species.

Viola pedata.

1, entire plant; 2, corolla and calyx of flower removed, to show the anthers and nectary; 3, stamen; 4, section of capsule; 5, section of seed, showing the embryo.

All the *Violaceæ* possess in a greater or less degree emetic properties, which reside principally in their roots; the principle on which this property seems to depend has been separated by Boullay from some species of *Viola*, and has been called Violina. *Viola odorata* is admitted into the Edinburgh and Dublin Pharmacopœias for the purpose of making a syrup of the flowers, which is used on account of its scent, and is administered to children as a laxative: it is also used as a test of acidity and alkalinity, being rendered green by alkalis and red by acids. [IONIDIUM; VIOLA.]

VIOLET. [VIOLA; VIOLACEÆ.]

VIPER. [VIPERIDÆ.]

VIPER'S BUGLOSS. [ECHIUM.]

VIPER'S GRASS. [SCORZONERA.]

VIPERIDÆ, a family of Snakes, which are thus characterised by Dr. J. E. Gray:—Face without any suborbital pit on the side; upper jaw toothless, with fangs in front; rostral shields broad, band-like; scales keeled (except in *Acanthophis*); tail short, tapering.

The following synopsis of the genera is given in the 'British Museum Catalogue:'—

I. Head depressed, rounded on the sides, covered with acutely-keeled scales.

a. Nostrils large, subsuperior, anterior, in the centre of a ring-like shield, edged with a large scale above. *Clothonina.*

1. *Daboia.*—Eyes convex, pupil round; head elongate; scales regularly keeled; nasal shield smooth in front. It is found in India.

2. *Clotho.*—Eyes convex, pupil oblong, erect; head short, broad, scales keeled, ending in a spine; nasal shield interrupted by a small shield in front. It is found in Africa.

b. Nostrils small, subanterior, sublateral. *Cerastina.*

3. *Cerastes.*—Subcaudal plates 2-rowed; nostrils lunate on the hinder part of a small nasal plate; eye-lid of males horned.

4. *Echis.*—Subcaudal plates 1-rowed; nostrils minute in suture of two small scales; the anterior frontal shields minute, smooth; pupil round.

II. Head more or less shielded; nostrils anterior, lateral.

a. Head flat-topped, high on the sides, shielded in front; nostrils in the middle of a shield; tail-end simple; subcaudal plates 2-rowed. *Viperina.*

5. *Vipera.*—Superciliary shield distinct; rest of the head covered with small smooth plates; nose more or less recurved.

6. *Pelias.*—Vertebral, occipital, and superciliary plates distinct; front of head with small shields; nose blunt.

b. Head ovate, rounded on the sides, crown entirely shielded; nostrils between two plates; tail-end simple; subcaudal plates 2-rowed. *Sepedonina.*

7. *Sepedon.*—Scales keeled; loreal shields none; one anterior and three posterior ocular shields; subcaudal shields 2-rowed.

c. Head depressed, shielded, prominent over the eyes; nostrils between two shields; tail ending in a recurved spine; subcaudal plates 1-rowed. *Acanthophina.*

8. *Acanthophis.*—Head-shield rather scale-like; loreal none.

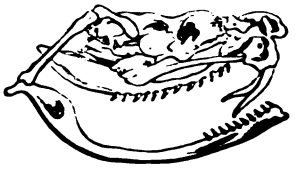
III. Head dilated, depressed, covered with acutely-keeled scales, rounded on the sides.

a. Nostrils large, subsuperior, anterior, in the centre of a ring-like shield, edged with a large scale above. *Clothonina.*

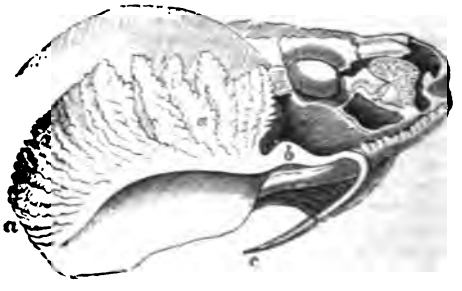
The family contains 9 genera and 20 species, of which 2 genera and 4 species are from Asia, 5 genera and 12 species from Africa, 2 genera and 3 species in Europe, and 1 genus and 1 species from Australia.

One of the most characteristic features of this group of animals is the possession of glands which secrete a poison with which they destroy their prey.

The machinery which enables the venom-snakes to inflict the wounds by which they kill is seen in the accompanying plates.



Skull of Rattlesnake: profile.



Tooth and poison-gland of *Trigonocephalus mutus*

a a, poison-gland; *b*, duct; *c*, fang: the letter indicates the position of the slit, from which the poison passes into the wound.

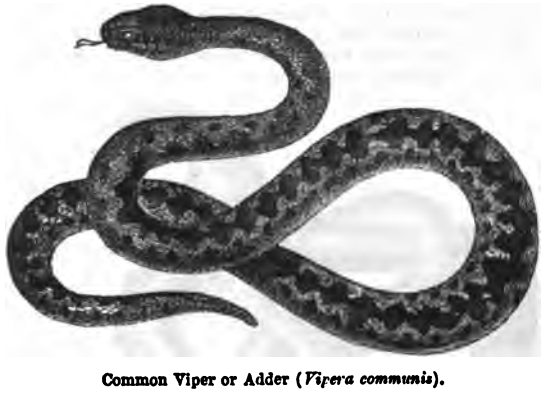
We now proceed to describe a few of the forms illustrative of this poisonous family.

Pelias Berus, Merr.; *Vipera*, Ray; *V. vulgaris*, Latr.; *V. communis*, Leach; the Common Viper.

"The head," says Mr. Bell, in his 'British Reptiles,' "is somewhat depressed, almost oval, slightly widening behind the eyes. Gape as long as the head, extending behind. No teeth in the upper maxillary bones excepting the poison-fangs; a row of small teeth in the palatine bone on each side. Neck rather smaller than the back of the head, from which the body increases to nearly the middle of the entire length; the rest of the body to the vent scarcely diminishing; the tail becoming almost abruptly smaller, and tapering to its extremity, which is pointed: the tail varies in proportion to the body, but is generally not more than one-eighth of the total length, and in some even less. The head is covered with small squamose plates, which in some specimens are regularly formed and symmetrically placed; but in others they are very irregular. There are three which are larger than the others, namely, the vertical and the pair of occipital plates. The scales of the back and sides are semioval or somewhat lanceolate, imbricated, and distinctly carinated. They are disposed in eighteen series. The plates of the abdomen have nothing particular in their form; they vary in number, but usually consist of about one hundred and forty to about one hundred and fifty, and those of the tail are about thirty-five pairs.

Head of the Viper. (Bell.)

"The general ground-colour varies considerably. In some it is nearly olive, in others a rich deep brown, and in others a dirty brownish-yellow; and when in high health, and shortly after having cast the skin, the surface is slightly iridescent in particular lights. A mark between the eyes, a spot on each side of the hinder part of the head, and a zigzag line running the whole length of the body and tail, formed by a series of confluent rhombs, as well as a row of small triangular spots on each side, all of a much darker hue than the ground-colour of the body, and frequently almost black. I have a specimen in my collection which I received alive from Hornsey Wood, the ground of which was almost perfectly white, and all the markings jet-black. The under parts are plumbeous in some, with lighter or darker spots; in others wholly black."



Common Viper or Adder (*Vipera communis*).

This is, not improbably, the Ἔχις of Aristotle and the Greeks, and the *Vipera* of Virgil ('Georg.,' iii. 417), Pliny ('Nat. Hist.,' viii. 39; x. 42; xi. 37) and the Romans. It is the Marasso of the Italians; Vipère of the French; Hugg-Orm of the Swedes; and Adder (anciently written Nedre, and later Eddre, with the loss of the initial *n*, from the Anglo-Saxon Nædre) of the country people in many parts of England and Scotland.

This reptile is found in Europe generally, from the north of Russia to the south of Italy and Spain; in England and Scotland, but not in Ireland.

From a very early period there appears to have been a notion that the female Viper, in order to take care of her young, swallows them. This is a question not easily answered, and it has been warmly disputed. There is no physiological reason against it. The young might live in such a situation for some time: it is well known that frogs will live and cry in the stomach of a serpent. But the evidence of the viper-catchers is strong against the fact, and we have never met with any one who could state that he had actually seen the young enter or issue from that retreat. It is not improbable that when female vipers in the last stage of pregnancy have been surprised, and on being opened have disclosed living young, the spectators, not aware of the extreme thinness of the membrane which incloses them, and which a very slight pressure will suffice to rupture, have leaped to the conclusion that the young had entered the mouth for protection.

When a viper is about to strike, it is generally more or less coiled, and elevates the head and neck, which are drawn backwards, the former in a horizontal position. The head is then suddenly darted at the object of attack, and the erected tooth plunged into it and withdrawn with a motion almost too quick for the eye to follow. Unless very much irritated the serpent will not immediately repeat the bite, as if conscious that time is required for the renewal of the poisonous secretion, so as to make it sufficiently virulent.

We are not aware of any well-authenticated case of a person bitten by a viper terminating fatally; but we would by no means insure a person so wounded in the heats of summer or autumn, especially if the wound be inflicted on a naked part, and if he be of a bad habit of body. The remedy used by viper-catchers is to rub olive-oil on the part wounded, over a chafing-dish of coals. They also take it internally. Some of them suffer themselves to be bitten by vipers full of 'sweltered venom,' confident in their remedy. Such cases will be found in the work of Dr. Mead, who proved the innocence of the poison when swallowed, by taking it himself without the slightest ill effect, an example not to be rashly followed, for any recent injury to the gums, or the skin of the mouth or throat generally, would render such an experiment extremely hazardous from the vascularity of the part. Great medical virtues have been attributed to vipers.

The lingering belief in the wonderfully invigorating qualities of 'viper broth' is not yet quite extinct in some places. Pliny, Galen, and others praise the efficacy of viper flesh in the cure of ulcers, elephantiasis, and other disorders arising from a corrupt state of the system. By the ancients the animal was generally served to the patient boiled like fish, as being more efficacious than when taken in the form of a powder or other dried state. Sir Kenelm Digby's beautiful wife was fed on capons fattened with the flesh of vipers.

Open copses, dry heaths, newly-cleared woodlands, and sandy wastes are the usual haunts of the viper, which, in winter, is frequently found in its hybernaculum, intertwined with several of its own species, and in an almost torpid state. These conglomerations may have given rise to the mode in which the celebrated Ovum Anguinum was produced. Pliny indeed ('Nat. Hist.,' xxix., c. 3) attributes its production to snakes convoluted together in the summer, and notices the statements of the Druids with regard to this mystic creation. Mason has not omitted to take advantage of this tradition in his 'Caractacus,' where the Druid sings—

> "From the grot of charms and spells,
> Where our matron sister dwells,
> Brennus, has thy holy hand
> Safely brought the Druid wand,
> And the potent adder-stone
> 'Gender'd 'fore the autumnal moon!
> When in undulating twine
> The foaming snakes prolific join."

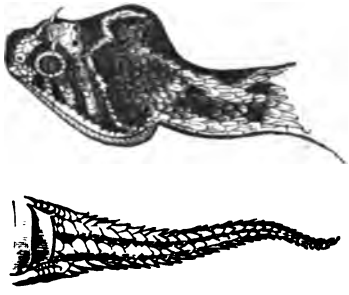
Our modern druidesses gives much the same account of the Ovum Anguinum, Glain Neidr, as the Welsh call it, or the Adder-Gem, as the Roman philosopher does, but seem not to have so exalted an opinion of its powers, using it only to assist children in cutting their teeth, or to cure the chin-cough, or to drive away an ague. These beads are made of glass, and of a very rich blue colour: some are plain, others streaked: we say nothing of the figure, as the annexed plate will convey a stronger idea of it than words.

Adder-Stones. (Pennant.)

Vipera (*Cerastes*) *caudalis*, Smith (*Vipera ocellata*, Smith), is a species described by Dr. Andrew Smith, and is found in South Africa.

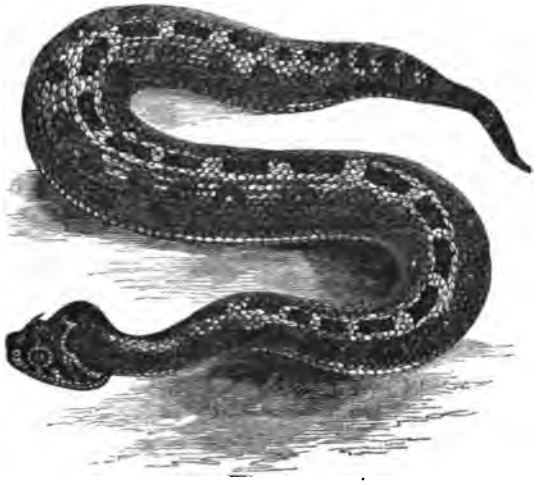
Dr. Smith says of this snake, that, though generally inactive, it is by no means so when injured: its movements are then performed with activity; and when once it seizes the obnoxious object, it retains its

hold with great determination, and some considerable exertion is often required to detach it.



Head and Tail (under side) of *Vipera* (*Cerastes*) *caudalis*. (Smith.)

The head is distinct; the body thick in proportion to its length; the tail short, tapered, and pointed. Angles of the jaws very divergent, giving greater width to the hinder part of the head, the anterior portion of which is narrower. Nose rounded; nostrils near its apex, each in the centre of a thick projecting scale. Eyebrows arched, each armed near its middle with a slender pointed slightly-recurved spine, about a line or a line and a quarter in length. Scales of anterior part of the head, particularly round the eyes, very small; those between and immediately behind the nostrils imperfectly carinated; on the hinder part of the head they are oval, as on the body, and distinctly carinated. On the back and sides they are arranged in longitudinal rows; and from the points of each row overlapping the base of those immediately behind them, the carinations form continuous ridges, about twenty-seven in number generally.



Vipera (*Cerastes*) *caudalis*. (Smith.)

Echidna inornata (Smith) is another African species.

Back and sides dark yellowish-brown; belly brownish-yellow, sparingly sprinkled with brownish dots; tail above, indistinctly marked with dull brown spots or bars. Head oblong, heart-shaped. Length 13¼ inches. (Smith.)

Echidna inornata. (Smith.)

Dr. Smith notices the fact that the Vipers and one or two species of *Elaps* are the only snakes of South Africa which permit themselves generally to be closely approached without evincing any apparent concern. The others manifest a disposition to act on the offensive

or to fly: even an unusual noise, without its cause being visible, is sufficient, he remarks, to insure the retreat of the innocuous ones.

The different species of *Naia* and the *Elaps lubricus* (Merr.) are, he observes, always ready for the fight; and when their haunts are invaded they often advance upon the intruder with the head and anterior part of the body almost perpendicular, the neck expanded, and an expression sufficiently indicative of the malignant purpose they have in view. "To witness such a proceeding," says Dr. Smith in continuation, "once fell to my own lot. Walking in the vicinity of Graham's Town, I happened to excite the attention of a *Naia Hæmachates*, which immediately raised its head, and warned me of my danger by the strength of its expiration; it then commenced an advance, and, had I not retired, I should in all probability have suffered, provided I had not been fortunate enough to disable it, which possibly would not have happened, considering that the species, in common with others of the same genus, is extremely active. Even though I retired I was not satisfied the danger was past, as the flight of this snake's enemy does not always put a stop to its advance when once commenced."

Dr. Smith figures three varieties of *Naia Haje* in his 'Zoology of South Africa' and the young state of the serpent, with the synonyms *Echidna flava*, Merr., *Naia nigra*, Smith, Geel Copell, Bruin Copell and Spuugh-Slang of the Cape Colonists.

Naia Haje (young). (Smith.)

Dr. Smith remarks that if this reptile be specifically different from *Naia Haje* of Northern Africa, he had not, after closely comparing them, been able to discover the differences which, in his opinion, could justify him in regarding them as distinct.

Spuugh-Slang (*Naia Haje*).

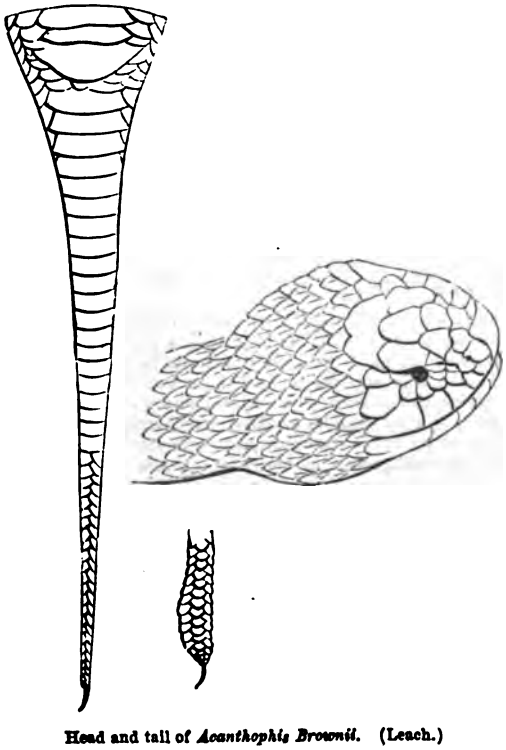
Colour uniform livid blackish-brown, the livid tinge strongest on the under parts, forming almost a purplish slate-colour, which is very dark and shining towards the head. (Smith.)

The variety most rarely met with, according to Dr. Smith, is the Spuugh-Slang (Spitting-Snake) of the colonists, so named from its

supposed power of ejecting its poison to a distance. All the Cobra-di-Capellas of Southern Africa, he remarks, distil poison from the points of their fangs when they are much irritated, and are able to eject a portion of it beyond the mouth by a forcible expiration; but that any power greater than that is possessed by the Spuugh-Slang, Dr. Smith is not disposed to believe: the contrary nevertheless is, he allows, strongly maintained both by the European and native inhabitants.

Acanthophis tortor, Less. *A. Brownii*, Leach; *A. antarctica*, Wagler; is a native of Australia, where it was first noticed by Mr. Robert Brown, the celebrated botanist. The colonists call it the Death Adder and the Black Snake.

Acanthophis tortor, Less. (*Acanthophis Brownii*, Leach ?).
a, head. (Lesson.)



Head and tail of *Acanthophis Brownii*. (Leach.)

M. Lesson states that this snake is very much diffused in Australia where the colonists dread it much in consequence of the mortal wounds which it inflicts. Its bite, he says, has often killed convicts in less than a quarter of an hour, if the reports of the inhabitants may be credited. It is, he adds, very common in the small woods and sandy heaths which surround Botany Bay, where M. Lesson states that he has often seen it in his excursions

VIPERINA. [VIPERIDÆ.]

VIREONI'NÆ. [MUSCICAPIDÆ.]

VIRGI'LIA, a genus of Plants belonging to the natural order *Leguminosæ*, named after Virgil the Roman poet.

VIRGIN'S BOWER. [CLEMATIS.]

VIRGINIAN SNAKE ROOT. [POLYGALA.]

VI'ROLA SEBI'FERA, a large tree of Guyana, which belongs properly to the genus *Myristica*, and is in fact by some called Nutmeg of Cayenne, and has the same properties as many of the other species of that genus. When incisions are made into the bark, a reddish glutinous juice exudes, which, when fresh, is used as a caustic, and which concentrates in time. The mace is of a red colour, and within it the kernel is of a whitish colour, which, when powdered and put into boiling water, yields a yellowish-coloured fatty substance which swims on the surface; it is caustic in taste, and has a slight odour of nutmeg. In the country candles are made of it; hence Europeans call the tree Porte Suif.

VISCUM, a genus of Parasitical Plants belonging to the natural order *Loranthaceæ*, of which one species is found wild in this country. *V. album*, the Mistletoe, is in many respects a production of great interest to the physiologist. The seeds in germination seem to offer an exception to a general law, that the radicle of the embryo shoots downwards, and the plumule upwards; for it is found that the radicle of the Mistletoe invariably turns itself down upon the body to which it is attached, whatever may be the position of the surface of that body with respect to the earth. For instance, if a cannon ball, to which mistletoe-seeds are glued on all sides, be suspended by a cord some distance from the earth, both the upper and under seeds, as well as those at the sides, all direct their radicle to the surface of the ball. This property ensures their growing upon the branches of trees, to whatever side they may happen to stick.

In fixing itself upon a branch, the embryo of the Mistletoe curves its radicle down upon the bark, and then adheres firmly to it, and it is a twelvemonth before the plumule begins to extend; this may be to give the radicle time to pierce the bark and introduce itself below the liber, where it expands and acts the part of a root by attracting thence the fluids which are necessary for the support of the parasite.

It is not a little remarkable that in the structure of its ovary this plant, and others of its order, should offer the singular fact of the ovule not existing at the time of impregnation, nor appearing till from six weeks to two months later.

The fruit, which is covered with a viscid pulp, is made by the Italians, and even in Herefordshire, into a kind of birdlime; and as it is a favourite food of the large or Missel Thrush, it is thought to have given rise to the proverb, 'Turdus malum sibi cacat.'

The plant is not of any known use to man, and is of popular interest chiefly as having been connected with Druidical superstitions. The Mistletoe of the Druids was exclusively that found upon the oak, and was possibly so much valued because of its rarity; for its appearance on that tree is now so rare, that many persons have believed the Mistletoe of the Druids either to have been some other plant or to have had no real existence.

(Loudon, *Arboretum Britannicum*, vol. ii.)

VISION. [EYE.]

VISMIA (in honour of M. de Visme, a Lisbon merchant), a genus of Plants belonging to the natural order *Hypericaceæ*. The calyx is 5-parted, the petals 5, usually villous on the inside.

V. Guianensis is a small tree with a stem about 8 feet high, the leaves ovate, lanceolate-acuminate, dilated at the base, rufous beneath, smooth above, filled with transparent dots. The bark when wounded yields a gum-resin, which when dry becomes hard, and resembles gamboge. The leaves and fruit likewise yield a similar secretion. It is used in medicine as a purgative, in doses of from 7 to 8 grains.

VITA'CEÆ, or VINI'FERÆ, *Vineworts*, a natural order of Plants belonging to Lindley's albuminous group of Polypetalous Exogens. The species of this order are composed of sarmentose and climbing shrubs, and hence the order is sometimes called *Sarmentaceæ*, of which the Grape-Vine is the type. Kunth has named the whole order *Ampelideæ*, from ἄμπελος, the vine. Jussieu, in the first edition of the 'Genera Plantarum,' called this order Vites. The calyx is small, with an entire or toothed margin; the petals 4 or 5, inserted on the outside of the disc, turned inwards at the edge in æstivation in a somewhat valvate manner, and the apex often inflexed; the stamens are equal in number to the petals, and placed opposite them, sometimes sterile by abortion; the filaments are distinct, or slightly cohering at the base; the anthers ovate and versatile; the ovary is superior, 2-celled; the style single, very short; the stigma simple; the ovules definite and erect; the fruit a globose berry; the peduncles are racemose, thyrsoid, corymbose, cymose or umbellate, opposite the leaves, and are sometimes changed into tendrils.

This order has acid properties, in common with *Grossulaceæ* and *Berberaceæ*. It has also affinities with *Umbelliferæ* and *Geraniaceæ*.

This order includes 6 genera, which for the most part inhabit the warmer parts of the northern temperate zone, and are found in both the Old and New worlds. Most of them are natives of Asia, one of Australia, and none in Europe. The most characteristic property of this order is acidity, which is most fully developed in the Grape-Vine. [VITIS.] Some of the species of *Cissus* are used in medicine.

VITALITY, a term equivalent to that of Life, and applied to the functions performed by living bodies, that is, plants and animals. Linnæus defined the three kingdoms of nature as follows:—Minerals grow; Plants grow and live; Animals grow, live, and feel. Here the fact of living is made to distinguish between minerals and plants, and the inquiry is naturally made for a definition of life. It is often assumed to be a set of actions under the controlling influence of a vital principle, but, as such a principle has never been demonstrated, it must be regarded only as an assumed cause. Some writers have supposed that all the phenomena of life may be resolved into the action of chemical and physical forces acting upon special forms of matter, and that in plants and animals are presented the results of chemical and physical activity in forms in which it does not exist amongst minerals. Coleridge, in his 'Idea of Life,' contends that the collective activities of the material universe is as much a life, and its parts as much entitled to be regarded as living, as a plant in its special organs.

Setting aside however the idea of a vital principle, or confining this term to the force which regulates and produces the specific form in each individual animal or plant, and which is then applicable as well to minerals, there are a certain set of phenomena in plants and animals to which the term 'vital' seems especially applicable. This term may be thus applied without in any manner assuming the existence of any force independent of those which are known to influence all matter upon the surface of the earth.

Thus, the growth and reproduction of cells may be regarded as a vital process; also the contractibility of the muscular tissue, and the sensibility of the nervous tissue. These processes are called collectively Vital Processes. The force by which cells grow has been called the Organising Force, the Plastic Force, the Assimilative Property, and the Metabolic Property. The contractibility of the muscles has been properly called Muscle-Force, whilst the sensibility of the nerves has been called Nerve-Force.

That these forces are dependent on physical forces is seen in the fact that plant-cells will not grow without light. Muscle-force and nerve-force are not producible but by the assimilation of materials that have been formed by chemical actions produced by heat and light.

The natural philosopher has demonstrated that electricity, galvanism, and magnetism, are different manifestations of the same force. He has rendered it probable that motion, heat, light, and chemical affinity, are also convertible forces. The physiologist has followed this train of thought, and rendered it probable that, with regard to muscle-force and nerve-force, they are but differentiations or other manifestations of the physical forces. Muscle-force and nerve-force depend upon the destruction (chemical change) of cells which are formed out of materials (protein) which have been formed by the influence of heat and light upon the carbonic acid and ammonia supplied to the cell of the plant. A certain amount of protein is the expression of a certain amount of chemical change, and this again in decomposition is the expression of the amount of vital force, which a part composed of protein will exhibit. Vital phenomena are found to be but the expressions of chemical and physical change, and result in one or other of the physical forces. This view of the nature of vitality does not lead to materialism, as the consciousness of man exists independently of the physical changes which go on in his body, and the character of his mind is formed in virtue of its retaining impressions from the ever-active changes which go on in his body through the agency of the vital forces. [Muscle; Nervous System; Animal Kingdom; Motions of Plants; Vegetable Kingdom; Cells.]

(Matteucci, *Electro-Physiological Researches*, in *Philosophical Transactions;* Matteucci, *On the Physical Phenomena of Living Beings;* Grove, *On the Correlation of the Physical Forces;* Reynolds, *Objects and Scientific Position of Physiology; British and Foreign Medical Review*, vol. xxx.)

VITEX, a genus of Plants belonging to the natural order *Verbenaceæ*. It has a short campanulate 5-toothed calyx. The corolla is irregular, somewhat labiate, divided into 5 lobes. Stamens 4, didynamous, inserted into the corolla. Ovary superior, roundish; style the length of the stamens; 2-pointed and diverging stigmas. The fruit is a globular berry, a little hard, with its base covered by the calyx, and divided into four single-seeded cells.

V. agnus-castus, the longest-known species, and a native of the south of Europe, has digitate leaves of 5 or 7 nearly entire leaflets, something resembling those of the hemp-plant, and it forms a shrub of about 12 feet in height. The flowers are arranged in spiked whorls, and have an agreeable fragrance. The fruit is globular, rather smaller than black pepper, with an acrid and aromatic taste, whence it is called Petit Poivre and Poivre Sauvage in the south of France. It was well known to the ancients, and forms the *Piper agrestis* of some authors. In India the fruits of the species *V. trifylla* and *V. Negundo*, which are indigenous there, have the same properties ascribed to them, and are called Filfil Burree (Wild Pepper). The ancients considered the *Vitex* anti-aphrodisiac, but the berries, from their warm aromatic taste, must be possessed rather of stimulant properties.

VITIS, a genus of Plants, the type of the natural order *Vitaceæ*. It possesses the following characters:— Calyx usually 5-toothed; petals 5, cohering at the top, resembling a calyptra, separating at the base and deciduous; 5 stamens; style none; berry 2-celled, 4-seeded; cells and seeds often abortive. The species are climbing shrubs, with simple lobed, cut or tootned, rarely compound leaves, the thyrsoid racemes of small greenish-yellow flowers. They are found principally in Asia and America.

The best known of the species of *Vitis*, and perhaps one of the most extensively cultivated and useful of plants, is the *V. vinifera*, the Common Vine or Grape-Vine. It is characterised among the other species by possessing lobed, sinuately-toothed, naked or downy leaves. A multitude of varieties of this plant have been recorded, both occurring wild and resulting from its very extensive cultivation.

Grape-Vine (*Vitis vinifera*).

1, cutting, with a bunch of fruit; 2, inflorescence; 3, transverse section of berry in young state; 4, veritcal section of the same; 5, section of ripe fruit; 6, section of seed, showing embryo.

Like most extensively cultivated plants, it is very difficult to ascertain of what country the vine is originally a native. It is among the plants of which we have the earliest records in the Books of Moses, and from which it appears to have been made use of in the same manner as at the present day. Although the vine is found in many places wild, it may still be doubted whether it is indigenous there, on account of its frequent cultivation. There can be little doubt of its being truly indigenous in the East, in the district between the Black and Caspian seas. In the forests of Mingrelia and Imiretia it flourishes in all its magnificence, climbing to the tops of the highest trees, and bearing bunches of fruit of delicious flavour. In these districts no cultivation of the vine exists, and the inhabitants seldom harvest the abundance of fruit that is produced. [Vine, in Arts and Sc. Div.]

In many spots in France, Germany, Portugal, and Italy, the vine is found wild, but the fruit is very generally of an inferior kind, and it may be doubted whether it is truly indigenous in any parts of Europe.

The cultivation of the vine extends from near 55° N. lat. to the equator, but in south latitudes it only extends as far south as 40°. It is cultivated at various elevations. In middle Germany it ceases from about 1000 to 1500 feet above the level of the sea. On the south side of the Alps it reaches 2000 feet; in the Apennines and Sicily 5000 feet; and on the Himalayas as high as 10,000 feet above the level of the sea. The point of the greatest importance in the ripening of the fruit of the vine is the length of the summer. Thus, although the maximum of summer heat is as great at Moscow as in Paris, yet the vine will not ripen its fruit in the former place, and this arises from the fact that although the greatest heat of the months of June and July are as great as that of Paris, the months of August and

September are several degrees below. Nor will the mean temperature serve as a rule to indicate where the vine may be cultivated. England has a mean temperature as high as many parts of the world, where the vine flouishes in the greatest perfection; but it will be found that although England is warmer than these countries in the winter, it is not so warm in the months of September and October, at which time the vine is ripening its fruit.

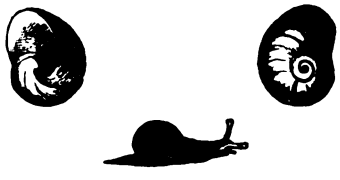
The fruit of the vine is used as an article of diet in several ways. Its agreeable sweet acid flavour when ripe has always rendered it a very desirable food when fresh. The ancients also, there can be little doubt, were in the habit of drinking the expressed juice of the grape before fermentation. Grapes are also dried and used under the name of raisins. The drying is generally effected by cutting half through the fruit-stalk whilst they are suspended on the tree. Grapes thus dried are called Muscatel raisins, and are principally brought from Spain and the Levant. There is another dried grape used much in this country, called currants, or Corinths, but which are very different things from the common currant of our gardens, and are the produce of a vine which grows in Zante and Cephalonia. [WINE, in ARTS AND SC. DIV.]

Some of the species of *Vitis* have been introduced into our shrubberies and gardens as ornamental climbers.

VITREOUS HUMOUR. [EYE.]

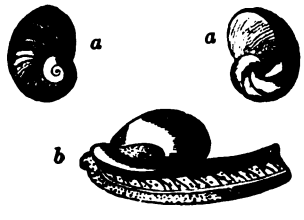
VITRI'NA, Draparnaud's name for a genus of *Helicidæ*.

M. De Ferussac has divided the genus into the genera *Helicolimax* and *Helicarion*. The last-named sub-genus consists of exotic species, which seemed to him to approximate more nearly to *Parmacella*. We subjoin illustrations to these two genera. [HELICIDÆ; LIMAX.]



Helicolimax pellucida.

Shell magnified. Animal natural size.



a, Shell of *Helicarion Cuvieri*; *b*, *Helicarion Freycinetti*.

VITRIOL, BLUE. [COPPER.]

VITRIOL, GREEN. [IRON; MELANTERITE.]

VITRIOL, WHITE. [ZINC.]

VITTÆ, in Botany, a term most frequently applied to the receptacles of oil which are found in the fruits of Umbelliferous plants. [UMBELLIFERÆ.]

VIVERRA. [VIVERRIDÆ.]

VIVE'RRIDÆ, a family of Carnivorous Animals, embracing the genus *Viverra* of Linnæus. This author thus defines his genus *Viverra*:—Dentes primores vi: intermediis brevioribus. Molares plus quam tres. Lingua retrorsum, sæpe aculeata. Ungues exserti.

The species comprised under this genus, in the twelfth edition of the 'Systema Naturæ,' are *Viverra ichneumon*, *V. nasua*, *V. narica*, *V. putorius*, *V. Zibetha*, and *V. Genetta*.

Linnæus places the genus between *Felis* and *Mustela*.

The Civettes (*Viverra*) of Cuvier are arranged, in his last edition of the 'Règne Animal,' between the Dogs (*Canis*) and the Hyænas, which are immediately followed by the Cats.

The Civets are subdivided into, 1, the Civets, properly so called (*Viverra*, Cuv.); 2, the Genets (*Genetta*, Cuv.); 3, the Paradoxure (*Paradoxurus*, F. Cuv.); 4, the Mangoustes (*Herpestes*, Ill.); 5, the Suricates (*Ryzæna*, Ill.); and, 6, the Mangues (*Crossarchus*, F. Cuv.).

Cuvier says of this group that the genera composing it have three false molars above, and four below, the anterior of which sometimes fall out; two rather large tuberculous teeth above, a single one below, and two projecting tubercles on the inside of their lower canine anteriorly, the rest of that tooth being more or less tuberculous. Their tongue he describes as beset with sharp and rough papillæ; their claws are raised more or less in walking; and there is near their anus a more or less deep pouch, where particular glands secrete an unctuous and often odoriferous substance.

The *Viverrina*, Dr. J. E. Gray's third family of *Felidæ*, is the first of his second subdivision of that family, namely, *Necrophaga*.

The *Viverrina* comprise the following genera:—*Viverra*, *Proteles*, *Prionodon*, *Genetta*, *Galidia*, *Galictis*, *Herpestes*, *Mungos*, *Atilax*, *Ichneumia*, *Uva*, *Crossarchus*, *Ryzæna*, *Hemigale*, *Paradoxurus*, *Paguma*, *Arctictis*, *Cynogale*, *Cryptoprocta*, and *Bassaris*.

Viverra (Cuv.).—The deep pouch situated between the anus and the sexual organs, is divided into two bags filled with an abundant concretion of the consistence of pomade, exhaling a strong musky odour, secreted by glands which surround the pouch. Pupil of the eye round during the day. Claws only half retractile. Dental Formula:—

$$\text{Incisors, } \frac{6}{6}\text{; Canines, } \frac{1—1}{1—1}\text{; Molars, } \frac{6—6}{4—4} = 36.$$

V. Civetta, the Civet. Length of the elongated body from two to three feet; tail about half as long as the body. Height from ten inches to a foot. Hair of the body long, brownish-gray, with numerous interrupted transverse black bands or spots of the same colour. The hairs on the ridge or middle line of the back from between the shoulders are longer, and can be raised or depressed at the pleasure of the animal. Legs and most part of tail black; upper lip and sides of the neck almost white. Eyes surrounded each by a black patch. Two or three black bands pass from the base of the ears obliquely towards the shoulder and neck, which last has a broad black patch. It is a native of the north of Africa.

The Civet approaches in its habits nearest to the Foxes and smaller Cats, preferring to make its predatory excursions against birds and smaller quadrupeds in the night, although, like these *Carnivora*, it will occasionally attack its prey in the daytime.

In a state of captivity it becomes in a degree tame, but never familiar, and is dangerous to handle. The young are fed on farinaceous food, millet-pap for instance, with a little flesh or fish; and, when old, on raw flesh. Many of them are kept in North Africa to obtain the perfume which bears the name of the animal, and brings a high price. The civet is procured by scraping the inside of the pouch with an iron spatula at intervals about twice a week. If the animal is in good condition and a male, especially if he has been irritated, a dram or thereabouts is obtained each time. The quantity collected from the female does not equal that secreted by the male. Civet, like most other articles of this nature, is much adulterated, and it is rare to get it quite pure. The adulteration is effected with suet or oil to make it heavier.

Civet (*Viverra Civetta*).

V. Rasse is a species found in Java. Dr. Horsfield says "It supplies in Java the place which the *V. Civetta* holds in Africa, and the *V. Zibetha* on the Asiatic continent from Arabia to Malabar, and in the large islands of the Indian Archipelago. I have endeavoured to show that, by its form and marks, it is essentially distinct from the *V. Zibetha*; and it differs as much in its natural disposition as in external characters. The *V. Zibetha* is an animal comparatively of a mild disposition; it is often found among the Arabs and Malays who inhabit the maritime parts of Borneo, Macassar, and other islands, in a state of partial domestication; and, by the account of the natives, becomes reconciled to its confinement, and in habits and degree of tameness resembles the common domestic cat. The Rasse, on the contrary, preserves in confinement the natural ferocity of its disposition undiminished. As the perfume is greatly valued by the natives, it is frequently kept in cages; but, as far as I have observed, must always be obtained for this purpose from a wild state, never propagating in a state of confinement.

"The Rasse is not unfrequently found in Java, in forests of a moderate elevation above the level of the ocean. Here it preys on small birds and animals of every description. It possesses the sanguinary appetite of animals of this family in a high degree, and the structure of its teeth corresponds strictly with the habits and modes of life. In confinement it will devour a mixed diet, and is fed on eggs, fish, flesh, and rice. Salt is reported by the natives to be a poison to it. The odoriferous substance is collected periodically: the animal is placed in a narrow cage, in which the head and anterior extremities are confined; the posterior parts are then easily secured, while the civet is removed by a simple spatula."

The substance obtained from the Rasse agrees with the civet afforded by the *V. Civetta* and *V. Zibetha* in colour, consistence, and odour. It is a very favourite perfume among the Javanese, and applied

both to their dresses and, by means of various unguents and mixtures of flowers, to their persons. Even the apartments and the furniture of the natives of rank are generally scented with it to such a degree as to be offensive to Europeans; and at their feasts and public processions the air is widely filled with this odour. ('Zoological Researches.')

Rasse (*Viverra Rasse*). (Horsfield.)

Genetta, Cuv.—Odoriferous pouches reduced to a slight depression formed by the projection of the glands, and without any perceptible excretion, although the odour is manifest. The pupil has a vertical slit, and the claws are entirely retractile, as in the Cats.

G. vulgaris, the Common Genet (*Viverra Genetta*, Linn.), is gray, spotted with small black or brown patches, which are sometimes round and sometimes oblong; the tail, which is as long as the body, is ringed with black and white, the black rings being to the number of nine or eleven. There are white spots on the eyebrow, the cheek, and on each side of the end of the nose. It is found from the south of France to the Cape of Good Hope, and Cuvier says that it differs in the size and number of the patches, the bands along the shoulder and neck, the lines on the nape, &c.

The Genet loves lowlands, particularly the banks of rivers and the neighbourhood of springs. In Constantinople it is domesticated, and kept in the houses, where it is said to catch mice as well as a cat.

Common Genet (*Genetta vulgaris*).

Paradoxurus (F. Cuv.).—Has the character generally of the Civets and Genets. Tail capable of being rolled from above downwards to its base, but not prehensile. Toes five, nearly palmated; sole of the foot tuberculous, applied throughout its surface to the ground; claws semi-retractile. Eyes with the pupil slit longitudinally. No pouch.

Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6}=40$.

P. typus, the Paradoxure. It was confounded by Buffon with the Common Genet, a confusion which M. F. Cuvier dissipated; in form and habits, indeed, it does not differ much, and the toes and claws closely agree in number and retractility. The secretory pouch is absent. The tail is very peculiar: as long as the body, and depressed, not to say flattened, above and below; the extreme or more distant half is, when extended, turned over, so that the lower side is uppermost, and the animal can roll it up spirally from above, downwards and from the extremity to the base.

Paradoxure (*Paradoxurus typus*). (F. Cuvier.)

Mangusta, Olivier. [ICHNEUMON.]

M. Javanica, has the ear bearing considerable resemblance to that of man. Pouch very extensive. Hair long on the body and tail, but short on the head and extremities, rigid and glossy. Length, including the tail, about 2½ feet.

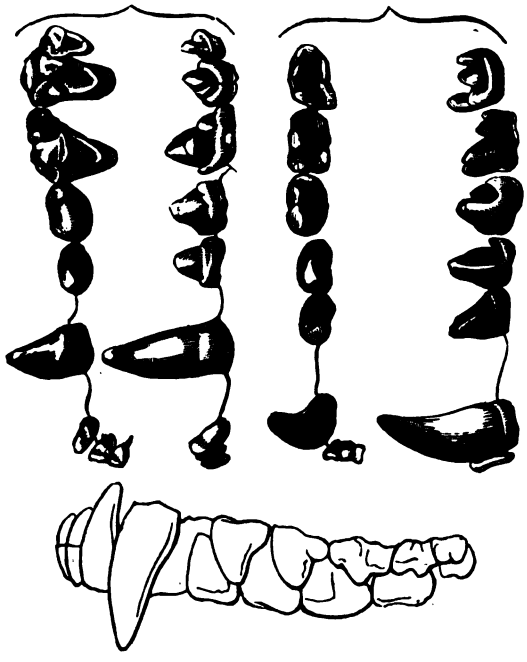
Rumphius gives a curious account of this species, which is the Garangan of the natives, who greatly admire its agility. It attacks and kills serpents with the greatest boldness; and Rumphius speaks of its value in performing this service and its method of encountering those reptiles. The Javanese nobles, he says, pay a considerable price for it, that they may amuse themselves with the sport of these fights. When the two enemies are opposed to each other, the serpent endeavours to twine round the quadruped and kill it. The latter submits to this, but inflates itself to turgescence; and when the serpent enfolds it and advances its head to give the deadly bite, the Mangouste contracts his body, slips out of the folds, seizes the serpent by the neck and kills it.

Garangan (*Mangusta Javanica*). (Horsfield.)

Dr. Horsfield states that the *Mangusta Javanica* is found most abundant in the large teak-forests, and that it is very expert in burrowing in the ground in pursuit of rats. "It possesses," says our author in continuation, "great natural sagacity; and from the peculiarities of its character, it willingly seeks the protection of man. It is readily tamed, and in a domestic state it is docile and attached to its master, whom it follows like a dog; it is fond of caresses, and frequently places itself erect on its hind legs, regarding everything that passes with great attention. It is of a very restless disposition, and always carries its food to the most retired place in which it is kept to consume it. It is very cleanly in its habits. It is exclusively carnivorous, and very destructive to poultry, employing great artifice in the surprising of chickens. For this reason it is rarely found in a domestic state among the natives, as one of their principal articles of food is the common fowl, and great quantities are reared in all the villages. The Javanese also, like the Mohammedans in general, have a great partiality for cats, and they are unwilling in most cases to be deprived of their society for the purpose of introducing the Garangan. It has also been observed that its sanguinary character shows itself occasionally in a manner that renders it dangerous in a family as a domestic animal, and it indulges at intervals in fits of excessive violence."

Ryzæna, Ill.—Feet rather long; toes four, armed with robust but not retractile claws proper for burrowing. Tongue furnished with horny papillæ. Ears small. Pouch leading into the anus. Tail long, slender, and pointed.

Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{5-5}{5-5}$=36.



Teeth of *Ryzæna*. (F. Cuvier.)

This genus resembles the Ichneumons in the tinting and stripes of the coat; but the legs are longer, and there are only four toes on each foot. The dentition too differs, for they are without the small molar immediately behind the canine.

R. Capensis, the Suricate, is about four feet long, including the tail. Fur a mixture of brown, white, yellowish, and black. The colour of the hair is brown at the bottom, black near the tips, and hoary at the points; those on the back undulated; inside of the legs yellowish-brown; tail tufted with black. It is found in Africa, and the Cape of Good Hope.

At the Cape, Pennant states that this species is called Meer-Rat. In habits and manner it is said to resemble the Mangoustes, and its urine is very fetid. It feeds on flesh, preys on mice, and is a great enemy to *Blattæ*.

Suricate (*Ryzæna Capensis*).

Crossarchus, F. Cuv.—Head more rounded than that of the Ichneumons, and the muzzle larger. The pupil round. The muzzle moveable. The ears small, round, and bilobate. The tongue smooth on its edges, but papillose and horny at the centre. The tail flattened. Five toes on each foot. Pouch secreting an unctuous fetid matter.

C. obscurus is nearly two feet long, including the tail, which is about eight inches. Fur consisting of two kinds of hair; the external rather

harsh and of a uniform brown, a little brighter on the head, cheeks pale. It is a native of the coast of Africa and Sierra-Leone. It feeds on flesh, and is cleanly and well-behaved in confinement.

Crossarchus obscurus.

Cryptoprocta, Bennett.—This genus approaches more nearly than most of the other forms of this family to the *Felidæ*, having the claws on both feet truly retractile, and furnished with the retractile ligaments; those of the anterior limbs being also acute, both at their points and edges.

Body slender, limbs robust and of moderate length; head narrow and slightly elongated; glandular muzzle small; nostrils with a deep lateral sinus; whiskers numerous and stiff, the longest exceeding the head in length; eyes rather small, placed above the angle of the mouth, the opening of which is not much prolonged backwards; ears unusually large, rounded, with a fold on the posterior margin and one or two sinuosities within, hairy both within and without, except in the auditory passage; neck slender; anterior limbs somewhat shorter than the posterior; tail (which appeared to be mutilated at the extremity) as long as the body, reaching, when retroverted, to between the ears, cylindrical, and uniformly hairy; soles of anterior feet naked to the whole extent of the carpus; of the posterior, nearly to the heel: claws retractile, five on each foot; on the anterior, sharp-pointed and edged, compressed, curved, short, and cat-like; on the posterior, rather larger, compressed, less curved, and obtuse. The toes united nearly to the tips; on the fore feet the middle the longest; those on each side scarcely shorter and nearly equal to each other; innermost and outermost also nearly equal to each other, but still shorter than the adjoining ones: on the posterior feet, third and fourth toes nearly equal and rather longer than the second and fifth; thumb considerably shorter.

C. ferox is a native of Madagascar.

Cryptoprocta ferox.

Nasua, Storr.—Feet pentadactyle, furnished with sharp claws. Tail long, pointed, not prehensile. Nose very much elongated, and very moveable. No anal follicles. Six ventral teats.

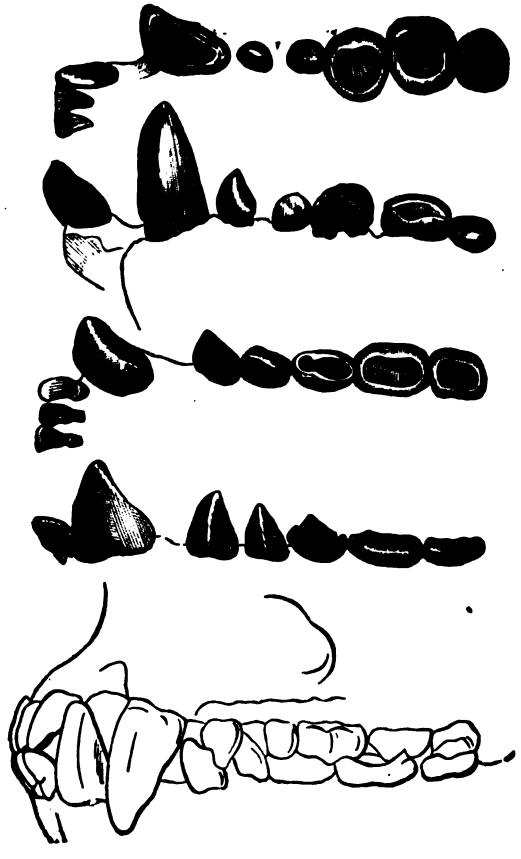
Dental Formula:—Incisors, $\frac{6}{6}$; Canines, $\frac{1-1}{1-1}$; Molars, $\frac{6-6}{6-6}$=40.

N. narica, the Brown Coati Mondi. It is a native of America.

Brown Coati (*Nasua narica*).

Cercoleptes caudivolvus, the Potto, or Kinkajou, is referred by some writers to *Ursidæ*, but by others to the *Viverridæ*. It has the following dental formula:—

$$\text{Incisors, } \frac{6}{6}\text{; Canines, } \frac{1-1}{1-1}\text{; Molars, } \frac{5-5}{5-5} = 36.$$



Teeth of Potto or Kinkajou, twice the natural size. (F. Cuvier.)

Specimens of this animal are to be seen alive in the gardens of the Zoological Society, Regent's Park.

Potto or Kinkajou (*Cercoleptes caudivolvus*). (F. Cuvier.)

VIVIANACEÆ, *Vivianads*, a natural order of Exogenous Plants with free stamens, no disc, albuminous seeds, a curved embryo, permanent petals, and a ribbed calyx. The species are herbaceous or half-shrubby plants, with opposite or whorled leaves, without stipules. They are related to *Tiliaceæ* and *Tropæolaceæ*. All the species inhabit Chili and South Brazil. There are four genera and fifteen species.

(Lindley, *Vegetable Kingdom*.)

VIVIANITE. [Iron.]

VIZCACHA. [Chinchillidæ.]

VOANDZEIA, a Plant belonging to the natural order *Leguminosæ*. It was formerly called *Glycine subterranea*. It is allied to *Arachis hypogæa*, or the Earth-Nut of the coast of Africa and of Asia. The only species of the genus is *V. subterranea*, which is so called in consequence of its peduncles bending down and sinking into the ground, where the pods ripen.

VOCHYA'CEÆ, or VOCHYSIA'CEÆ, *Vochyads*, a natural order of Exogenous Plants. The species belonging to this order are trees, with opposite branches, which, when young, are 4-cornered. The leaves are entire, mostly opposite, sometimes towards the extremities of the branches they are alternate, and are supplied with two stipules at their base. The flowers are symmetrical and partially complete, the calyx is imbricated, ovules ascending, and stigmas single. The affinities of this order are with *Sapindaceæ*, *Staphyleaceæ*, and *Celastraceæ*.

There are about 40 species of this family altogether; they are all natives of equinoctial America, where they are found inhabiting ancient forests, the banks of streams, and sometimes the sides of mountains to a very considerable elevation. None of these trees are remarkable for their beauty or for their uses, but the striking irregularity of the structure of their flowers renders them objects of great interest to the botanist.

VOICE. [Larynx.]

VOLATILE-OILS. [Oils.]

VOLBORTHITE, Vanadiate of Copper, is a Mineral occurring in small clusters of olive-coloured crystals, sometimes united into globular masses. Streak green, almost yellow. In thin splinters transparent, with a vitreous lustre. Hardness, scratches calcspar. Specific gravity 3·55. It was found by Von Volborth on examining some Siberian copper-ores.

VOLKONSKOITE, a Mineral containing oxide of chromium. It occurs amorphous. Fracture conchoidal or uneven. Very soft; feels smooth. Colour fine grass-green. Dull; assumes a polish when rubbed by the fingers. When heated in a glass tube, loses water, and becomes of a brown-colour; by calcination loses about one-third of its weight, and becomes of a dark brown-colour.

It was found in Mount Jessmictski, in the government of Perm, Siberia, occurring in thin veins and nests. It contains silica, green oxide of chromium, peroxide of iron, magnesia, and water.

VOLTAITE, *Iron Alum*, a Mineral occurring crystallised in regular octohedrons. Colour brown or black. It is found at the Solfatara near Naples, and consists of sulphuric acid, protoxide of iron, alumina potash, and water.

VOLTZIA, a genus of Fossil Plants.

VOLTZITE. [Zinc.]

VOLUTA. [Volutidæ.]

VOLUTELLA. [Volutidæ.]

VOLUTIDÆ, a family of Gasteropodous *Mollusca*, whose shells are prized by collectors above most others for their beauty and rarity; and which, from their numbers and carnivorous habits, are

powerful agents in keeping the *Mollusca* and *Conchifera* within due limits.

The genus *Voluta* stands, in the last edition of the 'Systema Naturæ,' revised by Linnæus, between the genera *Bulla* and *Buccinum*, with the following definition:—Animal, a Limax, or Slug. Shell unilocular, spiral. Aperture ecaudate, subeffuse. Columella or pillar plaited. No labium nor umbilicus.

Linnæus thus subdivides the genus:—

* Aperture entire.

Species:—*V. Auris Midæ, Auris Judæ, tornatilis, solidula, livida,* and *caffea.*

** Cylindroid (suboylindrical and emarginate).

Species:—*V. porphyria, oliva,* and *ispidula.*

*** Ovate (obovate, effuse, emarginate).

Species:—*V. dactylus, miliaria, monilis, persicula, pallida, faba, glabella, reticulata, mercatoria, rustica, paupercula, mendicaria,* and *cancellata.*

**** Fusiform.

Species:—*V. tringa, corniculata, virgo, scabricula, ruffina, sanguisuga, caffra, morio, vulpecula, plicaria, pertusa, mitra, musica, vespertilio, ebræa, turbinellus, capitellum, ceramica, pyrum,* and *lapponica.*

***** Ventricose.

Species:—*V. Æthiopica, cymbium,* and *olla.*

The species belonging to the Linnæan genus *Voluta*, when Lamarck published his 'Animaux sans Vertèbres,' amounted to nearly 300, and they would be now considerably above that number. Some of these species are even referred to other families.

The following is a definition of the *Volutidæ* as at present constituted:—Shell turreted or convolute; aperture notched in front; columella obliquely plaited; operculum absent. Animal with a recurved siphon; foot very large, partly hiding the shell; mantle often lobed and reflected over the shell; eyes on the tentacles or near their base; lingual ribbon linear; rachis toothed; pleura unarmed.

We give the genera of this family and illustrations of some of the species:—

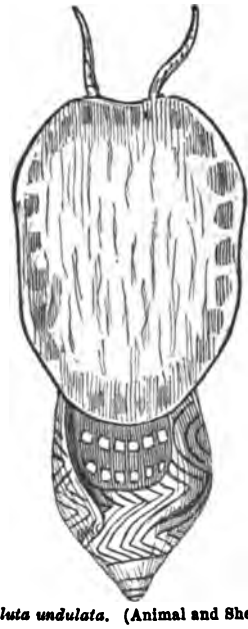
Voluta has the shell ventricose, thick; spire short, apex mamillated; aperture large, deeply notched in front; columella with several plaits. *V. musica* and a few others have a small operculum. Animal, eyes on lobes at the base of the tentacles; siphon with a lobe on each side, at its base; lingual teeth 3-cusped.

This comprises *Cymbiola* and *Harpula* of Sowerby, *Volutella* of D'Orbigny, *Scapha* of Gray. *Volutilithes* and *Scaphella* of Sowerby, and *Melo* of Broderip are sub-genera. Seventy recent species and eighty fossil species are known.

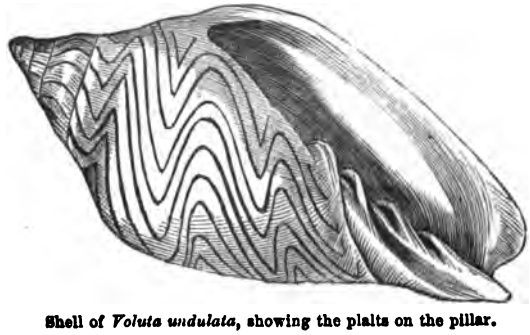
V. undulata has the shell ovate-fusiform, smooth, yellowish-white, clouded with fulvous or purple-black spots, ornamented with numerous bay or brown longitudinal undulatingly flexuous lines; principal plaits on the pillar four; sometimes two smaller additional ones.

It is found on the coasts of Australia, Port Western, Bass's Strait, the Island Maria, &c.

Voluta undulata. (Animal and Shell.)
Anterior part seen from above.



Voluta undulata. (Animal and Shell.)
The whole seen from below. ('Astrolabe.')



Shell of *Voluta undulata*, showing the plaits on the pillar.

V. pacifica has the shell ovate-fusiform, anteriorly tuberculiferous,

Voluta Pacifica. ('Astrolabe.')

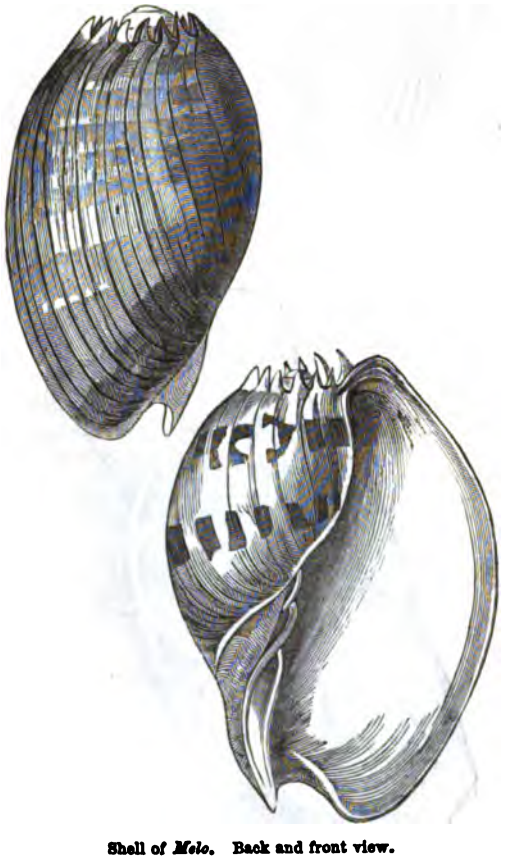
pale yellow or flesh-colour ornamented with brown spotted bands, and bay vein-like markings; pillar 5-plaited.

It is found in New Zealand, in the Bay of Islands.

V. (*Melo*, Broderip) *Æthiopicus* has the shell obovate, ventricose, of an orange-cinnamon colour, the spire coronetted with thick-set short-vaulted spines; pillar 4-plaited.

This shell is a native of the African Ocean and the East Indian seas.

Animal of *Voluta* (*Melo*) *Æthiopicus*. ('Uranie.')

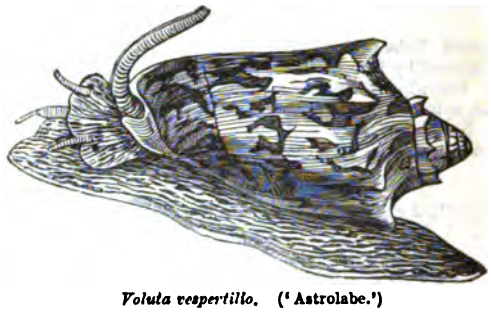


Shell of *Melo*. Back and front view.

V. vespertilio has the shell turbinated, armed with strong distant acute tubercles, white, yellowish, or reddish, painted with angularly flexuous spots; spire muricated, the apex with small tubercles; lip with a sinus above; pillar 4-plaited.

It is found in the Indian Seas, Amboyna, Moluccas, &c.

The species of *Voluta* have been found at depths ranging from 7 to 14 fathoms. The species are very numerous and very beautiful.



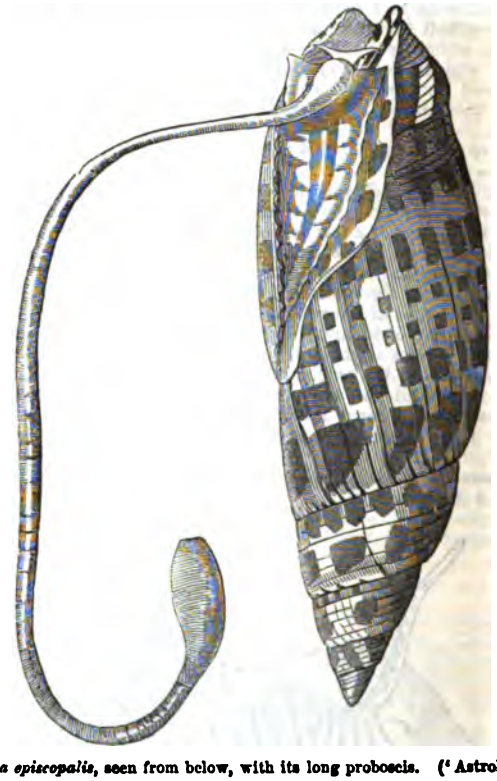
Voluta vespertilio. ('Astrolabe.')

Mitra, Mitre Shells, have the shell fusiform, thick; spire elevated, acute; aperture small, notched in front; columella obliquely plaited; operculum very small.

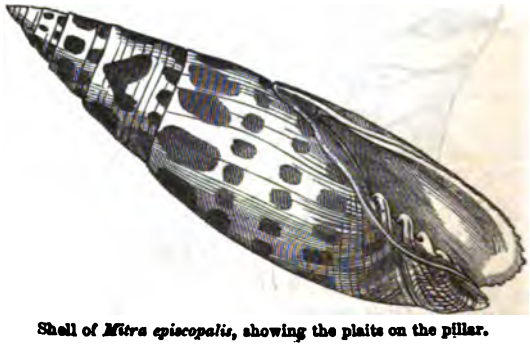
The animal has a very long proboscis; it emits a purple liquid, having a nauseous odour, when irritated. The eyes are placed on the tentacles, or at their base. Three hundred and fifty recent species and ninety fossil have been described.

M. episcopalis, Bishop's Mitre Shell. The animal has a narrow foot, compressed and channelled at its root, nearly square and slightly auriculated in front with a marginal furrow, and pointed behind. The head is very small, rounded, with two tentacles, which are scarcely a line and a half in length; the eyes sessile at their base. An enormous proboscis, which is sometimes double the length of the shell.

The respiratory siphon does not project beyond the canal; it is marked with black at the point: the rest of the animal is yellowish. The proboscis is white.



Mitra episcopalis, seen from below, with its long proboscis. ('Astrolabe.')



Shell of *Mitra episcopalis*, showing the plaits on the pillar.

Shell turreted, smooth, white, spotted with bright red; pillar four-plaited; outer lip denticulated at its lower part; epidermis thin. It is found in East Indian seas and islands of the South Sea, Tongataboo.

M. adusta, has the shell fusiform, turreted, albido-lutescent, ornamented with longitudinal rufous-brown spots; the striæ transverse, impressed, rather remote, and dotted; the sutures crenulate; the pillar five-plaited. It is found at Timor, Vanikoro.

There are at least two varieties.

Mitra adusta, seen from below. ('Astrolabe.')

M. corrugata. The shell is ovate-fusiform, longitudinally plicated, transversely rugous, whitish; bands and belts brown; whorls angulated above; the last whorls with a submuricated angle; pillar four-plaited. It is found in the Indian Ocean and New Guinea.

Mitra corrugata. ('Astrolabe.')

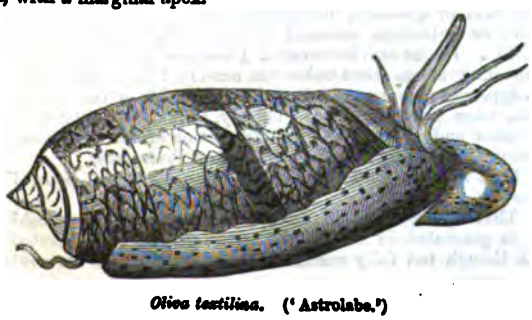
The species have been found at depths varying from the surface to seventeen fathoms, on reefs, sandy mud, and sands. The species are all inhabitants of warm countries.

Imbricaria and *Cylindra* are sub-genera of *Mitra*.

Volvaria has the shell cylindrical, convolute; spire minute; aperture long and narrow; columella with 3 oblique plaits in front. The species, five in number, are all fossil.

Marginella has the shell smooth, bright; spire short or concealed; aperture truncated in front; columella plaited; outer lip (of adult) with a thickened margin. Animal similar to *Cypræa*.

Oliva, which is sometimes referred to *Buccinidæ*, has the following characters:—Animal involved, compressed, with a small head terminated by a proboscis; tentacles approximated, enlarged at their base and subulate at their extremity, carrying the eyes on small convexities about their middle part externally; foot very large, oblong, and slit transverse anteriorly; mantle with a single lateral lobe covering the shell in great part, with two tongue-like processes at the side of the branchial opening, and forming in front a very elongated siphon; a single branchial pectination; male organ very voluminous, on the anterior part of the right side. Operculum horny, elongated, very small, with a marginal apex.

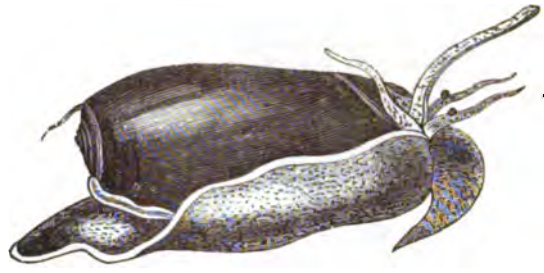


Oliva textilina. ('Astrolabe.')

M. Rang, whose descriptions we have selected, states that the genus *Oliva* is one of the richest in the colour and brilliancy of the shell and variety of species; and he refers to the beautiful collection of M. Duclos, who had made the genus his particular study.

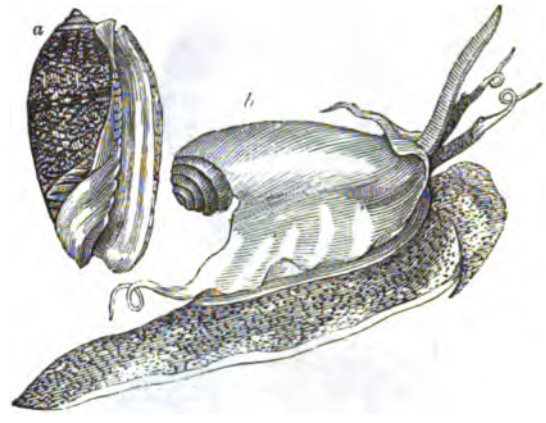
O. textilina has the shell cinereous white, subreticulated with flexuous dotted lines, with two brown bands inscribed as it were with characters; the callus of the canal prominent. It is found in the Antilles and New Guinea.

O. maura has the shell cylindrical, the apex retuse, black; lip subplicate externally; aperture white. It is found in the East Indian Ocean, Australia, and Amboyna.



Oliva maura. ('Astrolabe.')

O. sanguinolenta, has the shell cylindrical, very delicately reticulated, with rufous brown small lines, girt with two brown zones; the pillar orange-red. It is found in the East Indian Ocean and on the coast of Timor.



Oliva sanguinolenta. ('Astrolabe.')

a, Shell seen from below; *b*, animal out of the shell, shown as when creeping on its large foot.

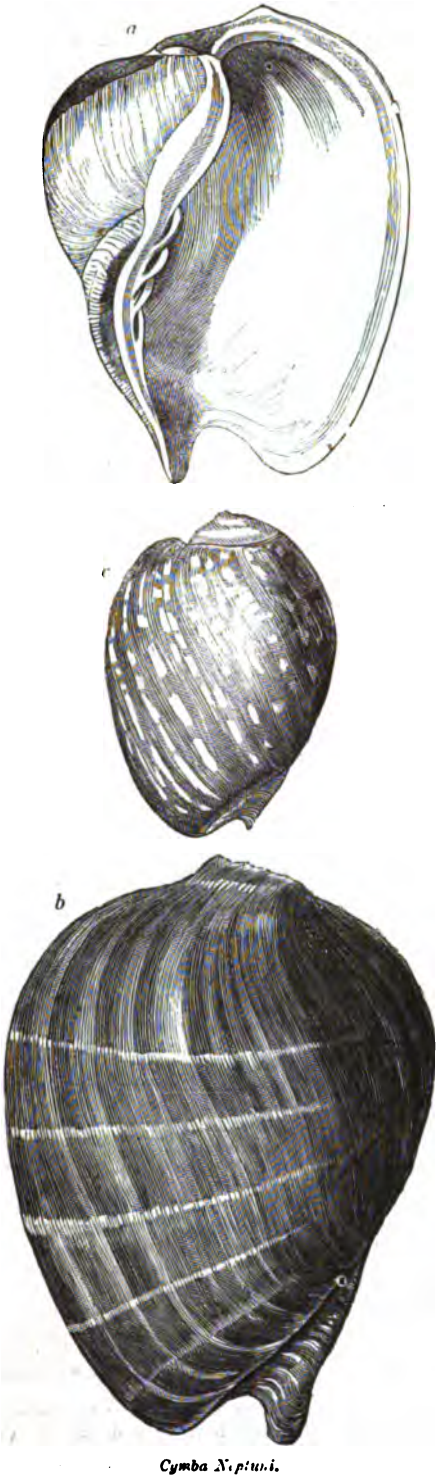
The species have been found at depths varying from the surface to twelve fathoms, on mud, sandy-mud, coarse sand, &c. The species are fond of flesh, but they only suck the juices; and at Mauritius they are taken with that bait in the following manner, according to Lieutenant Harford, who was for some time there, brought home some very fine Mauritian shells, and gave the information to Mr. Broderip. The fishery was carried on by means of a line made to run parallel with the bottom of the sea, to which line small nooses, each containing a piece of the arms of a cuttle-fish (*Sepia*), were appended so that the bait touched the bottom. To one end of the line a chain-shot was attached by way of mooring; and over it were a buoy and a flag. The other end of the line swung with the tide, and that end was also marked by a buoy and a small flag. The sport was carried on in deep water over sand-banks, and the best times were the morning and the evening. The apparatus was occasionally cautiously drawn up and the Olives which were found adhering to the bait were taken into the boat in which the fishermen were.

Olivella and *Scaphula*, Sowerby, and *Agaroma*, Gray, are sub-genera; 117 recent and 20 fossil species have been described. (Woodward, 'Manual of the Mollusca.')

Cymba, Broderip. The species are called Boat-Shells. The shell is like *Voluta;* nucleus large and globular; whorls few, angular, forming a flat ledge round the nucleus. The foot of the animal is very large, and deposits a thin enamel over the under side of the shell. It is ovoviviparous, and the young animal is very large when born; the nucleus becomes partly concealed by the growth of the shell. Ten recent species have been described.

C. Neptuni has the shell obovate, tumid, ventricose, of a brownish-red, covered with a strong brown epidermis, over which an enamel-like glaze is extended from the pillar over about a fourth part of the shell, leaving the epidermis of the back uncoated. In full-grown specimens the spire and apex are entirely concealed, and the upper border of the

body-whorl, which is carinated and somewhat reflected, overhangs both, so as to form an open somewhat rounded concavity. Pillar 4-plaited. It is found on the African coasts in shallow water on sands and mud.



Cymba Neptuni.

a, seen from below, showing the plaits of the pillar; *b*, seen from above; *c*, young seen from above.

VOLUTILITHES (Fossil). [VOLUTIDÆ.]

VOLVA, in Botany, is the external membranous or fleshy covering which incloses the stipes and pileus of the young state of many of the order *Fungi*.

VOLVA'RIA. [VOLUTIDÆ.]

VOLVOX, a genus of organic beings referred by Ehrenberg to his family of *Infusoria*. Siebold was the first to doubt the correctness of Ehrenberg's classification, and the result has been that through the subsequent researches of Williamson, Busk, and Cohn, the species of *Volvox* are now regarded as forms of the vegetable kingdom.

Ehrenberg describes three species of *Volvox: V. globator*, *V. aureus*, and *V. stellatus*. A fourth form is described by Ehrenberg under the name of *Sphærosira Volvox*.

The following is Mr. Busk's account of these forms of *Volvox*:—

"The more common and best known form of *Volvox globator*, to the naked eye, or under a low power, appears as a transparent sphere, the surface of which is studded with numerous regularly placed green granules or particles, and which contains in the interior several green globules, of various sizes in different individuals, though nearly always of uniform size in one and the same parent globe.

"These internal globes, which are the young or embryo *Volvox*, at first adhere to the wall of the parent cell, although the precise mode of connection is not very apparent. When thus affixed, they are in a different concentric plane to the smaller green granules. At a later period, and after they have attained a certain degree of development, these internal globes become detached, and frequently exhibit a rotatory motion, similar to that of the parent globe.

"In the form of *Volvox*, termed *V. aureus* by Ehrenberg, the outer sphere, or cell, exhibits precisely the same structure as the above, the only apparent difference between them consisting in the deeper green colour of the internal globules. These however soon exhibit a more important distinctive character in the formation of a distinct cell-wall of considerable thickness around the dark-green globular mass. This wall becomes more and more distinct; and, after a time, the contents, from dark-green, change into a deep orange-yellow; and simultaneously with this change of colour the wall of the globule acquires increased thickness, and appears double.

"The third form, or *Volvox stellatus*, differs in no respect from the two former, except in the form of the internal globules, which exhibit a stellate aspect, caused by the projection on their surface of numerous conical eminences, formed of the hyaline substance of which the outer wall of the globule is constituted. The deep green colour of the contents of these stellate embryoes, and their subsequent changes into an orange colour, at once point out their close analogy with those of *V. aureus*. I have no doubt of their being merely modifications of the latter: and in fact the two forms are very frequently to be met with intermixed, and on several occasions I have observed smooth and stellate globules in the interior of one and the same parent globe.

"The organism described and figured by Ehrenberg, under the name of *Sphærosira Volvox*, also presents the appearance of a transparent globe set with green spots, but it differs from the foregoing in two important respects:

"1. In the absence of any internal globules or embryoes.

"2. In the irregular size of the green granules lining the wall, which, instead of being of a uniform size, are of various dimensions."

Mr. Busk and Professor Williamson, in the first volume of the new series of the 'Microscopical Society's Transactions,' have furnished in great detail an account of the development of these curiously organised granules. From their observations, it appears that the green ciliated granules which stud the surface of the *Volvox* are produced from a central embryonic mass of protoplasm by successive division by segmentation. Mr. Busk observed in these green granules a curious phenomenon.

"It will also be observed, that each ciliated cell or zoospore, as it may analogically be termed, contains a green granular mass or masses, composed, for the most part probably, of chlorophyll granules and a more transparent body, which I suppose may be regarded as a nucleus, and derived, as it would appear, from one of the bright spherules which have been noticed before. At an early period after the maturity or completion of the zoospores they exhibit a minute circular clear space, or sometimes, but I think rarely, more than one, which is worthy of very attentive consideration. This space is of pretty uniform size in all cases, and about 1·9000th of an inch in diameter. It may be situated in any part of the zoospore, or not unfrequently in the base, or even in the midst of one or other of the bands of protoplasm connecting it with its neighbours. Its most important character consists in its contractility—a property already known to be possessed by similar spaces or vacuoles in vegetable spores; but what appears to me a very curious, and as yet unnoticed, peculiarity of this contraction, consists in the fact that it is very regularly rythmical. In several cases in which I have watched the phenomenon in question, uninterruptedly, for some time, the contractions or pulsations occurred very regularly at intervals of about 38" to 41". In one case however, if I was not misled in the observation, the interval was about twice this, namely, 1′ 25". The contraction, which appears to amount to complete obliteration of the cavity of the vacuole, takes place rapidly or suddenly, as it were, whilst the dilatation is slow and gradual." This contraction of vacuolar spores has since been observed by Cohn in a species of *Protococcus*.

Mr. Busk thus sums up the result of his observations upon *Volvox globator*:—

"1. That it originates in an apparently nucleated discoid cell, which is generated in the interior of the parent, and liberated in a perfect though not fully matured form, within which are contained similar germs.

"2. That the contents of this apparently nucleated discoid cell

consisting of a grumous material and refractive amylaceous (?) spherules, after a time undergo segmentation, at the same time exhibiting a distinct wall, beyond which is a delicate areola, apparently of a gelatinous consistence.

"3. That this segmentation, attended with a corresponding augmentation in the number of the refractive spherules, terminates ultimately in the formation of numerous contiguous particles or segments.

"4. That these ultimate segments are gradually separated from each other, remaining connected only by elongated processes or filaments, and constituting the ciliated zoospores of the mature *Volvox*.

"5. That these zoospores at first are simple masses of protoplasm, containing a transparent nuclear body, and that afterwards they present for a time clear circular spaces, which contract rhythmically at regular intervals; and are subsequently furnished with a brown eye-spot; and at a very early period with two long retractile cilia, which arising from an elongated hyaline beak penetrate the parent cell-wall, and exert active movements external to it.

"6. That in a concentric plane internal to these ciliated zoospores are placed the germs of future individuals destined to follow the same course."

VOMER. [SKELETON.]

VULPES, Brisson, the generic name for a species of that subdivision of the great genus *Canis*, which has the pupils of the eyes elliptical or almost linear by day, though they become round or nearly so in the hours of darkness.

Although the dental formula and general osteological character of the Foxes agree with that of the true Dogs, the lengthened and sharp-pointed muzzle, the round head, the erect and triangular ears, the form of the pupil, the long body, short limbs, and elongated, thick, and bushy brush, constitute differences which separate the former from the latter, at least sub-generically.

V. vulgaris (Brisson), the Common Fox; *Canis vulpes*, and *C. alopex* (the latter the variety, if variety it may be called, with the tip of the tail black ?) of Linnæus; Volpe of the Italians; Raposa of the Spanish; Raposa of the Portuguese; Fuchs of the Germans; Vos of the Dutch; Raff of the Swedes; Rev of the Danes; Tod of the Scotch; Llwynog, fœm. Llwynoges of the Welsh, is too well known to require description. The time of gestation may be taken at from 60 to 65 days, and the birth of the young takes place in April. In a year and a half they attain their full size, and have been known to live 13 or 14 years; but as this can only have been ascertained, observes Mr. Bell, of individuals in confinement, it is very probable that, in a state of nature, it considerably exceeds that period. Of its cunning much has been said, and a great deal of it is true. The reader will find some interesting remarks on the habits and economy of the Common Fox by Dr. Weissenborn in the number of Loudon's 'Magazine' (N. S.) for October 1837.

The Common Fox inhabits, according to Linnæus, Europe, Asia, and Africa. Cuvier mentions it as reaching from Sweden to Egypt, both inclusive. Mr. Strickland notes it as occurring near Smyrna. The Fox named Melanogaster by the Prince Bonaparte in his 'Fauna Italica' is probably a variety only. The strong smell proceeding from the anal glands and urine of the Common Fox is very offensive.

V. fulvus, the American Fox, which is, according to Sir John Richardson, very plentiful in the wooded districts of the Fur Countries, about 8000 (skins) being annually imported into England from thence, bears a strong resemblance to the Common European Fox, and, until De Beauvois pointed out its peculiarities, was considered identical with it. Thus it is the European Fox of Pennant. Sir John Richardson observes that the American, or Red Fox, does not possess the wind of its English congener, its strength being exhausted by the first short burst, though it runs about a hundred yards with great swiftness, and is soon overtaken by a wolf or a mounted huntsman. He gives the following synonyms:—European Fox of Pennant; Red, or Large Fox, of Hutchins; Large Red Fox of the Plains of Lewis and Clark; Renard de Virginie of Palisot de Beauvois; *Canis fulvus* of Desmarest; Red Fox of Sabine (Franklin's 'Journ.'), and Makkeeshew of the Cree Indians.

V. Lagopus, the Arctic Fox, is considered by Sir John Richardson to be identical with the Pied Foxes of James; *Canis Lagopus* of Linnæus and Forster, Colonel Sabine, Mr. Sabine, Dr. Richardson, and Dr. Harlan; Arctic Fox of Pennant and Hearne; Greenland Dog of Pennant (?), a young individual; Isatis and Arctic Fox of Godman; Stone Fox of authors; Terreance-arioo of the Esquimaux of Melville Peninsula; Terieniak of the Greenlanders; Wappeeskee-ahew-makkeeahew of the Cree Indians; and Pezzi of the Russians.

This creature is extremely cleanly. It never soils its habitation, nor has it any unpleasant smell. It breeds on the sea-coast, chiefly within the Arctic Circle; is very unsuspicious and easily taken by traps, even, as it is stated, when baited in its presence. Captain Lyon, R.N., received fifteen from one trap in four hours. It is gregarious, forming burrows in sandy spots, 20 or 30 together. Sir John Richardson saw one of these fox villages on Point Turnagain, in 68½° N. lat. It soon becomes tame in confinement and is eager to hide its food as soon as it obtains it, even when there seems no danger of losing it. Snow is the material generally used for this purpose, and when piled over the food is forcibly pressed down by the nose.

"This Fox is found in the highest northern latitudes throughout the winter. The young generally migrate to the southward late in the autumn and collect in vast multitudes on the shores of Hudson's Bay: they return early the following spring along the sea-coast to the northward, and seldom again leave the spot they select as a breeding-place." (Captain James Ross.) "Their southern limit in North America appears to be about 50° N. lat. They are numerous on the shores of Hudson's Bay, north of Churchill, and are found at Behring's Straits; but the brown variety (*V. fuliginosus*) is the more common in the latter quarter." (Sir John Richardson.)

The fur is considered to be of small value in commerce, but the flesh is said to be good food, particularly when young. Captain Franklin and his party compared the flavour of the young animal to that of the American hare. In the Arctic voyages they have always been regarded as luxuries.

Arctic Fox (*Vulpes Lagopus*) in its winter dress.

Zoologists generally agree that the Sooty Fox, or Blue Fox (*Canis fuliginosus*), is only a variety of the animal above described and figured.

V. Caama, the Caama, the smallest of the South African foxes. Dr. Smith, in his 'Catalogue to the South African Museum,' from a specimen in which our figure is taken, observes, that some few individuals are to be met with within the limits of the colony, but that the favourite residence of the species seems to be to the northward; though there it is daily becoming less and less numerous, owing to the skins being much in request among the natives as a covering in the cold season. Many of the Bechuanas, it is stated, find their sole employment in hunting these animals with dogs, or snaring them. Like other foxes, it is a great enemy to birds which lay their eggs on the ground; and it is suspiciously watched by the ostrich in particular during the laying season. The Caama, when he succeeds in obtaining the eggs, pushes them forcibly along the ground till they come in contact with some substance hard enough to break them, when he feasts on the contents. The natives take advantage of the watching of the ostrich for this robber to lure the bird to its destruction. Knowing that the anxious parent runs to the nest the moment a fox appears, they fasten a dog near it and hide themselves.

Caama (*Canis Caama*).

The ostrich approaches to drive away the supposed fox, and is shot by the concealed hunter. ('Catalogue of the South African Museum.')

V. Bengalensis (Shaw) is brown above, with a longitudinal black band. The space round the eyes is white, and the tail is terminated with black. It is the Fox of the Dukhun (Deccan), Kokree of the Mahrattas, *Canis Kokree* of Sykes, which the Colonel considers to be new to science, although it much resembles the descriptions of the Corsac, and is described by him ('Zool. Proc.,' 1831) as a very pretty animal, but much smaller than the European Fox.

The *Canis Himalaicus*, Hill Fox of the Europeans in the Doon, in Kumaon, and the more western and elevated parts of the mountains, agrees with the common European and American foxes (*C. vulpes* and *C. fulvus*) in the black marks on the backs of the ears, and in front of the hind and fore legs. The coat consists of long, close, rich fur, as fine as that of any of the American varieties, and of infinitely more brilliant and varied colours. (Royle, 'Flora Himalaica.')

V. Zaarensis, the Fennec. This animal, which has given rise to much controversy, is generally placed by the French zoologists among the Foxes; but the observations of Mr. Yarrell lead him to pronounce decidedly that the Fennec appears to him to belong to the genus *Canis* properly so called; the osteological part of the structure closely resembling that of the dog, and the pupil of the eye being circular.

The Fennec obtained by Bruce when he was consul-general at Algiers, was said to be more frequently found in the territories of Benni Mezzab and Werglah, where the date grows. In these districts the Fennecs are hunted for their skins, for which there is a market at Mecca, whence they are exported to India. Bruce, after leaving Algiers, bought two more Fennecs, one at Tunis, which had been brought by the Fezzan caravan to the Island of Gerba, and thence to the place where Bruce procured it; the other at Senaar, and he knew not whence this last came. Both these resembled the first, and were called Fennecs. The Fennec which Bruce had at Algiers lived for several months, and when he left that place he gave the animal to Captain Cleveland, R.N., who presented it to Mr. Brander, the Swedish consul. His favourite food consisted of dates or any sweet fruit; but he was also very fond of eggs. He would eat bread when hungry, more especially if it was rendered palatable by honey or sugar. The sight of a bird aroused him to eager watchfulness as long as it was present; and a cat was his aversion. He would endeavour to hide from the latter; but never showed a disposition to resist or defend himself. The animal was disposed to sleep by day, but as night came on it became restless to excess. Bruce never heard it utter any sound. He says that the animal is described in many Arabian books under the name of El Fennec, by which appellation he states that it is known all over Africa; and he conceives that the word is derived from the Greek φοινιξ, a palm or date-tree, adding that the animal builds his nest on trees, and does not burrow in the earth.

M. Rüppell has figured and described in his 'Atlas Zu der Reise im Nördlichen Afrika,' together with six other species of *Canis*, the Fennec, *Canis Zerda*, Zimm. Three specimens were transmitted to Frankfurt, all perfectly alike in markings, and differing little from each other in size. They were found in the neighbourhood of Amlenkal, and in the desert of Korti, where they inhabit holes made by themselves. They do not nestle on trees, as Bruce asserted.

Fennec (*Vulpes Zaarensis*).

The following species of *Vulpes* are given in the 'List of the Specimens of Mammalia in the British Museum:'—*V. vulgaris*, the Fox; *V. flavescens*, the Persian Fox; *V. Azarae*, the Agouarachay; *V. Niloticus*, the Sabora; *V. Lagopus*, the Arctic Fox, or Pesni; *V. cinereo-argentatus*, the Kit-Fox; *V. fulvus*, the American Fox, or Makkeeshew; *V. Bengalensis*, the Kokree; *V. Magellanicus*, the Culpeo; *V. Corsac*, the Corsac; *V. Cama*, the Asse; *V. dorsalis*, the Senegal Fox; and *V. Zaarensis*, the Fennec.

VULPINITE, a siliceous variety of the Anhydrous Sulphate of Lime. [ANHYDRITE.] It contains about 8 per cent. of silica, and is a little above the usual hardness of anhydrite (3·5).

VULSELLA. [MALLEACEA.]

VULTUR, VULTURE. [VULTURIDÆ.]

VULTURIDÆ, a family of Raptorial Birds, whose geographical distribution is confined to warm climates, where they act as scavengers to purify the earth from the putrid carcasses with which it would otherwise be encumbered.

It has been matter of dispute whether they are directed to their fetid food, for they seldom prey on living animals, by the eye or by the nasal organ. There can however, in our opinion, be little doubt that both the senses are made to contribute to the discovery of the carcass. The lofty flight and telescopic eye are well adapted to detect any dying or dead animal, and as the action of one vulture may be, in all probability is, watched by another, a sort of telegraphic communication as to the position of the object is kept up. [BIRDS; CONDOR.]

The genus *Vultur* of Linnæus stands first in his first order, *Accipitres*, and consists of the following species:—*V. gryphus*, *V. harpyja*, *V. papa*, *V. monachus*, *V. aura*, *V. barbatus*, *V. percnopterus*, and *V. albicilla*. ('Syst. Nat.,' ed. 12.)

Cuvier divides this great genus into the following sub-genera:—

The Vultures properly so called, *Vultur*, Cuv.—These have a large and strong beak, with the nostrils placed diagonally at its base; the head and the neck without feathers and without caruncles; a collar of long feathers or of down at the bottom of the neck. The species are found on the ancient continent.

Sarcoramphus, Duméril.—America, Cuvier remarks, produces Vultures remarkable for the caruncles which surmount the membrane of the base of their beak, which is as large as that of the preceding genus, but the nostrils are oval and longitudinal. These are the *Sarcoramphi* of Duméril.

Cathartes, Cuv. (*Gallinazos*, or *Catharistes*, Veill.).—These have the beak of the *Sarcoramphi*, that is to say, it is stout, and the nostrils are oval and longitudinal; but there is no fleshy crest, although their head and neck are plumeless.

Percnopterus, Cuv. (*Gypaëtos*, Bechst.; *Neophron*, Sav.).—The bill in this group is slender, long, a little convex above its curvature; the nostrils oval and longitudinal; and the head, but not the neck, denuded of feathers. These are birds of moderate size, and which do not approach the Vultures properly so called in extent of power; they are therefore more ravenous after carrion and all kinds of impurities which attract them from afar; even excrements are palatable to this filthy race. Illiger comprises both this and the preceding sub-genera under his *Cathartes*.

Under this sub-genus Cuvier places the Urubu, *Vultur Iota*, C. Bonap., of America.

The Griffons (*Gypaëtos*, Storr; *Phene*, Sav.).—These, Cuvier observes, are arranged by Gmelin under the genus *Falco*, but approximate more closely to the Vultures in their habits and conformation. Their eyes are placed à fleur de tête, their claws are proportionally weak, their wings are half opened in their state of repose, their crop projects from the bottom of the neck when it is full, but the head is entirely covered with feathers. Their distinguishing characters consist of a very strong beak, which is straight, hooked at the point, and convex at the hooked part; of nostrils covered with stiff bristles directed forwards, and a pencil of similar bristles under the beak. Their tarsi are short and feathered down to the toes; their wings are long, and the third quill is the longest.

Prince Bonaparte makes the *Vulturidæ* the first family of his first order, *Accipitres*, and notices the following sub-families and genera:—

a. Vulturinæ.

Genera:—*Neophron*, *Cathartes*, *Sarcoramphus*, *Vultur*, and *Gypa*.

b. Gypaëtinæ.

Genus:—*Gypaëtos*.

It must be remembered that none but European and American birds are admitted into this arrangement.

The *Vulturidæ* of Mr. G. R. Gray form the first family of his first sub-order (*Accipitres Diurni*) of his first order (*Accipitres*). The following sub-families and genera are placed by Mr. Gray under this family:—

Sub-Family 1. *Gypaëtinæ.*

Genus:—*Gypaëtos*.

Sub-Family 2. *Cathartinæ.*

Genera:—*Neophron*, *Cathartes*, and *Sarcoramphus*.

Sub-Family 3. *Vulturinæ.*

Genera:—*Gyps* (Sav.); *Vultur*; and *Otogyps* (G. R. Gray).

Sub-Family 4. *Racaminæ.*

Genus:—*Gyphoierax*, Rüpp.; *Racama*, J. E. Gray—*Vultur* (*Gyphoierax*) *angolensis*.

We now proceed to give a few illustrative species:—

Vultur fulvus, the Griffon Vulture, is Le Griffon of the French; Weisskopfiger Geier of the Germans; Avoltoio di Color Castagno of the Italians.

Head and neck covered with close-set, short, white, downy feathers; lower part of the neck surrounded with a ruff of long, slender, white feathers, sometimes with a slight tinge. On the middle of the breast a space furnished with white down. The whole of the body, the wings, and the origin of the tail yellow-brown or Isabella colour; quills and tail-feathers blackish-brown; beak livid-yellow, cere darker;* iris hazel; feet gray or light-brown. Total length exceeding four feet.

The female is larger than the male.

The young have a whitish down varied with brown on the head and neck; the rest of the body very bright yellow, marked with great spots of gray or white.

It is a native of the mountainous parts of the north of Europe, Silesia, the Tyrol, Dalmatia (where it is very numerous), Spain (abundant near Gibraltar), the Alps, the Pyrenees, Turkey, the Grecian Archipelago, the north of Persia, and the north of Africa.

Head of Griffon Vulture.

Griffon Vulture (*Vultur fulvus*).

The nest of this Vulture is generally formed upon the most elevated and inaccessible rocks, but it often builds on the highest forest-trees, and in Sardinia on the loftiest oaks, where the nest of brushwood and roots is more than three feet in diameter. The eggs, which are generally two in number, though some state that it occasionally lays as many as four, are of a dull-greenish or grayish-white, slightly marked with pale reddish spots, and with a rough surface. Like all the other *Vulturidæ*, it feeds principally upon dead carcasses, to which it is frequently attracted in very considerable numbers. "When it has once made a lodgment upon its prey, it rarely quits the banquet while a morsel of flesh remains, so that it is not uncommon to see it perched upon a putrefying corpse for several successive days. It

* Temminck describes it as flesh-coloured.

never attempts to carry off a portion even to satisfy its young, but feeds them by disgorging the half-digested morsel from its maw. Sometimes, but very rarely, it makes its prey of living victims, and even then of such only as are incapable of offering the smallest resistance; for in a contest for superiority it has not that advantage which is possessed by the Falcon tribes, of lacerating its enemy with its talons, and must therefore rely upon its beak alone. It is only however when no other mode of satiating its appetite presents itself, that it has recourse to the destruction of other animals for its subsistence. After feeding, it is seen fixed for hours in one unvaried posture, patiently waiting until the work of digestion is completed, and the stimulus of hunger is renewed, to enable and to urge it to mount again into the upper regions of the air, and fly about in quest of its necessary food. If violently disturbed after a full meal, it is incapable of flight until it has disgorged the contents of its stomach; lightened of which, and freed from their debilitating effects, it is immediately in a condition to soar to such a pitch as, in spite of its magnitude, to become invisible to human sight. In captivity it seems to have no other desire than that of obtaining its regular supply of food. So long as that is afforded it, it manifests a perfect indifference to the circumstances in which it is placed." (Bennett.)

V. cinereus appears to be the Vautour Arrian and Vautour Noir of the French; Cinereous or Ash-Vulture and Bengal Vulture of Latham; and Grauer Geier of the Germans. It is a native of Europe. It is found in lofty mountains, and the vast forests of Hungary, the Tyrol, and the Pyrenees; the south of Spain and Italy; accidentally in Dalmatia; more frequently in Sardinia; in Sicily; rarely in Italy, and never in the forests; very accidentally in Germany.

Its food consists of dead animals and carrion, but never of living animals, of which it shows fear; the least animal, says Temminck, terrifies it.

This is the genus *Gyps* of Savigny. Mr. Gould, in his great work on the 'Birds of Europe,' notices a deviation in this species from the true or more typical vultures, manifested in the partially bare neck, open ears, curved claws, and powerful beak.

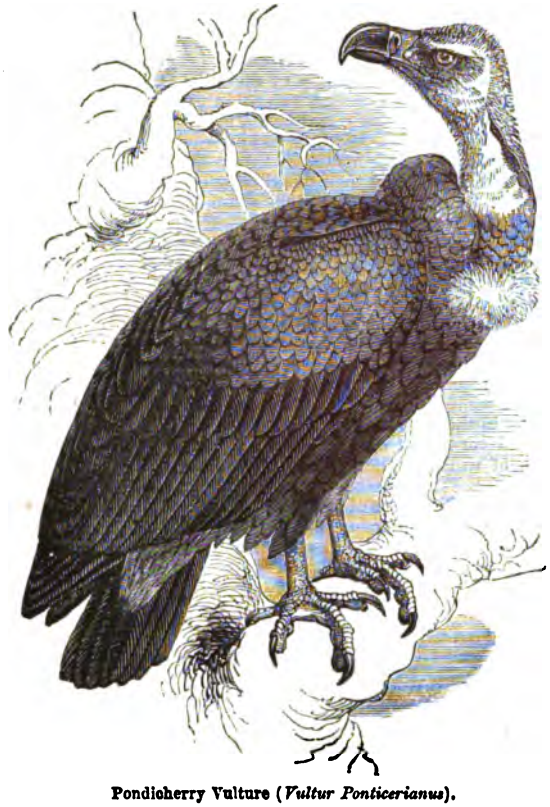
Bengal Vulture (*Vultur* (*Gyps*) *cinereus*).

V. Ponticerianus, the Pondicherry Vulture. The adult is about the size of a goose; a long loose naked membrane or wattle takes its origin about an inch below the meatus auditorius, and widens into a rounded form in the middle; the whole head and neck naked and flesh-coloured, but there are some short scattered hairs thereon; crop

covered with a small brown down, and round it is a longer white down.

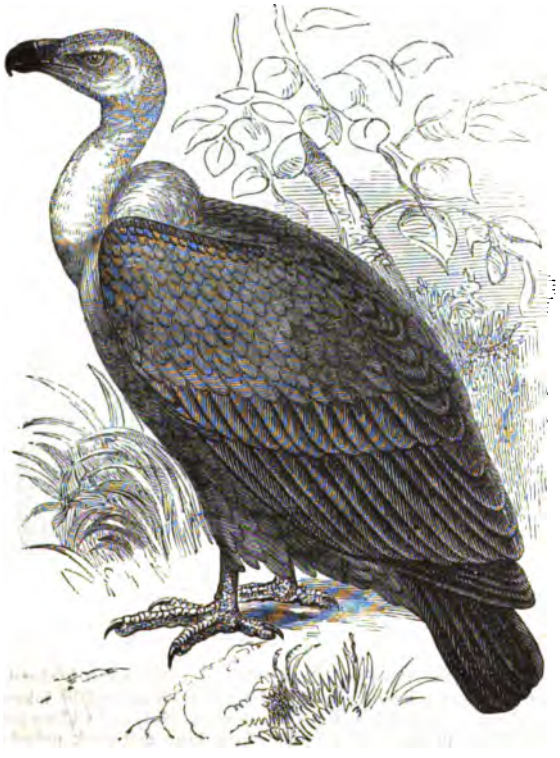
The young with the head and neck more or less clothed with short down. (Temm.)

It is a native of Bengal (probably spread over the continent of India), Java, and Sumatra.



Pondicherry Vulture (*Vultur Ponticerianus*).

V. Indicus, the Indian Vulture, has the head and neck denuded of feathers; all the upper plumage Isabella-ash colour varied with brown



Indian Vulture (*Vultur Indicus*).

and whitish; lower parts spotless very bright yellow; a slight short deep brown down, close-set and very smooth, covers the breast; bill black, but the point lighter; naked skin of the head rusty ash. It is about the size of a turkey. Total length 3 feet 3 inches.

It is found in India and Ceylon.

It is very voracious. It lingers all day near the sea-shore to prey on the dead fish thrown up by the waves. The species lives generally on carrion, and is said to disinter corpses. The flight of these vultures is heavy, and, like their congeners, they sometimes assemble in vast numbers on the battle-field.

V. Kolbii, Kolbe's Vulture. This is the Stront-Jager of Kolbe, and the Chasse-Fiente of Temminck. The head is covered with downy ferruginous feathers, which are whitish on the back of the neck; a ruff of loose ferruginous or dirty white feathers round the back of the neck; cere blackish; iris black; back and wings ferruginous or gray-brown; quills black; belly rather lighter ferruginous; feet brownish; claws black. Size less than that of the Griffon Vulture, but in general aspect and plumage very like that species. It is however easily distinguished. In Kolbe's Vulture the feathers of the wings and of the lower parts are all rounded at the end. In the Griffon Vulture they are long and acuminated. In Kolbe's Vulture the ruff is neither so long nor so abundant as in the Griffon, and the adult is nearly entirely of a whitish-Isabella colour. The adult Griffon is uniform bright brown throughout.

It is found in Barbary, and different parts of Africa, India, and Java.

Kolbe's Vulture (*Vultur Kolbii*).

V. auricularis, the Sociable Vulture. This is the Oricou of Le Vaillant and the French; and Ghaip, with the preceding clapping sound, of the Namaqua Hottentots. It has the head and greater portion of the neck red and naked, with the exception of a few hardly discernible hairs; beak horn-coloured, tinged with yellow at its base; iris chestnut. The folds of red naked skin originate behind the ears, surround the upper part of them, and then descend several inches, being irregular in their outline and nearly an inch broad at their widest part. Throat covered with hairs inclining to black.

This gigantic species, a fit machine for assisting in the clearance of the soil of Africa from the putrid bodies of elephants, hippopotami, rhinoceroses, and giraffes, haunts the caverns of rocks, and is altogether a mountain bird. There its night is passed, and there among the lofty crags it retires to repose when it has sated its appetite. Le Vaillant saw large flocks of them perched at sun-rise on the precipitous entrances to their abodes, and sometimes the extent of the rocky region was marked by a continued chain of these birds. Their tails are worn down by friction against their craggy haunts and by the soil

of the plains, in consequence of the laborious efforts which they make to raise themselves into the air; when once on the wing however their flight is grand and powerful. They rise higher and higher, till their enormous bulk is lost to human ken; but though beyond the sphere of man's vision the telescopic eye of the bird is at work. The moment any animal sinks to the earth in death, the imperceptible vulture detects it. Does the hunter bring down some large quadruped beyond his powers to remove, and leave it to obtain assistance—on his return, however speedy, he finds it surrounded by a band of vultures, where not one was to be seen a quarter of an hour before.

It is a native of South Africa. It has been taken in the neighbourhood of Athens, and must be therefore added to the catalogue of European birds; but it does not appear in Mr. Gould's grand work of the 'Birds of Europe.'

Sociable Vulture (*Vultur auricularis*).

Gypaëtus barbatus.—This is the celebrated Lämmergeier. It is the Avoltoio Barbuto of the Italians; the Weissköpfige Geier Adler, and Bartadler of the Germans; and Bearded Vulture of the English.

Head and upper part of the neck dirty white; a black stripe extends from the base of the beak, and passes above the eyes; another, arising behind the eyes, passes over the ears; lower part of the neck, breast, and belly, orange-red; mantle, back, and wing-coverts, deep gray-brown, but on the centre of each feather is a white longitudinal stripe; wings and tail-feathers ashy-gray, the shafts white; tail long, very much graduated; beak and claws black; feet blue; iris orange; eye surrounded by a red lid. Length about four feet seven inches.

According to the age of the bird the plumage varies as follows:—there are brown feathers more or less on the top of the head; those of the lower part of the neck, breast, and belly often terminated with black; the white stripe on the middle of the feathers of the back and the coverts of the wings more or less developed; the belly often of a gray brown or variegated with white; iris of a more or less deep orange colour.

The young in the first two years have the head and neck of a brown-black; the lower part of the body gray-brown with spots of dirty white; on the upper part of the back are great white spots; the mantle and the wing-coverts are blackish with brighter spots; quills blackish-brown; iris brown; feet livid.

It inhabits the highest mountains of Europe, Asia, and Africa, the chain of the Pyrenees, and the Helvetian Alps, Sardinia, Greece, and the Tyrol. In Asia, the chain of the Caucasus, the Himalaya Mountains, the Siberian and Persian Mountains. It is also found in the lofty mountains of Central Africa and towards the borders of the Red Sea, principally in the most inaccessible parts of those mountains, and where there is plenty of the larges sort of game.

"Unlike the typical vultures," says Mr. Gould, "which are distinguished by their bare necks, indicative of their propensity for feeding on carrion, the Læmmergeyer has the neck thickly covered with feathers, resembling those of the true eagles, with which it also accords in its bold and predatory habits, pouncing with violent impetuosity on animals exceeding itself in size; hence the young Chamois, the Wild Goat, the Mountain Hare, and various species of birds find in it a formidable and ferocious enemy. Having seized its prey, the Læmmergeyer devours it upon the spot, the straight form of their talons disabling them from carrying it to a distance. It refuses flesh in a state of putrefaction, unless sharply pressed by hunger; hence nature has limited this species as to numbers: while, on the other hand, to the Vultures, who are destined to clear the earth from animal matter in a state of decomposition, and thus render the utmost service to man in the countries where they abound, she has given an almost illimitable increase."

Bearded Vulture (*Gypaëtus barbatus*).

Neophron percnopterus. This is the Vautour Ourigourap of Le Vaillant, the Rhachamah or Pharaoh's Hen of Bruce and others, Avoltoio Aquilino and Caporaoccajo of the Italians, and Maltese Vulture of Latham. Head and only the front of the neck covered with a naked skin of a livid yellowish colour; the whole plumage pure white, except the great quill-feathers, which are black; feathers of the occiput long and loose; cere orange, iris yellow, mandibles blackish; feet livid yellow, claws black, tail very much graduated. Length two feet and a few inches.

According to age, the bird varies in its plumage, being either deep brown spotted with rusty, or bright gray-brown varied with white and yellow feathers. In this state the naked part of the head is livid, the cere white slightly tinged with orange, the iris brown, and the feet livid white.

The young in the first year have the naked part of the head livid, covered with a thin gray down; cere and feet gray ash; the whole plumage deep brown varied with yellowish-brown spots; greater quill-feathers black; iris brown.

It is found (very rarely) in the north of Europe, in Switzerland in the neighbourhood of Geneva. Very common in Spain on the Pyrenees, Portugal, Malta, Turkey, and in the Archipelago. Nowhere so abundant as in Africa. Russia as far north as Astracan, Arabia, Persia; the Deccan (Col. Sykes).

In October, 1825, one of these birds was killed near Kilve in Somersetshire. It was, when first seen, feeding upon a dead sheep, and had so gorged itself with flesh, that it was either incapable of flight or indisposed for exertion, and was easily shot. At the same time, another bird, apparently of the same species, was seen in the neighbourhood, but escaped.

This vulture does not congregate, except when an all-attractive carcass calls them together, but goes in pairs, the male and female seldom parting company. "In the districts which this species

inhabits," says Mr. Yarrell, "every group of the natives has a pair of these vultures attached to it. The birds roost on the trees in the vicinity, or on the fences which bound the inclosures formed for their cattle. They are to a certain degree domiciled and harmless. The people do them no injury: on the contrary, they are glad to see and encourage them, because they clean the premises of all the offal and filth they can find. In default of other food they eat frogs, lizards, and snakes."

Egyptian Vulture (*Neophron percnopterus*). (Gould.)

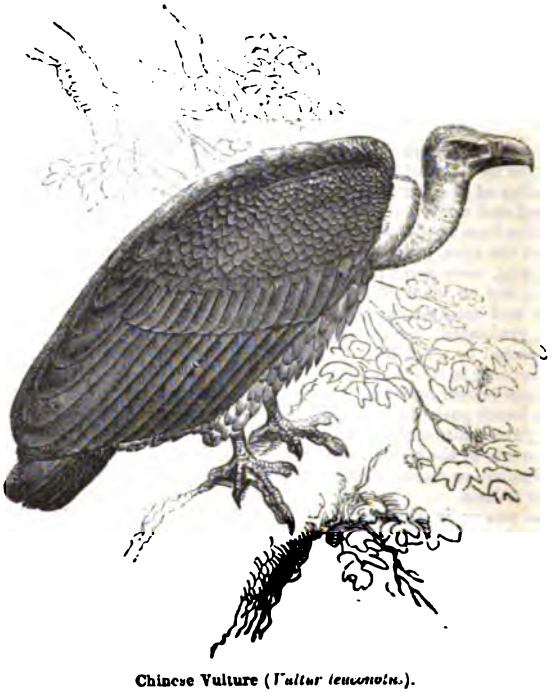
Sarcoramphus papa, the King Vulture, or King of the Vultures. This is the Coxcaquauhtli (Queen of the Vultures) of the Mexicans (Hernandez). The naked skin of the head and neck brilliantly coloured. Beak reddish, with a shade of black; cere bright orange, prolonged between the nostrils into a comb about an inch and a half long, loose in texture, and falling on either side of the bill when the head is erect. Round the eye a scarlet circle; iris nearly colourless; side of the head purplish black. Back of the head covered with short down inclining to black. On each side behind the eye several broad and deep wrinkles of the skin, whence rises a thick and prominent fold extending obliquely downwards along the neck, reddish-brown mixed with blue, and marked with many lines of small black hairs. From the bright red upper part of the neck the colour gradually lessens in intensity, fading into orange and yellow towards the lower part. Round the bottom of the neck is a broad ruff of soft, downy, deep ashy-gray feathers.

Young of the Year, &c.—Deep bluish, with the exception of the abdomen and lateral tail-coverts, which are white. In the next year the young becomes dusky, marked with longitudinal white spots, and up to that time the greater portion of the head and neck is blackish-violet. The colouring which marks the adult is assumed in the third year, excepting a few black feathers among the upper coverts of the wing.

With a highly developed sense of smelling and a piercing sight, the expanse and strength of the wing of the King Vulture enables it to reach a lofty height, and there remain, bringing its powers of observation to bear over a wide tract of country. Patient under hunger, this vulture is said never to attack birds and quadrupeds, however small, while they are alive, though, when pressed with hunger from the want of its favourite carrion, it will feed upon snakes and lizards. This bird is found occasionally in Florida, in the United States, which is probably the northern limit. It is common in Paraguay, but, according to D'Azara, not going beyond 32° S. lat. Between the limits, especially towards the central parts of America, it appears to be abundant.

King Vulture (*Sarcoramphus papa*).

Vultur leuconotus, the Chinese Vulture. This bird is brownish-black; lower part of the back white, as are the wings beneath and the inside of the thighs; when the wings are closed the white on the back is not seen; head brownish-black with short dark hairs; back of the neck covered with whitish down, the front of it livid flesh-colour and bare; at the bottom of the back of the neck is a dirty white ruff; on each side white feathers lap over the bottom of the neck and the crop; the cere is blackish; the bill horn-colour, black at the tip; iris dark; legs dirty brown-white with black scales; claws black. It is the size of a turkey.



Chinese Vulture (*Vultur leuconotus*).

W

WACHENDO'RFIA, a genus of Plants belonging to the natural order *Hæmodoraceæ*, named after E. J. Wachendorf, professor of botany at Utrecht. It has an inferior flower, with 6 permanent withering irregular oblong parts; the 3 upper ones most erect, of which the two lateral ones have each a spur at the base; the 3 lower ones widely spreading. The stamens are 3, with thread-shaped, divaricated declining filaments, shorter than the corolla; the anthers oblong, incumbent. The ovary is superior, roundish, with 3 furrows; style thread-shaped, declining; the stigma simple, tubular. The fruit is a 3-lobed triangular-obtuse compressed capsule, with 3 valves, and 3 cells. The seeds are solitary, rough or hairy, and compressed.

W. thyrsifolia, Tall-Flowering Wachendorfia, has perennial smooth leaves, with a close oblong panicle. It is a native of the Cape of Good Hope, and thrives well in greenhouses in this country, and it will grow in the open air in fine seasons in May and June. The flowers are of a fine golden colour. The root is perennial, and of a saffron or red colour. Many of the plants belonging to *Hæmodoraceæ* yield a matter used for dyeing, and De Candolle remarks that it is probable the species of *Wachendorfia* might be used for the same purpose.

WACKE, a barbarous name formerly much employed by German geologists, and thence introduced into English geology. It is regarded as a soft and earthy basalt, but has been used in other senses, and rather indefinitely. (Ansted, *Elementary Geology*.)

WAD. [Manganese.]

WADING-BIRDS. [Grallæ; Grallatores.]

WAGEL. [Laridæ.]

WAGNERITE, a Mineral, consisting of *Fluophosphate of Magnesia*. Its primary form is an oblique rhombic prism. Fracture uneven. Colour yellow, of different shades; often grayish. Streak white. Hardness 5·0 to 5·5. Lustre vitreous. Translucent. Specific gravity 3·11. It is found in the valley of Holgraben in Salzburg. It contains phosphoric acid, hydrofluoric acid, magnesia, oxide of iron, and oxide of manganese.

WAGTAILS. [Motacillinæ.]

WAHLENBE'RGIA, a genus of Plants named after Wahlenberg, author of the 'Flora Japonica' and other works. It belongs to the natural order *Campanulaceæ*, and many of the species embraced in it were formerly included under the genus *Campanula*. The species consists chiefly of herbs, which are for the most part annual. The leaves are mostly alternate, sometimes opposite, and are generally found in greatest abundance at the lower part of the plant. The flowers are seated on long peduncles, drooping at first, but erect in fruit. The calyx is 3-5 cleft; the corolla 3-5 lobed at the apex, rarely divided to the middle. The stamens 3-5 in number, free, the filaments broadest at the base. The style inclosed, pilose, especially at the upper part; stigmas 2-5. The ovary combined with the tube of the calyx. The capsule 2-5-celled, opening by as many valves as cells at the apex, each bearing a dissepiment in the middle. The seeds very numerous and minute. Above 50 species of plants belonging to this genus have been described. They are most abundant in the southern hemisphere, and are particularly numerous at the Cape of Good Hope. The following is one of the most remarkable forms presented by the genus:—

W. hederacea, Ivy-like Wahlenbergia, is a glabrous plant with slender ascending stems; the leaves are placed on long petioles, cordate, and bluntly 5-7 angled; the corolla 5-lobed at the apex, four times longer than the lobes of the calyx; the capsule hemispherical. This plant is a native of the west of Europe and of North America: it is abundant in Great Britain in Cornwall and Sussex, and is also found in Epping Forest. It is also a native of Scotland and Ireland. This plant was called *Aikinia hederacea* by Salisbury, in honour of John Aikin, a British botanist. It is the *Campanula hederacea* of Linnæus, who was followed by Smith, Hooker, and others.

WALAN, the name of a tree in Amboyna, which was first described and figured by Rumphius, in his 'Herbarium Amboinense,' and called by him *Ichthyoctonos montana*. It is a large tree, and much valued by the natives of the island in which it grows. It is very rare, and the description of Rumphius is too imperfect to allow at present of its being assigned to any particular division of the vegetable kingdom.

The inhabitants of the isle of Amboyna use the bark of the roots for catching fish. Before it is used for this purpose it is powdered, and this process by the natives is always attended with a peculiar ceremony. The bark of the root is the part of the tree employed, and when it is collected for fishing, a large party attends. It is powdered by a single individual with a large stone, and whilst this process is going on, the rest lie round the stone in a circle; when all is over, a signal is given by one of them crowing like a cock; they then arise and collect the powder into little baskets which is reserved for use. In catching the fish other ceremonies are employed. The party goes in the morning early, and after throwing the powder upon the water and mixing it till it foams, they cast a net over the river, and then retire from the river, maintaining a death-like silence till the poison has acted on the fish. In the course of an hour the net is generally found full of half-dead fish. The fish will recover from the effect of the poison if thrown into fresh-water, and are quite wholesome as food, although they will not keep so long as fish caught by other means. Rumphius procured some of the bark, and, omitting the ceremonies, found it a very successful mode of fishing.

WA'LCHIA, a genus of Fossil Plants. [Coal Plants.]

WALKE'RA, a genus of Plants named after Richard Walker, D.D., founder of the botanic garden at Cambridge. It belongs to the natural order *Ochnaceæ*, and is known by possessing 5 petals, 5 stamens with ovate anthers; an obovately kidney-shaped fruit, which is a drupe; an inverted embryo with a hooked beak. There are two species of this genus known. *W. serrata* has serrate crenate leaves, racemes of flowers somewhat corymbose, and the lobes of the calyx lanceolate. It is a native of Malabar and Ceylon, and has yellowish flowers and reddish fruit. The roots and leaves are very bitter, and are used in decoction by the inhabitants of Malabar as a tonic and anthelmintic. *W. integrifolia* is a native of French Guyana, and has entire leaves.

WALL-CRESS, the common name of the Plants belonging to *Arabis*, an extensive genus in the natural order *Cruciferæ*. Nearly 70 species of this genus have been described; they are most of them small plants, fond of growing in dry stony places and on walls, and hence their English name Wall-Cress. Their fruit is a linear silique, with flat 1-nerved valves. The seeds are oval or orbicular, compressed, in one row in each cell; the cotyledons are flat. The radical leaves are usually stalked, whilst those of the stem are sessile, or embrace the stem; they are entire or toothed, rarely lobed. The whole plant is frequently covered with hairs, of which those on the stem are simple, whilst those on the leaves are bifid or trifid. The flowers are white in most instances, rarely red. Several of the species are natives of Great Britain, and many of them are cultivated in gardens on rock-work and flower-borders, on account of their blooming early in spring.

A. turrita, Tower Wall-Cress, has leaves embracing the stem; the pods all on one side, recurved, flat, and linear; the bracts foliaceous. This plant is a native of Europe, in Spain, France, Switzerland, and Italy. In Great Britain it appears to be almost an entirely academical plant, as the only localities mentioned are the walls of colleges at Oxford and Cambridge.

A. hirsuta, Hairy Wall-Cress, has hairy toothed leaves, numerous straight pods, and the pedicels the length of the calyx. It is a native of middle and northern Europe, and also of North America, from Hudson's Bay to the Rocky Mountains. In Great Britain it is found in Sussex, Norfolk, and Suffolk, and also in Scotland.

A. rosea, Rose-Flowered Wall-Cress, has oblong subcordate half-stem-clasping leaves, covered with branched hairs; the pedicels longer than the calyx, and the stigma apiculate. It is a native of Calabria, and has rose-purple flowers.

A. albida, White-Leaved Wall-Cress, has toothed leaves, hoary or downy, with branched hairs. It is a native of Taurida and the Caucasus. It has large white flowers, and is a tufted plant, often cultivated in English gardens.

WALL-FLOWER. [Cheiranthus.]

WALL-PELLITORY. [Parietaria.]

WALL-RUE. [Asplenium.]

WALLI'CHIA, a genus of Plants belonging to the natural order *Byttneriaceæ*, named in honour of the late Dr. Wallich, superintendant of the East India Company's Botanical Garden at Calcutta.

WALNUT-TREE. [Juglans.]

WALRUS. [Phocidæ.]

WALTHE'RIA, a genus of Plants belonging to the natural order *Sterculiaceæ*, named after three botanists of the name of Walther and Walter. The genus is known by possessing a 5-cleft calyx, furnished with a lateral 1-3-leaved deciduous involucel; 5 petals; a single style with tuberculated or pencilled stigma; a 1-celled, 2-valved, 1-seeded capsule. The species are small shrubs, with small usually yellow-coloured flowers, disposed in axillary or terminal stalked heads, rarely in panicles, rising in clusters from the branches.

W. Durandinha has a suffruticose ascending stem, with ovate or ovato-orbicular leaves, obtuse, and cordate at the base; the lower ones pilose, the upper ones tomentose and glaucous; the heads of the flowers terminal and axillary; the calyx pubescent; the petals bearded above the claw; the tube of the stamens entire. This plant is a native of Brazil, on the banks of the river Uruguay, where it is called Durandinha, or Douradinha. This plant, like the whole of the order to which it belongs, contains much mucilaginous matter, and is used in decoction in the Brazils, as a remedy in diseases of the chest, and also in some of the forms of venereal disease. It is also used as an external application to wounds.

WANDEROO. [Macacus.]

WAPITI. [Cervidæ.]

WARBLERS. [Sylviadæ.]

WARNERIA, a genus of Plants named after Mr. Warner. This genus, which is now called *Hydrastis*, has but a single species. It belongs to the natural order *Ranunculaceæ*. The calyx is composed of three ovate sepals. The petals are wanting. The stamens and ovaries are numerous. The fruit is baccate, numerous, collected into a head; 1-celled, 2-seeded.

H. Canadensis is a small perennial herb, with tuberous roots. It is a native of North America, in watery places in tracts along the Alleghany Mountains, from Canada to Carolina. The head of its fruits very much resembles that of the raspberry. The root of this plant has been used both for dyeing and in medicine. It gives a beautiful yellow colour, and on that account has been called yellow-root. It is bitter, and acts on the system as a tonic, and for this purpose is recommended by Professor Barton.

WART-CRESS. [SENEBIERA.]

WART-HOG. [SUIDÆ.]

WARWICKITE, a Mineral, occurring in prismatic crystals of a brownish to an iron-gray colour, often tarnished, bluish, or copper-red. Lustre metallic, pearly to imperfectly vitreous or resinous. Hardness 5 to 6. Specific gravity 3 to 3·3. It is infusible before the blow-pipe. It is an American mineral, and is found in Magnesian Limestone. Professor Shepard says it is a fluo-titanate of iron, with some yttria. It has since been examined by Mr. Hunt, who says it contains no fluorine, and pronounces it to be a silicate and titanate of iron, magnesia, and alumina, with 7 per cent. of water. He calls it *Enceladite*. (Dana, *Mineralogy*.)

WASHINGTONITE, nearly allied to ilmenite. [TITANIUM.]

WASPS. [VESPIDÆ.]

WATER, in its liquid, aëriform, or solid state, is universally diffused through nature. It was once considered as one of the four elements, and is in common language still frequently so termed. Water however is now known to be a compound substance, consisting of hydrogen and oxygen, in the proportion of two volumes of the former gas and one volume of the latter; or by weight it is composed of 1 equivalent of hydrogen, 1, and 1 equivalent of oxygen, 8, = 9, its equivalent: it is in fact a protoxide of hydrogen.

Water is colourless, transparent, inodorous, and insipid; it is an imperfect conductor of heat and electricity; it is very slightly compressible, yielding only about 46·65 millionths of its bulk to the pressure of the atmosphere. Its specific gravity is 1, being the unit to which the density of all liquids and solids is referred, as a convenient standard, on account of the facility with which it is obtained in a pure state. A cubic inch of water at 62° Fahr., and 30 inches barometric pressure, weighs 252·458 grains, and as a cubic inch of atmospheric air weighs 0·31 grains, it is rather more than 815 times heavier than an equal volume of air.

Water, like all other fluids and substances, expands by exposure to an increase of temperature, and, with a curious exception, the dilatation within certain limits is proportionate to the degree of heat to which it is subjected. When water is cooled to 40° it is at the point of its greatest density, it then goes on expanding as it cools till reduced to 32°, when it solidifies, and this constitutes the exception to the law of contraction by reduction of temperature. If water at 40° be heated, it expands as the temperature rises, and this is conformable to the general law. This expansion of water by cold produces very important effects in the economy of nature; for if it increased in density, the frozen portions would sink down successively, and thus large bodies of water would become masses of solid ice.

The force with which water assumes the solid state is so great, that iron vessels of great thickness have been burst by it; and glass-vessels or lead-pipes are well known to be destroyed in winter time from the same cause. Ice is lighter than water, its density being 0·94, and hence it floats on water.

Water is commonly divided into certain heads, according to the source whence it is obtained, namely, into Atmospheric Water, including rain and dew; and into Terrestrial Water, comprising spring, river, well, lake, marsh, and sea-water; and, lastly, Mineral Waters. Water is seldom found in a state of perfect purity, but, from its great solvent and absorbent power, it is impregnated with a variety of saline substances, gases, and animal and vegetable substances, either living or undergoing a process of decomposition. The effect of these is to communicate different properties, and generally give it a peculiar taste, and not unfrequently an odour, which, if not cognisable by the blunted senses of man, is so by animals, especially the camel, which can scent water at a great distance in the desert. The specific gravity is often much increased, especially that of sea-water and of mineral-waters, from the saline ingredients, and of some of the great rivers, from the quantity of mud and other matters which they contain.

Rain-Water is commonly reckoned the purest; but it is by no means so free from accidental impregnations as is generally supposed. Whatever foreign ingredients exist in the atmosphere of any place are brought to the ground by the first rain that falls—thus it often contains nitric acid, carbonic acid, and chlorine; minute quantities of iron, nickel, and manganese; as well as of a peculiar organic substance, chemically different from the extractive matter and the gluten of plants and animals, called Pyrrhine. (Daubeny, 'Report,' p. 1.) Occasionally phosphoric acid is found in it, especially when the wind blows from the north-west. Much more important is the presence of ammonia, first pointed out by Liebig ('Chemistry in its Application to Agriculture') as the chief source of the nitrogen found in plants. Rain-Water, from its great purity, has high solvent powers, which fit it well for the part it has to perform in the economy of nature, and also for many operations in the laboratory. In this respect it is nearly equal to distilled water. When collected in the neighbourhood of towns however, it requires to be boiled and strained; and is always contaminated with some soluble and generally dangerous salt of lead, when collected from leaden-roofs or transmitted through leaden pipes or cisterns.

Dew differs little from rain, save in containing more atmospheric air. Ice-Water differs, when first obtained, from rain, it being destitute of atmospheric air, and hence it cannot sustain respiration in fishes; it is for the same reason mawkish and insipid; but by exposure to the air it speedily absorbs a due proportion. Snow-Water is nearly similar.

Spring-Water is of various degrees of purity, according to its source and the strata through which it passes. Its most common source is rain, which percolates through some of the superficial strata, and, meeting with some obstacle, is forced up to the surface. Hence it contains most of the ingredients found in rain-water, and frequently also various saline principles, especially chloride of sodium and salts of lime; when these last are abundant, the water is what is termed 'hard,' though this quality is derived in some cases from other saline principles. "Large springs are in general purer than small ones, and those which occur in primitive countries, and in siliceous rocks or beds of gravel, necessarily contain the least impregnation." (Dr. Paris.) Such is the great purity of some springs, that their specific gravity is almost the same as distilled water. The specific gravity of the spring at Malvern is only 1·0002.

All spring-waters are more or less charged with carbonic acid gas. The sources of this are various, but the following may be mentioned:—

1. The atmosphere. Water has the power of absorbing carbonic acid gas, and that which is contained in the atmosphere, resulting from combustion, respiration, and other processes, is absorbed by water.

2. The decay of animal and vegetable matters and soils, through which waters percolate supply a certain quantity of carbonic acid. All the wells in London which receive water from the surface drainage contain so large quantities of carbonic acid as to render them sparkling and more pleasant to drink; although the source of the carbonic acid points out the dangerous nature of the waters.

3. Water passing through strata in volcanic districts is frequently charged to a great extent with carbonic acid, as the waters of Carlsbad, Spa, Pyrmont, Seltzers, and many other places on the continent of Europe. This would seem to arise from the carbonic acid, in combination with lime and other materials in the interior of the earth, being set free by the internal heat of the earth, finding its way to the strata, through which springs flow.

Spring waters contain saline constituents, according to the nature of the strata through which they flow. Waters percolated from the filth of a town, as in the well-waters of London, contain large quantities of chloride of sodium. Nitrates are found as the result of the decomposition of nitrogeneous matters, and also sulphates and phosphates from the same source. Water from the chalk contains carbonate of lime. The springs near the salt-mines of Cheshire contain chloride of sodium, also iodine and bromine. In the neighbourhood of deposits of oxide of iron or sulphuret of iron, the springs become impregnated with this substance. When a water contains so large a quantity of any of these substances as to have its physical characters much altered, it is called a Mineral-Water, or Mineral-Spring. The study of the composition of mineral-waters throws much light on the composition of the rocks through which they have passed.

Dr. Gairdner, in his 'Natural History of Mineral and Thermal Springs,' has endeavoured to generalise the connection between the composition of mineral-waters and the rock formations from which they flow:—

"1. The salts held in solution in mineral-waters have often no connection with the acid, saline, or earthy matters which enter into the composition of the rocks which they traverse in their passage to the surface of the earth, which seems to be the first index that such waters cannot derive their origin from these formations.

"2. The mineral-waters of the primitive formations are almost all thermal, and generally possess a very high temperature. Their predominant impregnation is usually sulphuretted hydrogen gas, free carbonic acid gas, carbonate of soda, and in general salts with a base of soda, silica, few calcareous salts, except the carbonate of lime in some peculiar situations, and but a small quantity of iron.

"3. The waters of the transition and older secondary formations participate in those belonging to the primitive rocks. They are generally of a lower temperature, though some of them are still very hot; free carbonic acid is much less common, and sulphuretted hydrogen is almost entirely absent. Salts of soda still predominate, but the carbonate is not so common, and the sulphate of lime is found in the greater number of these waters. Silica exists in two or three examples.

"4. The waters of the newer secondary and tertiary formations are as distinctly characterised as those of the primitive rocks, placed at the other extremity of the series. They are all cold. Free carbonic

acid is almost entirely absent. Their predominating ingredients are the carbonate and sulphate of lime, sulphate of magnesia, and oxide of iron.

"5. The trachytic and basaltic formations, and modern volcanic rocks, present in their mineral waters many of the circumstances of temperature and composition which are found in the waters of the granite and other primitive rocks. Sulphuretted hydrogen, carbonic acid, carbonate of soda, carbonate of lime, and silica reappear, and many contain the free sulphuric and muriatic acids. The sulphate of lime, magnesian salts, and oxide of iron are again wanting. Thus, even in the present imperfect state of the science, the phenomena of mineral waters coincide with other geognostic observations, in placing below the granite the origin of the volcanic formations.

"6. It is often found that the mineral waters of a district have almost the same composition, in which case they generally issue from the crystalline and independent formations. In other cases they are subject to great varieties within a comparatively limited space, so that waters of a totally different composition rise close to each other, when they emerge from sedimentary rocks." (Gairdner, p. 242.) [Springs, Mineral, in Arts and Sc. Div.]

One of the next obvious practical distinctions between spring waters is that of thermal and cold. It is found that springs vary in temperature, according to the heat of the strata through which they pass. This is sometimes so great as to become very obvious to the senses. Though had recourse to for medicinal purposes, these springs naturally heated are not found to be more beneficial than those artificially heated. The medical use of the thermal springs has however served to mark their presence in many spots. Thus they are found in this country at Matlock and Buxton, and also at Bath and Bristol. On the continent at Aix-la-Chapelle, Baden Baden, in the Pyrenees, and many other places. Thermal springs are found in connection with volcanic action, and usually where this action is greatest the springs are warmest. This is seen in the Geysers of Iceland. [Geysers.] Heated waters dissolve up a larger quantity of saline constituents than cold waters, hence the amount of change produced by thermal waters is greater than that produced by cold.

Another class of substances which are found in all waters, and which give to many of them a special character, are organic matters. Living organisms, as the microscopic forms of *Algæ* [Diatomaceæ; Desmideæ], are common in almost all kinds of water, and a large number of plants and animals belonging to higher classes live in water. These die and decompose, and before they are resolved into chemical compounds of the organic elements are found in the form of fermenting and putrefying matters, which when taken into the animal system appear capable of producing a tendency to disease. These substances however are not so common in spring-waters as in river-waters. Some of them have been supposed to have a definite chemical nature, and have been named Glairine, Zoogene, Baregene, &c. (Lankester, 'Askern and its Mineral Springs.')

River-Water mostly originates in springs, augmented by rain-water. If it flows over sand or granite, it is found very pure, depositing in its course many earthy salts, especially the calcareous ones, from the escape of carbonic acid. This circumstance renders the water vapid, and less pleasant to drink than spring-water. It possesses however the property of absorbing and retaining oxygen; hence the surface-water both of rivers and the ocean holds more oxygen than the atmospheric air, to the amount even of 29·1 per cent. (Daubeny, p. 6.) This contributes both to the maintenance of the respiration of fishes and growth of aquatic plants, which last are one source of the supply of the oxygen. The abundant supply of water furnished by large rivers offers a great temptation to procure thence the immense quantity required for the use of the inhabitants of towns on their banks. This may or may not be a wise proceeding, according to the nature of the water. If hard, it can only be rendered fit for domestic purposes, such as cooking and washing, by chemical processes, or by long boiling in appropriate boilers. When, in addition to its saline impregnations, numerous adventitious ones, many of a disgusting and most revolting nature, are found, it is clear that such water is very unfit for the use of man. This is unhappily the case with the Thames water furnished to the inhabitants of London; and although the plan of diverting the sewage will get rid of a very objectionable quality in the water, it will leave unaffected the causes of the hardness of the water, which has a less obvious but still very serious influence on the health and comfort of the inhabitants. This is clearly shown in the evidence before the Commission on the Health of Towns, particularly that of Professor Clark of Aberdeen, whose simple process, if adopted by the various water companies, would remove almost every one of the inconveniences; and while costing little, would be attended with a vast saving of soap, soda, and labour, along with a diminution in the tear and wear of linen and everything required to be washed in it.

Lake-Water varies much in its composition. The main difference depends on the lake possessing an outlet or being destitute of one. The water of the former generally corresponds with that of the rivers which flow into it; but the flow becoming slower, there is more scope for the development of animal and vegetable life, and for the decomposition of organic remains. Those destitute of an outlet are mostly salt-water lakes, containing the same ingredients as the ocean, but in a more concentrated state. (Daubeny, p. 6.) Some lakes abound in tincal, such as the borax-lakes of Tibet.

Marsh-Water is stagnant, and abounds in animal and vegetable remains, either in a state of decomposition or passing into new combinations, generally of a low grade, as the lowest members of the vegetable kingdom and those of each section of the animal are mostly aquatic. These waters are for the most part unwholesome, as they emit mephitic gases, and produce disease if used for drink. The amount of unwholesome gases may be greatly diminished by substituting an active vegetation for an effete one. If these be of a bitter and astringent kind, such as bog-bean and tormentil, it greatly lessens the tendency to disease in the cattle which drink them. Previous to employing them as drinks for human beings, steeping different plants, or rubbing the sides of the vessels with bitter seeds, render them, if not quite pure, at least less noxious. Thus the tea-plant is used by the natives of China and Japan, the *Strychnos potatorum* by those of India, and the bitter almond by those on the banks of the Nile. [Strychnos.]

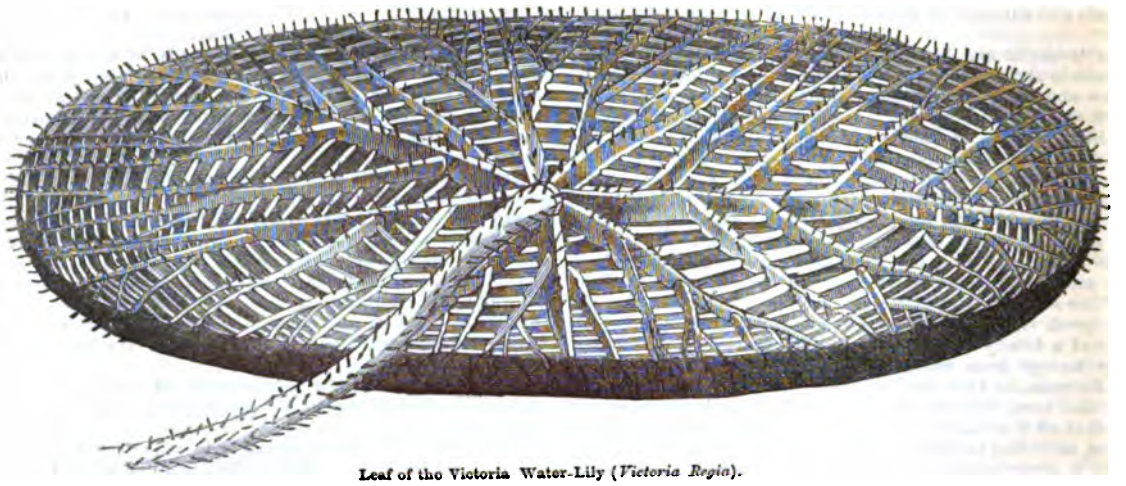
Impure or putrid water may be rendered pure by filtering through sand or charcoal, or by simply pouring it from one vessel to another in the sun.

The water of the ocean abounds in saline matters so much that it is unfit for dietetical purposes. The quantity of salt is not uniform, since the water of the Southern Ocean contains more salt than the Northern, while the proportion present in the water at the equator holds the middle place between the two. (Daubeny, p. 4.) Sea-water may be rendered fit for drinking by pressure, filtration, and freezing, or simply by boiling it, and condensing the steam as it arises. For an account of the composition of sea-water see Sodium, and of the uses of water for alimentary purposes see Food.

WATER-AVENS. [Geum.]
WATER-CALTROP. [Trapa.]
WATER-CHESTNUT. [Trapa.]
WATER-CRESS. [Nasturtium.]
WATER-CROW, a name for the Water-Ouzel. [Merulidæ.]
WATER-CROWFOOT. [Ranunculus.]
WATER-FLEA. [Daphnia.]
WATER-FLY. [Gyrinidæ.]
WATER-GUT. [Ulvaceæ.]
WATER-HEMLOCK. [Cicuta.]
WATER-HEN. [Rallidæ.]

WATER-LILY, the common name for the species of the family *Nymphæaceæ*. [Nymphæaceæ.] One of the most beautiful and the largest of the tribe is the *Victoria Regia*. This splendid plant, in the dimensions of its leaves, their varied tints, the colour, size, and fragrance of its flowers, may deservedly be called the queen of flowers. The following is the account of its discovery by Sir Robert Schomburgk:—"It was on the 1st of January, while contending with the difficulties nature opposed in different forms to our progress up the river Berbice, that we arrived at a point where the river expanded and formed a currentless basin. Some object on the southern extremity of this basin attracted my attention; it was impossible to form any idea what it could be, and, animating the crew to increase the rate of their paddling, we were shortly afterwards opposite the object that had raised my curiosity—a vegetable wonder. All calamities were forgotten; I felt as a botanist, and felt myself rewarded;—a gigantic leaf, from five to six feet in diameter, salver-shaped, with a broad rim, of a light green above and a vivid crimson below, resting on the water. Quite in character with the wonderful leaf was the luxuriant flower, consisting of many hundred petals, passing in alternate tints from pure white to rose and pink. The smooth water was covered with the blossoms, and as I rowed from one to the other I always observed something new to admire." The leaves are very large, measuring five or six feet in diameter. They have an orbicular form, the upper surface is bright green, and they are furnished with a rim round the margin from 3 to 5 inches in height; on the inside the rim has a green colour, and on the outside, like the under surface of the leaf, it is of a bright crimson; they have prominent ribs, which project an inch high, radiating from a common centre; these are crossed by a membrane, giving the whole the appearance of a spider's web; the whole leaf is beset with prickles, and when young is convolute. The stock of the flower is an inch thick, and studded with prickles. The calyx is 4-leaved, each sepal is 7 inches in length and 4 inches broad; the corolla covers the calyx with hundreds of petals; when first opened it is of a white colour, but subsequently changes to pink; it is very fragrant. Like all other water-lilies, its petals and stamens pass into each other, a petal often being found surmounted with half an anther. The seeds are numerous, and imbedded in a spongy substance. This plant has by some botanists been placed in the genus *Euryale*, whilst Lindley thinks it is nearer *Nymphæa*, from which it differs in the sepals and petals being distinct, the papilla of the stigma being prolonged into a horn, and the changing colour of its petals.

This splendid plant has now been successfully cultivated in many of the hot-houses of this country. Beautiful specimens are to be seen in the Royal Gardens at Kew, and at the Crystal Palace, Sydenham.



Leaf of the Victoria Water-Lily (*Victoria Regia*).

WATER-MELON. [CUCUMIS.]
WATER-MILFOIL. [MYRIOPHYLLUM.]
WATER-OUZEL. [MERULIDÆ.]
WATER-PEPPER. [ELATINACEÆ; POLYGONUM.]
WATER-PLANTAIN. [ALISMACEÆ.]
WATER-PLANTS. [ALGÆ; NYMPHÆACEÆ; HYDROCHARIDACEÆ; CORALLINACEÆ; CHARACEÆ; DIATOMACEÆ; DESMIDIEÆ; PISTIACEÆ; HALORAGACEÆ.]
WATER-RAIL. [RALLIDÆ.]
WATER-RAT. [MURIDÆ.]
WATER-SHIELDS. [HYDROPELTIDEÆ.]
WATER-SOLDIER. [STRATIOTES.]
WATER-SPANIEL. [SPANIEL.]
WATER-STARWORT. [CALLITRICHE.]
WATER-VIOLET. [HOTTONIA.]
WATER-WAGTAIL. [MOTACILLINÆ.]
WATERS, MINERAL. [WATER.]
WATERWORTS; some species of *Elatine* are so called.

WAVELLITE. *Hydrargillite, Devonite*, or *Lasionite*. This Mineral, which is a phosphate of alumina, was discovered by Dr. Wavel, hence its name. It occurs in globular concretions from a very small size to that of an inch in diameter; these consist of small slender crystals radiating from a centre, with imperfect terminations. Primary form of the crystal a right rhombic prism. Cleavage parallel to the lateral planes, and the greater diagonal of the prism. Hardness 3·5 to 4. It scratches carbonate of lime. Colour nearly white; gray, brown, yellow, and green of various shades. Lustre vitreous, somewhat pearly on the cleavage planes. Transparent, translucent. Specific gravity, 2·337. Before the blow-pipe it swells and becomes snow-white; when powdered, it dissolves without effervescence in nitric and sulphuric acids when heated, and gives out an acid which slightly corrodes glass.

This mineral is found at Barnstaple in Devonshire; near Cork, Ireland; in Cornwall, Germany, Brazil, &c.

Analysis of the mineral from Barnstaple, by (1) Fuchs, (2) Berzelius:

	(1)	(2)
Phosphoric Acid	34·84	33·40
Alumina	37·16	35·35
Water	28·00	26·80
Fluoric Acid	„	2·06
Lime	„	0·50
Oxides of Iron and Manganese	„	1·25
	100·00	99·36

WAX. [BEE.]
WAX-BILLS. [ESTRILDA.]
WAX-MYRTLE. [MYRTUS.]
WAX-PALM. [CEROXYLON.]
WAX-TREE, the common name of the Plants belonging to the genus *Vismia*. [VISMIA.]
WAX-WING. [BOMBYCILLA.]
WAYFARING TREE. [VIBURNUM.]

WEALDEN FORMATION, the uppermost series of the strata usually included by English geologists in the Oolitic System. [GEOLOGY.] This arrangement is justified by the plants, fishes, and reptiles which occur in the formation, for they are generically, and even specifically, more allied to Oolitic than to Cretaceous types of structure. But as the Wealden deposits are of fluviatile origin principally, we do not find in them the usual shells or *Crustacea* of the Oolites, but a peculiar series, of which a few species are also discovered in other districts.

The Wealden beds comprise a series of layers of clay, sand, and shale, with subordinate beds of limestone, grit, and sandstone, which are more or less regularly distributed, and contain remains of fresh-water *Mollusca*, as species of *Cyrena, Unio, Paludina*, &c. Fishes, *Sauria*, and Plants are also found in these deposits, with a few marine *Mollusca*. The following are the characters of the subordinate groups of the formation:—

1. WEALD CLAY.—Average thickness 140 to 200 feet.

Stiff clay of various shades of blue and brown; with subordinate beds of limestone and sand: *Septaria*.	*Paludinæ, Cypris Valdensis, Cyrena*, &c., the bones of reptiles rarely; scales and bones of fishes.	The Wealds of Sussex, Surrey, and Kent; forming the vale between the Downs and Forest Ridge.

2. HASTINGS SANDS.—Average thickness 400 to 500 feet.

a. Horsted Sand.

Gray, white, ferruginous, and fawn-coloured sand, and friable sandstone, with abundance of small portions of lignite.	Traces of carbonised plants.	Little Horsted, Uckfield, Framfield, Bexhill, Chailey, Fletching, Eridge Park, Tunbridge Wells, &c.

b. Strata of Tilgate Forest.

Sand and friable sandstone, of various shades of green, yellow, and ferruginous, surface oftentimes deeply furrowed. Tilgate stone, very fine, compact bluish or greenish gray grit, in lenticular masses, surface oftentimes covered with mammillary concretions; the lower beds frequently conglomeritic, and containing large quarts pebbles.	Ferns, and stems of vegetables, bones of Saurian animals, birds, turtles, fishes, &c.; shells of the genera *Unio, Cyclas, Cyrena, Paludina*, &c. Lignite wood.	Loxwood, Horsham, Tilgate, and St. Leonard's Forests; Chailey, Ore near Battle, Hastings, &c., Rye, Winchelsea.
Clay or marl; of a bluish gray colour; alternating with sand, sandstone, and shale.	Bones, and shells but rarely. Ferns; and stems of vegetables.	Tunbridge Wells.

c. Worth-Sandstone.

White and yellow friable sandstone and sand.	Ferns and Arundinaceous plants. Lignite, &c.	Worth near Crawley, St. Clement's Caves, Hastings, &c.

3. ASHBURNHAM BEDS.

A series of highly ferruginous sands, alternating with clay and shale, containing ironstone and lignite.	Ferns, Lignite, &c.	Lower part of Hastings Cliffs; near Buxted; West Hoathly; Crawley, &c.
Shelly limestone, alternating with sandstone, shale, and marl; and concretional masses of grit.	*Cypris*. Shells of the genera *Cyclas* and *Cyrena*; lignite carbonised vegetables.	Archer's Wood, near Battle; Brightling, Pounceford, Burwash, Hurst Green, Eason's Green.

The Dover Railway traverses the beds of the Wealden between Red Hill and the branch-line to Tunbridge Wells, exposing the Weald Clay and Upper Hastings Sands.

The fossils of this group are as follows:—

Plantæ.

Carpolithes Mantelli.
Clathraria Lyellii, Mant.
Endogenites erosa, Mant.
Equisetites Lyelli, Mant.
Lonchopteris Huttoni, Presl.
Lonchopteris Mantelli, Brong.
Pterophyllum Brongniarti, Mant.
Sphenopteris Mantelli, Brong.
S. Phillipsii, Mant.
S. Sillimani, Mant.

Insectæ.

Carabus elongatus, Brod.
Cerylon striatum, Brod.
Acheta Sedgwickii, Brod.
Blatta Stricklandi, Brod
Cixius maculatus, Brod.
Ricania fulgens, Brod.
Asiraca Egertoni, Brod.
Aphis Valdensis, Brod.
Cicada punctata, Brod.
Delphax pulcher, Brod.
Termes grandævus, Brod.
Æshna perampla, Brod.
Simulium humidum, Brod.
Platyura Fittoni, Brod.
Tanypus dubius, Brod.
Sciophila defossa, Brod.
Macrocerca rustica, Brod.
Culex (?) *fossilis*, Brod.
Chironomus extinctus, Brod.
Rhiphus priscus, Brod.

Crustacea.

Cypris, 5 species.

Conchifera Dimyaria.

Corbula alata, Sow.
Cyclas, 7 species.
Mytilus Lyelli, Sow.
Psammobia Tellinoides, Sow.
Unio, 10 species.

Monomyaria.

Gryphæa bulla, Sow.
Ostrea distorta, Sow.

Gasteropoda.

Actæon Popii, Sow.
Bulla Mantelliana, Sow.
Melanopsis, 2 species.
Neritina Fittoni, Sow.
Paludina, 4 species.
Potamidum carbonarium.

Pisces.

* *Placoides.*

Acrodus Hirudo, Ag.
Hybodus, 6 species.
Sphenonchus, 2 species.

** *Ganoides.*

Tetragonolepis mastodontus, Ag.
Lepidotus, 3 species.
Pholidophorus ornatus, Ag.
Ophiopsis penicillatus, Ag.
Gyrodus, 2 species.
Pycnodus Mantelli, Ag.

Reptilia.

Cetiosaurus, 2 species.
Chelonia, 2 species.
Goniopholis crassidens, Owen.
Hylæosaurus armatus, Mant.
Iguanodon Mantelli, Meyer.
Megalosaurus Bucklandi, Mant.
Platemys Mantelli, Owen.
Poikilopleuron Bucklandi, Desl.
Streptospondylus major, Owen.
Suchosaurus cultridens, Owen.
Trionyx Bakewelli, Mant.
Trestosternon punctatum, Owen.

(Tennant, *Stratigraphical List of British Fossils.*)

WEASELS. [MUSTELIDÆ.]

WEAVER-BIRDS. [PLOCEINÆ.]

WEBSTERITE. [ALUMINITE.]

WEEVIL. [CALANDRA; CURCULIO.]

WEINMA'NNIA, a genus of Plants belonging to the natural order *Cunoniaceæ*, named after John William Weinmann, a botanist. The species are trees, and natives of South America and the Mauritius. The leaves are compound or simple, with reticulated petioles; the calyx is permanent and 4-parted; the petals 4; stamens 8; an hypogynous, urceolated disc; the fruit a many-seeded capsule, opening at the dissepiments from the apex; the seeds are roundish and reniform. There are about 40 species of this genus described.

W. tinctoria is a native of the Isle of Bourbon; it has leaves with many pairs of leaflets, which are oblong, serrated, and smoothish; the joints of the rachis spatulate, and the fascicles of racemes many-flowered. This tree is called by the natives of Bourbon Tan Rouge, and is used for dyeing a red colour.

Most of the species of *Weinmannia* possess astringent properties, and may be used for dyeing. On this account they are also often employed in Peru to adulterate the various species of Cinchona barks which are collected for medicinal purposes.

WEISSITE, a Mineral, occurring in oblique rhombic prisms. Colour ash-gray or brownish. Presents only feeble traces of cleavage. Fracture even or coarse granular. Hardness, scratches glass, but is scratched by steel. Lustre pearly or hazy. Scarcely translucent. Specific gravity 2·80. Found at Fahlun, Sweden.

WELD. [RESEDACEÆ.]

WELLS. [SPRINGS; WATER.]

WELLS, MINERAL. [WATER.]

WENLOCK ROCKS. [SILURIAN SYSTEM.]

WENTLETRAP. [SCALARIA.]

WERNERITE. [SCAPOLITE.]

WESTRI'NGIA, a genus of Plants belonging to the natural order *Lamiaceæ*, named after Dr. Westring. The species are natives of Australia.

WETHERE'LLIA, a genus of Fossil Fruits.

WHALEBONE. [CETACEA.]

WHALES. [CETACEA.]

WHEAT. [TRITICUM.]

WHEATEAR. [SAXICOLA.]

WHEAT-FLY. [CECIDOMYIA.]

WHEEL-ANIMALCULES. [ROTIFERA.]

WHEELE'RA, a genus of Plants belonging to the natural order *Leguminosæ*, named after Mr. Thomas Wheeler. There is only one species of this genus well made out, and this is a native of America. It is a tree furnished with stipular spines, simple crowded leaves, or trifoliate leaves, with the leaflets sessile. It is called American Ebony, and has the name *W. Ebenus*. It is chiefly a native of the West Indies, and is cut and sent to this country under the name of ebony, though it is a very different plant from the true ebony. The wood is very hard, of a brownish-green colour, and bears a fine polish, and is much employed by cabinet and musical instrument makers.

WHELK. [BUCCINUM.]

WHETSTONE. [SLATE.]

WHIDAH. [PLOCEINÆ.]

WHIMBREL. [SCOLOPACIDÆ.]

WHIN. [GENISTA.]

WHINCHAT. [SAXICOLA.]

WHIP-POOR-WILL, the common name of the *Caprimulgus vociferus*.

This bird is the Wecoälis of the Delaware Indians; and Whippoo-Will of Lawson, "so named," says the latter, "because it makes those words exactly. They are the bigness of a thrush, and call their note under a bush, on the ground, hard to be seen, though you hear them never so plain."

Mr. Nuttall remarks, that in the lower part of the state of Delaware, he found these birds troublesomely abundant in the breeding season, so that the reiterated echoes of 'whip-whip-poor-will,' 'whip-peri-will,' issuing from several birds at the same time, occasioned such a confused vociferation as, at first, to banish sleep. This call, he adds, is continued, except in moonlight nights, usually till midnight, when they cease until again aroused, for a while, at the commencement of twilight. They pass the day in repose, retiring to the deepest and darkest woods, usually those in elevated situations.

Whip-Poor-Will (*Antrostomus* (*Caprimulgus*) *vociferus*).

Caprimulgus Carolinensis, Chuck-Will's-Widow, or Carolina Goat-Sucker, is another species, remarkable for the articular nature of the sounds of its voice. It is also found in the United States.

Flying low, and skimming a few feet above the surface of the ground, it settles on logs and fences, from which it pursues the flying moths and insects on which it feeds; sometimes sailing nearer the earth, it alights to pick up a beetle, or flutters round the trunk of a tree in search of any insect that may be crawling on the bark. Mr. Nuttall, who thus describes its mode of taking its prey, adds, that, like the species above described, it commences its singular serenade of 'chuck-will's-widow' in the evening soon after sunset, continuing the cry with short interruptions for several hours, and renewing it towards morning till the opening dawn. The tones are slower, louder, and more full than those of the Whip-Poor-Will, and may be heard on a still evening for half a mile. "The species," says Mr. Nuttall in continuation, "is particularly numerous in the vast forests of the Mississippi, where, throughout the evening, its echoing notes are heard in the solitary glens and from the surrounding and silent hills, becoming almost incessant during the shining of the moon; and at the boding sound of its fine voice, when familiar and strongly reiterated, the thoughtful superstitious savage becomes sad and pensive."

The same author states that in rainy and gloomy weather these birds remain silent in the hollow log which affords them and the bats a common roost and refuge by day. When discovered in this situation they ruffle their feathers, open their enormous mouths, and utter a murmur, almost like the hissing of a snake, to intimidate the intruder.

"If," says Mr. Nuttall, "superstition takes alarm at our familiar and simple species, what would be thought by the ignorant of a South American kind, large as the Wood-Owl, which, in the lonely forests of Demerara, about midnight breaks out, lamenting like one in deep distress, and in a tone more dismal even than the painful hexachord of the slothful Al. The sounds, like the expiring sighs of some agonising victim, begin with a high loud note, 'ha, ha, ha ha ha! ha! ha!' each tone falling lower and lower, till the last syllable is scarcely heard, pausing a moment or two between this reiterated tale of seeming sadness. Four other species of the Goatsucker, according to Waterton, also inhabit this tropical wilderness, among which also is included the Whip-Poor-Will. Figure to yourself the surprise and wonder of the stranger who takes up his solitary abode for the first night amid those awful and interminable forests, when at twilight he begins to be assailed familiarly with a spectral equivocal bird, approaching within a few yards, and then accosting him with 'who-are-you? who-who-who-are-you?' Another approaches and bids him, as if a slave under the lash, 'work-away, work-work-work-away;' a third mournfully cries 'willy-come-go! willy-willy-willy-come-go!' and, as you get among the highlands, our old acquaintance vociferates 'whip-poor-will, whip-whip-whip-poor-will!' It is therefore not surprising that such unearthly sounds should be considered in the light of supernatural forebodings issuing from spectres in the guise of birds." ('Manual of the Ornithology of the United States and of Canada.')

Chuck-Will's-Widow (*Caprimulgus* (*Antrostomus*) *Carolinensis*).

WHIRLWIG. [GYRINIDÆ.]
WHITE BEAM-TREE. [PYRUS.]
WHITE LEAD. [LEAD.]
WHITE WOOD. [ALBURNUM.]
WHITE-THORN. [CRATÆGUS.]
WHITEBAIT. [CLUPEIDÆ.]
WHITETHROAT. [SYLVIADÆ.]
WHITING. [MERLANGUS.]
WHITLOW-GRASS. [DRABA.]
WHORTLEBERRY. [VACCINIUM.]

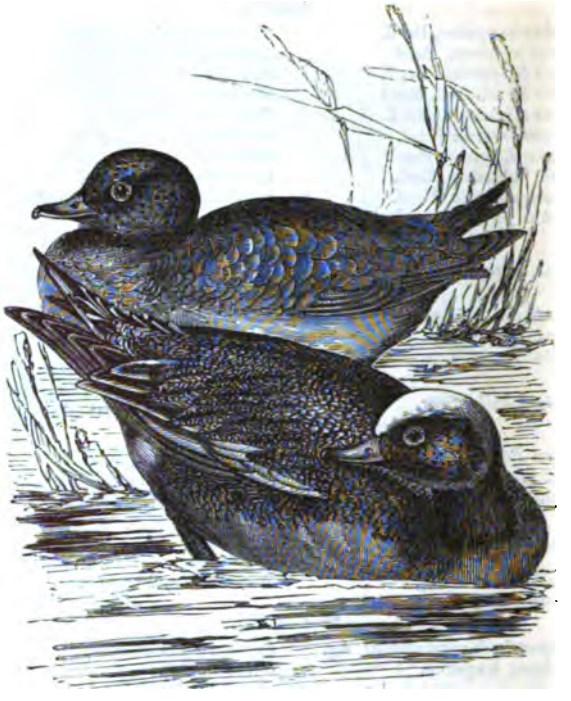
WICHTINE, a Mineral, with its cleavage parallel to the sides of a rectangular prism. Scratches glass. Colour black. Fracture flat, conchoidal. Found at Wichty in Finland. The analysis by Laurent gives—

Silica	56·3
Alumina	13·3
Protoxide of Iron	13·0
Peroxide of Iron	4·0
Soda	3·5
Lime	6·0
Magnesia	3·0
	99·1

WIDGEON, or WIGEON, the common name of the *Mareca Penelope*, *Anas Penelope*, Linn.

This bird is the Canard Siffleur of the French; Anistra Fischiarola, Anatra Marigiana, and Fischione, of the Italians; Pfeifente of the Germans; Smient, Fluit-eend, and Halve-eend-Vogel, of the Netherlanders; Wriand of the Swedes; Bles-and of the Danes; Whewer, Whim, Pundle, Pundle-Whim, Whew, Pandled Whew, Easterling, and Yellowhall, of the English; and Chwiw of the Welsh.

In the article DUCKS an illustration of the American Widgeon is given. We here give one of the Common Widgeon.



Widgeon (*Mareca Penelope*), male and female.

WIDOW-BIRD. [PLOCEINÆ.]
WILD BOAR. [SUIDÆ.]
WILD DUCK. [DUCKS.]
WILD GOOSE. [DUCKS.]
WILD SWAN. [CYGNINÆ.]
WILLEMITE. [ZINC.]
WILLOW-HERB. [EPILOBIUM.]
WILLOW-WARBLER. [SYLVIADÆ.]
WILLOWS. [SALIX.]

WILLUGHBEIA, a small East Indian genus of Plants belonging to the natural order *Apocynaceæ*, named after Francis Willughby, F.R.S.

W. Edulis, a native of Silhet and Chittagong, yields a milky juice, which concretes into an indifferent kind of elastic rubber or caoutchouc. The natives of the above districts eat the fruit, and esteem it good. The fruit of another species, *W. Martabana*, so called from the province of which it is a native, is yellow, and about the size of an orange.

WILSO'NIA, a genus of Plants belonging to the natural order *Convolvulaceæ*, named after Mr. John Wilson, of Kendal. Wilson was in an humble condition of life, and made great sacrifices for the purpose of enabling him to pursue his favourite study of botany. He is said to have been so anxious to possess Morison's work on plants, that he was about to sell his only cow to purchase it, when a benevolent lady in his neighbourhood presented him with a copy.

WINE. [FOOD; VITIS.]
WINE-TRAP. [ŒNOTHERA.]
WINGS. [BIRDS.]
WINTER ACONITE. [ERANTHIS.]
WINTER BERRY. [AQUIFOLIACEÆ.]
WINTER CHERRY. [PHYSALIS.]
WINTER GREEN. [PYROLA; TRIENTALIS.]
WINTERA. [WINTERACEÆ.]

WINTERACEÆ, a natural order of Exogenous Plants. This order is characterised by possessing hermaphrodite or unisexual flowers; from 2 to 6 sepals, which are sometimes not to be distinguished from the petals; the petals are from 2 to 30 in number, and, when more than 5, in several rows; the stamens are hypogynous, short, indefinite, and distinct, arranged in a single whorl, 1-celled; the embryo is very small and straight, and situated at the base of a fleshy albumen. The order consists of small trees or shrubs, with alternate, dotted, coriaceous, persistent leaves; convolute deciduous stipules; and solitary, sweet-scented, brown or chocolate-coloured flowers.

This order has obtained its name, given it by Brown, from *Wintera*, the old name of the *Drimys Winteri*. This name was given in honour of William Winter, a captain in the royal navy, who sailed round the world with Sir Francis Drake. It contains four genera—*Illicium*, *Temus*, *Drimys*, and *Tasmannia*. [ILLICIUM.]

These genera constitute the section *Illicieæ* of the order *Magnoliaceæ* of De Candolle, and the section *Winterææ* of Lindley in the same order. They differ from *Magnoliaceæ* in their dotted leaves, and also in their aromatic qualities. There are about ten species, of which two are found in Australia, two in the hotter parts of America, two in South

and two in North America, one in China and Japan, and one in New Zealand.

Drimys Chilensis.

a, cutting, with flowers and leaves; *b*, flower separated; *c*, carpel.

Temus moschata is a shrub found in Chili. The berries resemble those of the coffee-plant, and are exceedingly bitter to the taste.

Drimys Winteri, the true Winter's Bark, is a tree from 6 to 40 feet in height, and is a native of the Straits of Magalhaens and of Staten-land. This tree was brought back from the Straits of Magalhaens by Captain W. Winter. He had found it useful against scurvy in his ship's crew, and employed it both as a medicine and a condiment for food. [WINTER'S BARK, in ARTS AND SC. DIV.]

D. Granatensis, New Granada Winter's Bark, is a tree about 20 feet high, and grows in the mountains of New Granada and Brazil. In New Granada this tree is called Agi, and in the provinces of Quito and Popaya, Canela de Parama. Several varieties have been described. The bark of all of them is aromatic and stimulating, and is much used by the natives where they grow, both as a medicine and for seasoning their food.

Tasmannia aromatica is a native of Australia, especially in Van Diemen's Land. It possesses the same aromatic qualities as the species of the other genera of the family.

WIRE-WORM. This name is applied indiscriminately to the larvæ of several species of Beetle, which are injurious to the roots of corn and other plants. They mostly belong to the family of *Elateridæ*, and the perfect insects, on account of their leaping movements, are called Skipjacks. The most common form of Wire-Worm in England is the larva of *Elater* (*Cataphagus*) *sputator*. The last segment of the body of this larva is entire and long, resembling a bit of wire—hence the name given to these insects. [ELATERIDÆ.]

WISTA'RIA, a genus of Plants belonging to the natural order *Leguminosæ*, named after Caspar Wistar, professor of anatomy in the University of Pennsylvania. It has the following characters:—The leaves are unequally pinnate, and without stipules. The flowers are arranged in terminal racemes, and are of a blue lilac colour; when young they are accompanied by bracts which fall off as the flowers expand. The calyx is campanulate, somewhat bilabiate, the upper lip has two short teeth, the lower lip three teeth, which are subulate; the corolla is papilionaceous; the stamens diadelphous; a nectariferous tube girds the stipe of the ovary; the legume is coriaceous, 2-valved, 1-celled, and rather torulose. The species are deciduous twining shrubs, natives of North America and China. They grow vigorously in Great Britain, and form when in flower the handsomest ornaments of our gardens. The following are the species:—

W. frutescens, Shrubby Wistaria, has the wings of the corolla each furnished with two auricles; the ovary glabrous; the flowers odoriferous. This is an elegant climbing plant, and is a native of Virginia, the Carolinas, and Illinois, in boggy places. The flowers open from July to September. They are of a bluish-purple colour, the standard having a greenish-yellow spot at the base. They give out a sweet scent.

W. Chinensis, Chinese Wistaria, has the wings of the corolla each furnished with one auricle; the ovary villose; the flowers large. This plant is a deciduous twiner, and is a native of China, and was introduced into this country in 1816. It flowers in Great Britain in May and June, and sometimes produces a second crop of flowers in August. This species was originally called *Glycine Chinensis*, a name which in some places it still retains.

WISTONWISH, a common name given to the *Arctomys* (*Spermophilus*?) *Ludovicianus*. It is a native of the banks of the Missouri and its tributaries.

According to Sir John Richardson it is the Prairie Dog of Gass; Prairie Dog, or Wistonwish, of Pike; Petit Chien, Prairie Dog, Barking Squirrel, and Burrowing Squirrel, of Lewis and Clark, but not the Burrowing-Squirrel of their third volume; *Arctomys Ludovicianus* of Ord and Say; *Cynomys Socialis et Cinereus* of Rafinesque-Smaltz; *Monax Missouriensis* of Warden; *Arctomys latrans* of Harlan; and Prairie Marmot of Godman.

Mr. Say states that this interesting and sprightly animal has received the name of Prairie Dog from a fancied resemblance of its warning cry to the hurried barking of a small dog. The sound, according to him, may be imitated by the pronunciation of the syllable 'chek, chek, chek!' in a sibillated manner and in rapid succession by propelling the breath between the tip of the tongue and the roof the mouth. The assemblages of their burrows are denominated Prairie-Dog Villages by the hunters. They vary widely in extent: some are confined to an area of a few miles; others extend to a circumference of many miles. Mr. Say further observes that only one of these villages occurred between the Missouri and the Prairie towns; thence to the Platte they are much more numerous. He describes the entrance to the burrow as being at the summit of the little mound of earth brought up by the animal during the progress of the excavation below. These mounds are sometimes inconspicuous, but generally somewhat elevated above the common surface, though rarely to the height of 18 inches. Their form is that of a truncated cone, on a base of 2 or 3 feet, perforated by a comparatively large hole or entrance at the summit or in the side. "The whole surface," continues Mr. Say, "but more particularly the summit, is trodden down and compacted, like a well-worn pathway. The hole descends vertically to the depth of one or two feet, whence it continues in an oblique direction downward. A single burrow may have many occupants. We have seen seven or eight individuals sitting upon one mound. The burrows occur usually at intervals of about twenty feet. They delight to sport about the entrance of their burrows in pleasant weather. At the approach of danger they retreat to their dens, or when its proximity is not too immediate, they remain barking and flourishing their tails on the edge of their holes, or sitting erect to reconnoitre. When fired upon in this situation, they never fail to escape; or if killed, instantly to fall into their burrows, where they are beyond the reach of the hunter. As they pass the winter in a lethargic sleep, they lay up no provision of food for that season, but defend themselves from its rigours by accurately closing up the entrance to the burrow. The further arrangements which the Prairie Dog makes for its comfort and security are well worthy of attention. He constructs for himself a very neat globular cell with fine dry grass, having an aperture at top large enough to admit the finger, and so compactly formed that it might almost be rolled over the floor without injury."

Sir John Richardson observes that the Prairie Dog seems to differ from other American Marmots in the length of its thumb-nail, and to approach in that respect *A. fulvus* of Lichtenstein.

WITCH-ELM, or WYCH-ELM. [ULMUS.]

WITCH-HAZEL. [HAMAMELIDACEÆ.]

WITCHES'-BUTTER. [TREMELLINI.]

WITHAMITE, a Mineral occuring crystallised. Primary form an oblique rhombic prism; it is found also in small imbedded globular masses composed of radiating crystals. Fracture uneven. Hardness, scratches glass readily. Colour, red and reddish-white. Streak white. Translucent; opaque. Specific gravity 3·137. It is not acted on by acids. Before the blow-pipe intumesces and fuses with difficulty into a dark-gray scoria. With salt of phosphorus it dissolves with effervescence into a globule which contains a little silica, and becomes opaque on cooling. It is found at Glencoe in Scotland, and is regarded as a variety of *Epidote*. [EPIDOTE.]

WITHERI'NGIA a genus of Plants belonging to the natural order *Solanaceæ*, named after Dr. William Withering. The species are neither handsome nor useful.

WITHERITE. [BARYTES.]

WITTELSBA'CHIA, the name of a genus of Plants belonging to the natural order *Ternströmiaceæ*. The species are now referred to *Cochlospermum*. [COCHLOSPERMUM.]

WOAD. [GENISTA; ISATIS.]

WÖHLERITE, a Mineral occuring in angular grains, and in tabular crystals. Form undetermined. Cleavage distinct in one direction. Colour light-yellow, wine-yellow, honey-yellow, brownish-yellow. Streak yellowish-white. Fracture more or less conchoidal, splintery. Hardness 5·5. Lustre vitreous. Subtranslucent. Transparent. P

gravity 3·41. Found in an island near Brevig in Norway. The analysis by Scheerer gives—

Silica	30·62
Columbic Acid	14·47
Zirconia	15·17
Lime	26·19
Soda	7·78
Oxide of Iron	2·12
Protoxide of Manganese	1·55
Magnesia	0·40
Water	0·24
	——98·54

WOLF. [CANIS.]

WOLF-BERRY. [SYMPHORICARPUS.]

WOLF-DOG. More than one variety of the dog is known by this name.

The Wolf-Dog of Spain is nearly as large as a mastiff. The nose is pointed, the ears are erect, the coat long and fine, the tail bushy or feathered, and curling over the back. The colour is generally white with large fulvous or brown patches. Sometimes the coat is closer.

The Black Wolf-Dog of the Indians of Florida is described by Bartram as not differing from the wolves of the country excepting in its bark. That this animal is sagacious and trustworthy, appears from the fact that one was trained to watch and keep together horses without any human help.

The Irish Wolf-Dog is now very rare; and, indeed, the breed had been so crossed, that latterly two were seldom seen alike.

WOLF-FISH. [ANARRHICAS.]

WOLFRAM. [TUNGSTEN.]

WOLF'S-BANE. [ACONITUM.]

WOLKONSKOIT, a Mineral occuring amorphous. Structure compact. Fracture imperfect, conchoidal. Hardness 2·5. Colour light emerald-green. Streak bluish-green and shining. Opaque. Nearly dull. Specific gravity 2·2. It is so extremely fragile that it readily falls to pieces on a slight blow. It is found at Perm in Russia. It contains oxide of chromium, oxide of iron, silica, magnesia, and water.

WOLLASTONITE (*Tabular Spar*), a Mineral, consisting of Silicate of Lime. It occurs crystallised and massive. Primary form an oblique rhombic prism. Cleavage parallel to the terminal plane and horizontal diagonal. Fracture uneven. Hardness, scratched by phosphate of lime. Colour white, gray, yellow, red, and brown. Streak white. Lustre vitreous. Translucent, transparent. Specific gravity 2·805. The amorphous varieties are composed of columnar crystals lying in all directions, or fibrous, the fibres being either parallel or divergent. Before the blow-pipe on charcoal the edges are melted into a semitransparent colourless glass; but it requires a very great heat to fuse it perfectly; with borax it readily melts in large quantity into a transparent glass.

It is found in very perfect crystals at Vesuvius, at Capo di Bove near Rome, in the Bannat, Ceylon, North America, Sweden, &c.

WOLVERINE. [GULO.]

WOMBAT. [MARSUPIATA.]

WOOD. [EXOGENS; TISSUES, VEGETABLE.]

WOOD-APPLE. [FERONIA.]

WOOD-AVENS. [GEUM.]

WOOD-CHAT. [LANIADÆ.]

WOOD-COCK. [SCOLOPACIDÆ.]

WOOD-LARK. [ALAUDINÆ.]

WOOD-LEOPARD. [ZEUZERA.]

WOOD-LOUSE. [ISOPODA.]

WOOD-PIGEON. [COLUMBIDÆ.]

WOOD-RUSH. [LUZULA.]

WOOD-SAGE. [TEUCRIUM.]

WOOD-SORREL. [OXALIS.]

WOOD-STRAWBERRY. [STRAWBERRY.]

WOOD-SWALLOW. [SWALLOW-TRIBE.]

WOOD-WARBLER. [SYLVIADÆ.]

WOOD-WREN. [SYLVIADÆ.]

WOOD-RUFF. [ASPERULA.]

WOODBINE. [LONICERA.]

WOODPECKERS. [PICIDÆ.]

WOODSIA, a genus of Ferns, having circular sori, with an inferior involucre, divided at the edges into numerous capillary segments.

W. ilvensis is one of the rarest of our British Ferns; it is found in only two localities in Europe, one in Wales, and one in Scotland. It takes root in the fissures of rocks and in the bleakest part of mountainous places. The fronds are elongated, the pinnæ triangular, with deep lobes, the rhizoma tufted. There are varieties of this species, which are by some writers considered as distinct species, but Mr. Babington thinks this division unnecessary.

(Babington, *Manual of British Botany;* Newman, *British Ferns.*)

WOODY TISSUE. [TISSUES, VEGETABLE.]

WOOL. The curly hair of sheep and other animals is called Wool. [HAIR.]

WOOL COTTON. [GOSSYPIUM; COTTON.]

WOOL-TREE. [ERIODENDRON.]

WOOLD. [RESEDACEÆ.]

WOORALY. [STRYCHNOS.]

WORBLES and WORNILS, common names given to the larva of the Bot-Fly. [BOTS.]

WORM-GRASS. [SPIGELIA.]

WORMS. [ANNELIDA; ENTOZOA; INTESTINA; VERMES.]

WORMSEED. [SPIGELIA.]

WORMWOOD. [ARTEMISIA.]

WORTHITE, a Mineral, occurring in rolled masses, having a foliated crystalline structure, and sometimes presenting very small apparently 4-sided prisms or plates. Colour white. Hardness 8·5. Lustre vitreous. Translucent. Specific gravity 3·1. Found near St. Petersburg, and on the shores of the Bay of Finland. Analysis, by Dr. Hess: Silica, 40·79; alumina, 53·06; magnesia, 0·88; water, 4·63.

WOUND-WORT. [STACHYS.]

WOW-WOW. [HYLOBATES.]

WRASSE. [CRENILABRUS; LABRIDÆ.]

WREN. [TROGLODYTINÆ.]

WRIGHTIA, a genus of Plants belonging to the natural order *Apocynaceæ*, named after Dr. William Wright. It has a 5-parted calyx, a salver-shaped corolla with the throat crowned by ten divided scales; the stamens exserted, attached to the throat of the corolla, and the anthers sagittal, cohering by their middle to the stigma; the ovaries two, cohering; the style single, filiform, dilated at top; scales five to ten in number, seated at the base of the calyx outside the corolla: the follicles distinct or combined with adnate placentas.

W. antidysenterica is a native of Ceylon, and has sweet-scented flowers with a form resembling those of the Jasmine. The wood is white, of a fine grain, and susceptible of polish, and is used by the turner and cabinet-maker. The bark of this shrub, which goes by the name of Conessi bark in Great Britain, and Palapatta in India, is asserted to be a specific in dysentery and of use in most disordered states of the bowels. Its milky juice is also used as a vulnerary.

WRYNECK. [YUNX.]

WYCH-ELM. [ULMUS.]

WYCH-HAZEL. [HAMAMELIDACEÆ.]

WYDLE'RIA, a genus of Plants belonging to the natural order *Umbelliferæ*, named after H. Wydler, a botanist.

X

XALLE, the Turkish name of the seeds of the Prickly Christ's Thorn, *Paliurus aculeatus*. [PALIURUS.]

XANTHIDIUM. [DESMIDIEÆ; INFUSORIA.]

XANTHITE. [IDOCRASE.]

XA'NTHIUM, a genus of Plants mostly referred to the natural order *Compositæ*, but of which Link forms a small order called *Ambrosiaceæ*. The genus *Xanthium* has monœcious flowers; the male flowers have a many-leaved involucrum, tubular petals, and a paleaceous receptacle; the female flowers have an involucrum with a single leaf, which is bilocular, and embraces two flowers without petals. The species are herbs.

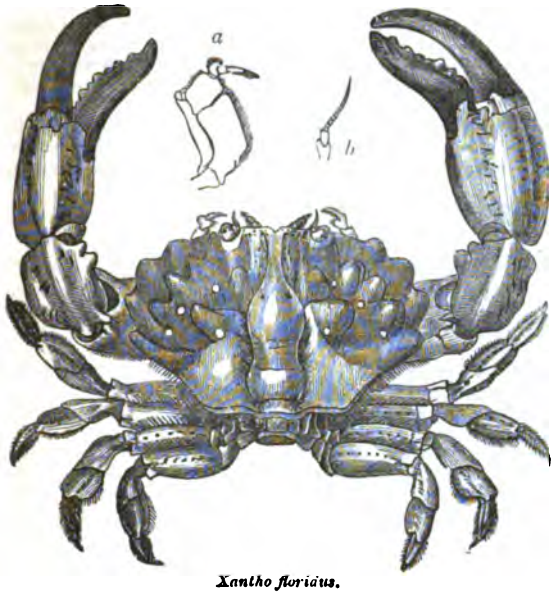
X. strumarium, the Lesser Burdock of English botanists, is a naked plant, with the lower leaves cordate, 3-lobed, toothed, and 3-nerved. It is found on roadsides and in cultivated places in Great Britain and other parts of Europe. *X. spinosum* is found in the south of Europe. It has entire or 3-lobed leaves, and is covered with 3-forked spines. An infusion of this plant is sometimes used as a yellow dye; hence the generic name, from ξανθος, yellow.

(Koch, *Flora Germanica;* Burnett, *Outlines.*)

XANTHO (Leach), a genus of Brachyurous *Crustacea*, placed by M. Milne-Edwards among his Cancerians Arqués [PLATYCARCINUS], between the genera *Lagostoma* and *Chlorodius*. The carapace is very wide, but never regularly ovoid, and with but little convexity; its surface generally entirely horizontal transversely, and not curved in its longitudinal direction, except on the anterior portion. Front ordinarily advanced, lamellar, and nearly horizontal; a narrow fissure divides it into two lobes, the border of which is more or less notched in the middle. The orbits present nothing remarkable, and resemble those of the Crabs and of *Zozymus*. The antennary fossets are narrow, transversal, and separated by a delicate partition. The basilary joint of the external antennæ is placed as in the *Zozymi*, but is in general shorter. The species are numerous, and spread in all seas.

We illustrate the genus by *X. floridus*, which is common on the English and French coasts, about two inches in length, of a reddish brown-colour, with black claws. (See next page.)

XANTHOCHYMUS, a genus of Plants belonging to the natural order *Guttiferæ*. It is by some botanists referred to the genus *Stalagmites* [STALAGMITES], from which it differs in its hermaphrodite flowers, and its stamens being disposed in five bundles. Three species of East Indian plants have been described under *Xanthochymus* by Dr. Rox-

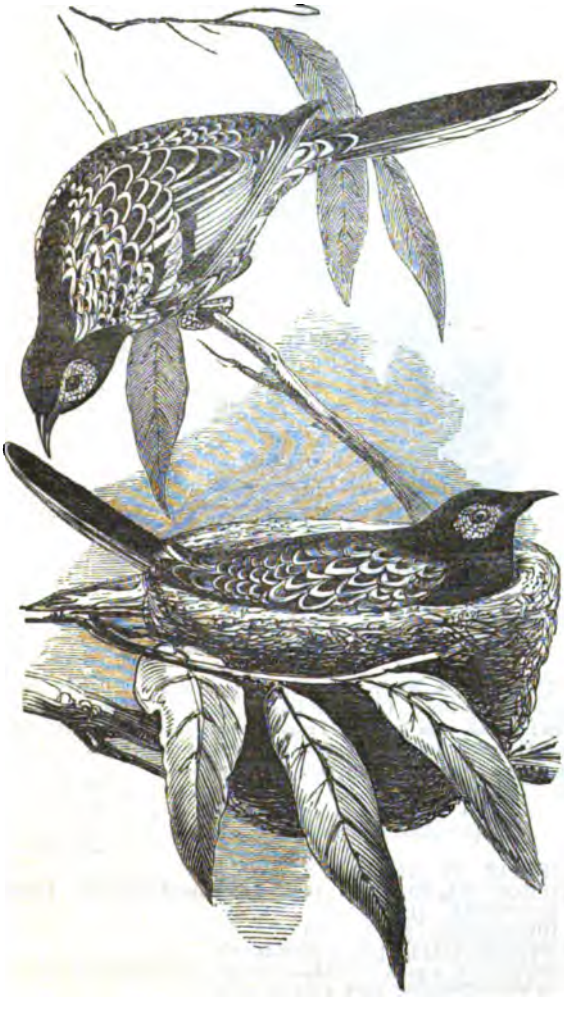


Xantho floridus.

a, external jaw-foot; *b*, external antenna.

burgh. Of these the *X. pictorius* is the most important. This plant is the *X. tinctorius* of Linnæus. It has lanceolate acuminate leaves, wrinkled petioles, and fruit 1-4-seeded. It is a native of the East Indies, in valleys among the Circar Mountains.

XANTHOMYZA, called by Swainson *Zanthomiza*, is a sub-genus of



Xanthomyza phrygia. (Gould.)

Meliphaga. [MELIPHAGIDÆ.] The bill is moderate, much curved; the culmen considerably arched. Face naked. Middle the much longer than the hallux. The tenuirostral type. (Sw.)

X. phrygia is the *Merops phrygius*, Black and Yellow Bee-Eater, and Black and Yellow Honey-Eater of Latham; Embroidered Bee-Eater of Shaw; Warty-Faced Honey-Eater and *Meliphaga phrygia* of Lewin; Le Merle Écaillé of Le Vaillant; *Philedon* of Temminck; *Philemon phrygius* of Vieillot; *Anthochæra phrygia* of Vigors and Horsfield; and Mock Regent Bird of the colonists of New South Wales.

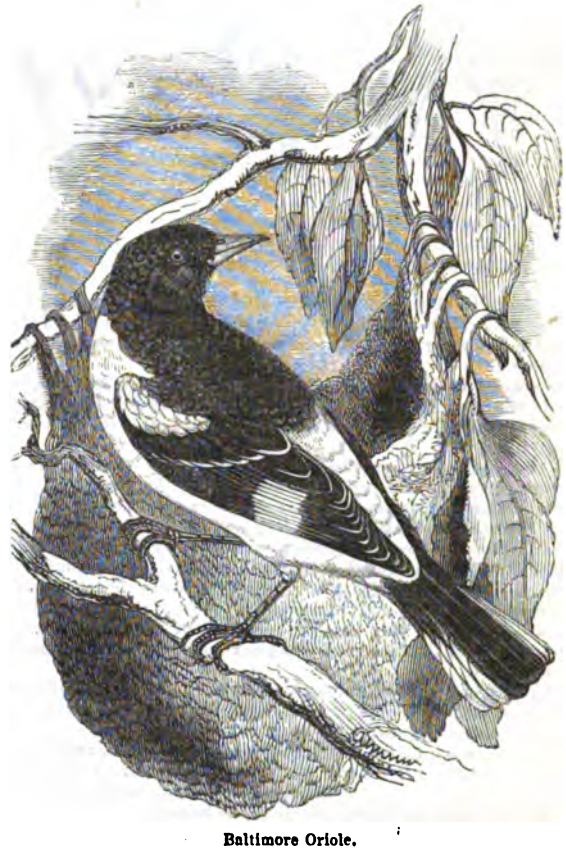
Sexes nearly alike in colouring, but the female much smaller than the male. The young destitute of the warty excrescences on the face, that part being partially clothed with feathers. It is a native of Australia.

XANTHOPHYLL. When Chlorophyll loses its green colour in autumn, it has been supposed that a new principle, Xanthophyll, takes its place. [CHLOROPHYLL.]

XANTHOPHYLLITE. [CLINTONITE.]

XANTHORHI'ZA, a genus of Plants belonging to the natural order *Ranunculaceæ* and the tribe *Pæonieæ*. It has a calyx composed of 5 deciduous sepals; 5 petals; 2- to 3-seeded carpels, but the seeds are usually solitary from abortion. There is but one species of this genus, *X. apiifolia*, which is a small shrub, a native of North America from Virginia to Georgia, where it grows on the shady banks of rivers, and is commonly known by the name of Yellow-Root. The bark of the root is intensely bitter, and is used in America as a tonic, but the plant has also acrid properties.

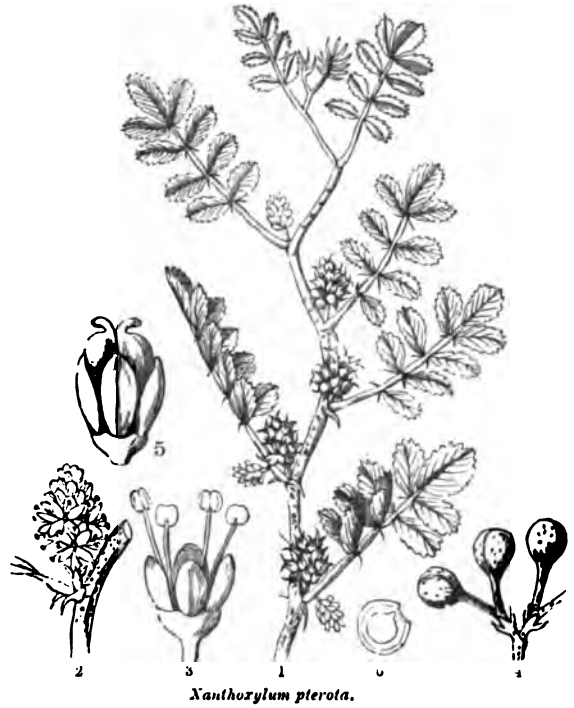
XANTHORNUS, a genus of Birds described in the article STURNIDÆ. We subjoin a representation of the Baltimore Oriole, or Golden Robin, which belongs to this genus.



Baltimore Oriole.

XANTHOXYLA'CEÆ, *Xanthoxyls*, a natural order of Exogenous Plants. The flowers are unisexual and regular; the calyx in three, four, or five divisions; the petals usually of the same number as the divisions of the calyx, usually longer than the calyx, and sometimes absent; the æstivation is generally twisted and convolute; the stamens are equal in number to the petals, or twice the number, and arise from around the base of the stalk of the abortive carpels; in the female flowers they are either absent or very imperfect; the ovary is made up of the same number of carpels as there are petals, or of a smaller number; the carpels are either distinct or more or less combined; there are mostly two ovules in each cell, sometimes four; the styles are more or less combined, according to the cohesion of the carpels; the fruit is either membranous or in the form of a berry, sometimes having from 2 to 5 cells, and sometimes consisting of several drupes or 2-valved capsules, of which the ex-carp is fleshy, and is easily separated from the endocarp; the see

solitary or twin, pendulous, usually smooth and shining with a testaceous integument; the embryo lies in the midst of a fleshy albumen, radicle superior, and the cotyledons ovate or flat. The species of plants belonging to this order are trees or shrubs, with exstipulate, alternate, or opposite leaves furnished with pellucid dots. The flowers are either axillary or terminal, and coloured gray, green, or pink.



Xanthoxylum pterota.

1, branch with leaves, flowers, and fruit; 2, flowers separated; 3, male flower; 4, stalked capsules; 5, female flower; 6, section of seed.

The plants in this order were included originally by Jussieu in his *Terebintaceæ*. They were first separated by Martius and Nees under the order *Xanthoxyleæ*, which was subsequently adopted by Adrien de Jussieu.

The species of *Xanthoxylaceæ* are found chiefly in America, especially in the tropical parts. A few of the species are found in Africa, in Mauritius and Madagascar, in India and China. One only is a native of Australia.

All this order, to a greater or less extent, possess aromatic and pungent properties. The species which are best known and used on account of these properties belong to the genera *Xanthoxylum*, *Brucea*, *Ptelea*, *Toddalia*, and *Ailanthus*. [BRUCEA; TODDALIA.]

Xanthoxylum fraxineum is a tree attaining a height of 14 or 15 feet, and is an inhabitant of North America from Canada to Virginia. The bark of this tree and its capsular fruit have a hot acrid taste, and are much used as a remedy for the toothache: it is on this account called Toothache-Tree, and this name is now applied to all the species of *Xanthoxylum*. A tincture of the bark is recommended as a remedy in rheumatism.

X. hyemale is a native of Brazil, where it is called Coentrilho, and the natives make use of a powder of the bark for the earache. The wood is also good and useful for many purposes.

X. Budrunga is a native of the East Indies, in Silhet, and is called Budrung; and the natives use the seeds, which have a warm spicy flavour, medicinally. The fruit is about the size of a pea, and the outer coat contains an exceedingly fragrant balsam.

X. Rhetsa is a native of the mountainous parts of the coast of the East Indies, and in the Telinga language is called Rhetsa-Maun, which means Council-Tree, as it is under the branches of this tree that the hill people assemble to discuss all matters of public interest.

X. emarginatum is a native of Cuba and Jamaica. It is a tree about 20 feet in height, with the branches inclining to the ground. On burning the wood of this tree the smoke is exceedingly odoriferous, and is supposed to have been the origin of the fine scent which Columbus perceived before discovering the island of Cuba.

The capsules and seeds of *X. hostile*, called Tej-bul by the natives, are used in India for intoxicating fish, and are supposed to be the Faghureh of Avicenna. In Japan the capsules of *X. piperitum* are used as a substitute for pepper. The fruits of many of the species are also held to be antidotes to the action of poisons on the system, and there can be little doubt that the secretions of these plants would be found valuable stimulant remedies in many diseases.

The *Ptelea trifoliata* is a native of North America, and the young green shoots are used in infusion as an anthelmintic.

The species of *Ailanthus* are large trees, and their timber is used for various purposes in the countries in which they grow. *A. glandulosa* is a native of China and the Moluccas, where it is called Ailanto. It attains a height of 60 feet. When the bark is wounded it gives out a resinous juice, which hardens in a few days. The wood is hard and heavy, and is susceptible of a very fine polish. It grows well in England. *A. Malabarica* is a large tree, a native of Malabar. The wood is used for making sheaths for spears, &c. A resinous juice flows from the bark when wounded. The fruit is triturated with maize and mixed with rice in decoction, and used as an application in ophthalmia.

XANTHO'XYLUM. [XANTHOXYLACEÆ.]

XEMA. [LARIDÆ.]

XENOLITE, a variety of Sillimanite.

XENOPELTIS, Reinwardt's name for a genus of Serpents which have two great triangular and imbricated plates behind the eyes, so that they are confounded with the scales which succeed them, and which above become smaller. The form belongs to the great group of *Coluber*.

XENOPS, Illiger, a genus of Birds, placed by Mr. Swainson in his family *Certhiadæ*, as the last genus of his sub-family *Certhianæ*.

X. genibarbis may be regarded as an example. It is a native of Brazil.

Mr. Swainson remarks that this extraordinary and not inelegant little creature has a bill totally different from that of any other bird. Its general habit, he states, evinces a close connection with the *Sittæ*, particularly those of Australia, some of which have their bills (which are slender) slightly inclining upwards, thus forming a connection between *Xenops* and the Straight-Billed *Sittæ* of the Old World.

Xenops genibarbis. (Swainson.)

XENOTINE, a Mineral occuring crystallised. Primary form a right square prism. Cleavage lateral, perfect. Colour yellowish-brown; streak pale brown. Fracture uneven and splintery. Hardness 4·25 to 5·0. Lustre resinous. Opaque. It is found at Lindesnaes, in Norway. Its analysis, by Berzelius, gives—

Phosphoric Acid	33·49
Yttria	62·58
Subphosphate of Iron	3·93
	——100

XIPHIAS. [SCOMBRIDÆ.]

XIPHOSO'MA, Fitzinger's name for a genus of Serpents. [BOIDÆ.]

XIPHOSURA. [LIMULUS.]

XIPHOSURUS. [IGUANIDÆ.]

XIPHOTEUTHIS. [*See* SUPPLEMENT.]

XIPOTHECA, a genus of Fishes belonging to the family *Tænioides*.

XULIONOSPRIONITES, a Fosil Fruit.

XYLITE. [IRON.]

XYLOCARPUS (from ξύλον, wood, and καρπός, fruit), a genus of Plants belonging to the natural order *Meliaceæ*. This genus, with *Persoonia*, has been referred by Aublet and other botanists to the genus *Carapa*. [CARAPA.]

XYLO'COPA (*Wood-Cutters*), a genus of Insects of the sub-family *Scopulipides*, Latreille, or *Anthophorides*. The insects composing it are characterised by the very thick coating of hairs upon the hind legs of the females, which constitute pollen-brushes. The basal joint of the posterior tarsi usually exhibits its extremity angularly produced. They have no pollen-plates, and the abdomen is destitute of a ventral pollen-brush. The wings have usually three perfect submarginal cells; the third joint of the antennæ is frequently long and clavate, being very slender at the base; the mouth is sometimes considerably developed. Notwithstanding the shortness of the wings and the comparative bulk of the body, these insects fly with much strength and activity, and with a loud buzzing noise.

The sexes differ considerably (in many cases), both in colour and structure; the males in some cases having very long antennæ, while in others the posterior femora are much thickened, and in a few the tarsi of the intermediate legs are furnished with curious brushes of hair. The face is frequently of a pale yellow-colour. The females are usually of darker and more obscure colours than the males. They form their nests in crevices of old walls or in banks exposed to the sun. Their cells are composed of earth and are very smooth in the inside, and the mouth of the nest is closed with the same material.

The wings of the *Xylocopa*, or (as they are frequently termed) Carpenter-Bees, are most frequently (although not always) black, with a fine purple or violet gloss. The habits, &c. of a French species, the *X. violacea*, have been carefully studied. The females of this species appear in the spring, and select posts, palings, &c. in which they construct burrows from 12 to 15 inches in length, and rather more than half an inch in diameter. The two extremities of the tunnel are covered, leaving a narrow passage at each end. Upon the completion of these works, they deposit an egg at the bottom, with a due supply of pollen-paste; the whole is then covered with a layer of agglutinated sawdust, formed during the construction of the burrow. The layer thus formed is made to act in the double capacity of a roof for the original cell and a floor for another above it. In this manner about twelve cells are usually formed. When the larvæ are full grown, they assume the pupa state, head downwards, so as to allow the lowermost and oldest to make its way out of the bottom of the burrow as soon as its wings are sufficiently developed, and which consequently occurs sooner than in those in the upper cells.

The males of some of the larger species, *X. latipes*, and some others not yet properly described, have the fore-legs greatly dilated. An excellent history of the *Xylocopa* is given by Réaumur ('Mém.,' tom. vi., mém. iv.).

XYLO'MA, a genus of *Fungi* approaching in character *Sphæria*. From this genus it was formerly distinguished by negative characters, such as the sporidia not being external. All the species which were referred to this genus are placed by Berkeley under the genera *Sphæria*, *Hysterium*, *Phacidium*, &c. The most common species of this genus are found on the decaying leaves of trees, especially of the sycamore and maple, the leaves of which are frequently covered with black spots, the results of the attacks of *Fungi* formerly referred to this genus.

XYLOMELON, or XYLOMELUM. [PROTEACEÆ.]

XYLOPHAGA. [PHOLADIDÆ.]

XYLO'PHAGI (*Wood-Eaters*), a family of Insects of the order *Coleoptera Tetramera:* they are distinguished from the family which usually precedes them (the Weevils) by the absence of a proboscis. [CURCULIO.] The antennæ are thickened towards their extremities, or perfoliated from the base; always short, and usually composed of less than eleven joints. The tarsi, which in some cases appear to be 5-jointed, are usually entire, the penultimate joint being dilated in some species and cordiform in others. In the latter case the antennæ are always terminated by a club, either solid and ovoid or trifoliate, and the palpi are short and conical. These insects generally live in wood, which is perforated and channelled in various directions by their larvæ. Some species are destructive to pines and firs, some to olives, while others feed on *Fungi*.

This family is divisible into three sections.

Section I. Those which have the antennæ composed of ten joints at least, either terminated in a thick club, generally solid, or having three elongated plates, or forming a cylindric and perfoliate club from the base; the palpi are conical; the anterior tibiæ in the majority are toothed and armed with a strong hook, and the tarsi generally have the penultimate joint bi-lobed. Some have the palpi very short, and the antennæ terminated in a solid or trilamellar mass, preceded by five joints at the least.

These *Xylophagi* compose the genus *Scolytus*, Geoffroy.

In some the penultimate tarsal joint is bi-lobated, and the antennæ have seven or eight joints preceding the club. *Scolytus* proper (Eccoptogaster, Herbst) has the antennæ straight and naked, the club solid and very compressed, its annuli forming concentric constrictions. *S. destructor* (*Hylesinus Scolytus*), the Common Elm-Destroying Scolytus, commits great ravages in the neighbourhood of London. This insect does not appear to restrict itself to the elm, but has also been found upon the plum. Dr. Hammerschmidt, who has frequently observed them in the bark of this tree (in the neighbourhood of Vienna), considers however that it differs slightly from the *S. destructor*, and terms it *S. Pruni*. Except in being smaller, there appears no other distinction.

The perfect insect or beetle is only two lines long, and the majority of them are still smaller; its breadth is about half a line, and it is firm and resisting to the touch. The head and throat form the principal part of the body; they are black and shining, very finely and thickly dotted, and the former (the head) covered with short yellowish gray hairs. The antennæ are of a light pitch-brown, ending in a knob. The wing-cases are obliquely cut off behind, and at the base near the thorax somewhat hollowed: they are marked in dotted lines, and their colours pitch-brown. The abdomen from the base to the apex appears as if slantingly cut off, and is of a similar colour to the thorax and dotted. The legs are of a reddish-brown, and the tibia dilated. The larva is of a yellowish white, and has a relatively large yellow shining head and a brown mouth. It is from one to two lines long, and it exhibits a whitish transparent swelling between the head and the first ring on the throat, which appears to be characteristic of the larva of this species. They confine themselves to the inner bark, forming winding and convoluted paths in it. Much important matter upon the habits and economy of the elm-destroying *Scolytus* will be found in the communication of Audouin and Spence upon this subject, to the respective Entomological Societies of Paris and London.

Hylesinus, Fabr., has the club of the antennæ solid and annulated, but pointed at the tip.

Hylurgus, Latreille, has the club of the antennæ solid, globular, and annulated. *Hylurgus* (*Hylesinus*) *piniperda*, the Scotch-Pine Black Beetle, is somewhat shaggy and black; the wing-cases are pitch-black, irregularly striated and entire at the tips; thorax anteriorly narrowed; antennæ and feet brownish red. The larva is thick, cylindrical, milk-white on the middle of the body; the head dull yellow, as also the front of the body and the anal extremity, only somewhat of a lighter tint. The abode and place of propagation of the perfect insect are in the pith of the side-twigs of the pine.

According to Bechstein, it bores through shoots of the spruce-fir when there are none of the Scotch pine to be had. The eggs are laid under the bark of sickly and felled pines, in the bark of which the maggot resides, while it feeds on the stagnated fermented juice which is found under the bark. The larvæ feed on the trunks of dead or dying trees, and the beetle only places her brood on healthy trees when compelled by necessity to do so. In one respect the ravages of this insect do less injury than those of some others, inasmuch as it generally only attacks the side-twigs, leaving the leading shoot untouched.

Camptocerus, Dej. [CAMPTOCERUS.]

Phloiotribus, Latr., differs from all the rest in the club of the antennæ being formed of three long filaments.

In others the tarsal joints, apparently five in number, are entire, and the club of the antennæ commences at the sixth or seventh joint.

Tomicus, Latr., has no notches at the sides of the thorax, and the tibia are not striated.

Platypus, Herbst, has the sides of the thorax notched to receive the femora, and the tibia are transversely striated. Fossil specimens of this genus have been found embedded in amber.

The others have the palpi large, very visible, and of unequal length; body depressed and narrowed anteriorly; the antennæ either 2-jointed (the second joint being very large and irregularly shaped), or 10-jointed and entirely perfoliated; tarsi entire.

These insects are of great rarity and very singular appearance, and are also foreign to Europe. They compose the genus *Paussus*, Linn.

Paussus proper has only two joints to the antennæ, the second very large and compressed.

P. sphærocerus. Professor Afzelius observed a dim phosphoric light to be emitted from the singular hollow antennæ of this insect. ('Linn. Trans.,' iv., 261.)

Hylotorus, Dalm., composed of a single species, apparently with ocelli, and with the antennæ scarcely longer than the head, and 2-jointed.

Cerapterus, Swed., has the antennæ 10-jointed and perfoliated. (Westwood in 'Trans. Linn. Soc.')

Section II.—Those which have only 10-jointed antennæ, and the maxillary palpi do not taper to a point, but are either of equal thickness throughout or dilated at the extremity. The joints of the tarsi always entire.

They are divisible into two principal genera, according to the mode in which the antennæ terminate. The three terminal joints form a perfoliate club in the first, or *Bostrichus*, Geoff.

Bostrichus proper has the body more or less cylindrical; the head rounded, nearly globular, and capable of being received into the thorax as far as the eyes; the thorax is never less convex before, and forms a kind of hood. The first two joints of the tarsi, as well as the last, are elongated. The species are found in old wood and timber.

B. dispar (*Apate dispar*, Fabr.), *Xyloterus dispar*, Erichson. This Apple-Bark Beetle is very common in Austria, but rare in this country. It is termed *dispar* because the male is not only about half the size of, but differently formed from, the female, bearing more resemblance to *Anisoplia horticola* than to the bark-beetles generally. The her

thorax are black; the extremity of the palpi and antennæ reddish; the wing-cases long, blackish, and somewhat hairy; the feet dilated, and of a reddish-yellow; the thighs black. The female somewhat resembles the Long-Haired Bark-Beetle, (*B. villosus*), but the wing-cases are not deeply furrowed, and the spots not so deep as they are in that species. The male (as we have previously observed) is smaller than the female, and it has chestnut-brown wing-cases and reddish thighs. These insects restrict their attacks almost entirely to the apple-tree. They make no distinction between the age or healthy state of the tree, whether it is young or old, or whether it may shoot out much or little; all that they require is that it should not be of a less thickness than about half an inch in diameter. Having found a suitable place, the female bores a completely round but somewhat oblique hole, penetrating nearly to the centre of the tree; she first goes upwards to the side, and then downwards. Upon coming near the bark, she turns back, and goes to the other side or downwards, forming a new path. These paths, leading upwards and downwards, seldom exceed one inch and a half in length. The minute particles of wood, or wormmeal, which are ejected, indicate the presence of the insect. In the case of the Pine-Beetle (*B. typographus* and *B. piniperda*), it is stated by Bechstein to be ejected by the larvæ, but in this case it is thrown out by the beetle itself.

B. typographicus, the Typographer Bark-Beetle, is perhaps the most destructive of the whole class. It particularly attacks the silver-firs (*Picea pectinata*); but when that tree is not abundant, it will attach itself to other species of pines and firs. The perfect beetle is from two to two and a half lines long, and from one line to one line and a quarter broad, and hairy. As long as it remains under the bark, it is of rusty yellow; but on exposure to the air, changes to a brownish-black colour.

The injury this insect does is chiefly effected by the larvæ, which destroy the sap-wood; and thus, if they are numerous, can kill a healthy fir in the course of a few weeks.

B. orthographus, Duftsch., the Spruce-Fir Bark-Beetle; *B. laricis*, Fabr., the Larch-Bark Beetle; *B. Pinastri*, Bechst., Red Bark-Beetle, require no particular notice.

Psoa, Fabr., has the body narrower than *Bostrichus*, and the thorax flat.

Cis, Latr., has the body oval, depressed, or but little elevated; last tarsal joint much longer than the others; head of the males frequently horned. Many minute species are found on *Fungi*.

Nemosoma, Desmar., has the body long, linear, and the mandibles robust and exserted. *N. elongata* is a small and rare British species, sometimes found under the bark of old palings.

The second genus is distinguished from the first by having the club or tenth joint of the antennæ solid and button-shaped; the body is elongated, with the front of the head narrowed into an obtuse snout or muzzle; the palpi are very small, and, as well as the mandibles, not prominent.

This genus is termed *Monotoma*.

Monotoma proper, Herbst, has the head as large as the thorax, and separated from it by a narrower part.

Corylon, Latr., has the front of the head produced into an obtuse triangle, the first joint of the antennæ much longer than the second; the body nearly oval or parallelopiped, and the elytra not truncate behind.

The genera *Synchita*, Helw., *Rhyzophagus*, Herbst, &c., are included in *Monotoma*, but are not deserving of any especial remarks.

Section III.—The *Xylophagi* of this division have eleven distinct joints in the antennæ; the palpi filiform, or thickened at the tips in some, or slender at the tips in others; the tarsal joints entire. Those in which the club of the antennæ consists only of two joints constitute the genus *Lyctus*.

Lyctus proper, Fabr., has the mandibles and basal joints of the antennæ exposed. *Diodesma*, Megerle, and *Bitoma*, Herbst, are included in the genus *Lyctus*.

In some the mandibles are concealed or scarcely visible. These are the genus *Mycetophagus*.

Mycetophagus proper has the antennæ at least as long as the thorax; body oval; thorax transverse; and the club of the antennæ commencing at the sixth or seventh joint.

Silvanus has the body nearly linear, of greater length than breadth, and as broad as the base of the elytra; palpi nearly filiform. *S. dentatus*, a small flat insect, frequently found floating in tea and coffee, being introduced with the sugar.

In others the mandibles are entirely exposed and large; the body often narrowed and depressed. These insects constitute the genus *Trogosita*. Olivier.

Trogosita proper has the antennæ shorter than the thorax; the mandibles shorter than the head, and crossed; the labium almost square, and not prolonged between the palpi, and the maxillæ have but a single lobe.

T. mauritanica, Linn., a flat Beetle, 4 lines long, of a pitch-black colour, found in nuts, bread, and the bark of trees: its larva is known in Provence under the name of Cadelle, and is said to commit great devastation on grain.

Prostomis, Latr. (*Megagnalus*, Meg.), and *Passandra*, Dalm., belong to this genus.

The reader who has carefully followed us over the three sections of the *Xylophagi* will readily perceive that Latreille makes use of this group for the purpose of effecting a transition between the *Curculionidæ* and *Cerambycidæ*, commencing with those which have the club of the antennæ solid, and proceeding through those families in which the club is less compactly constructed, as far as the *Trogositæ*. In this single character the transition is certainly obvious enough; but in other and more important points, as for instance in the structure of the imago, as well as in that of the larva, it cannot be maintained; and Westwood is probably right in transferring many of the *Xylophagi*, especially the *Trogositanæ*, to the *Necrophaga*.

XYLO'PHILI (*Wood-Lovers*), a section of Insects of the genus *Scarabæus* (Linn.), comprising two divisions, corresponding with the families *Dynastidæ* and *Rutelidæ* of M'Leay.

The *Dynastidæ* (comprising the *Geotrupes* of Fabricius) constitute an extensive series of gigantic insects, the males of which are pre-eminently distinguished by various singular protuberances, horns, or tubercles arising from the head and thorax, and often from both those parts (occasionally giving the insect a very peculiar appearance), and of which the females are destitute. The clypeus is small, triangular, pointed in front, or terminated by two small obtuse teeth; the labrum is a broad membranous plate, entirely concealed by the clypeus; the jaws are very robust and horny, and furnished with one or two obtuse teeth. The maxillæ are either terminated by a coriaceous ciliated lobe, or by an elongated corneous piece, having one or several acute teeth on its inside; the mentum is large, concealing the labrum, and of an ovoid or triangular form, truncated in front; the prosternum is not produced behind into a lobe; the tarsal claws are of an equal size, and the scutellum is distinct; the elytra do not entirely cover the extremity of the abdomen; the antennæ are 10-jointed, with the club 3-jointed, the central lamellæ not being inclosed within the two external ones. [DYNASTES.]

The colour of these insects is usually of a dark rich brown or chestnut colour. They reside either in rich vegetable mould or in the putrid detritus arising from the decomposition of trees.

Oryctes, Illiger, is a very numerous genus, having the legs all nearly of the same length, with the four hind tibia thick and crooked. As a type of this genus, we may take the common continental species, *O. nasicornis*, which is frequently found in the larva state in tan-pits. The eggs are oblong, about the size of a grain of hemp-seed, and of a yellow colour; the larva continues in that state four or five years, and then incloses itself in an oval and very smooth cocoon; the pupa lies upon its back, and the imago remains in its cell for about a month after it has attained the perfect state. The insect is about an inch and a half long, and the male is distinguished by having a curved horn upon the head.

Some of the *Dynastidæ* acquire an immense size. The *Scarabæus Hercules* (Linn.), an inhabitant of South America, is 5 inches long.

The *Dynastidæ* chiefly occur in the tropical zone, there being only 6 or 8 species found in Europe.

According to M'Leay, the proportion of tropical to extra-tropical species may be estimated at about eight to one.

The *Rutelidæ* consist entirely of exotic and for the most part brilliantly-coloured insects, of a moderate size, having the body of an ovate, subconvex, or depressed form, and shorter and more rounded than in the previous family, from which they also differ in the absence of the peculiar horns or prominences which are present on the heads of the male *Dynastidæ*. The antennæ are 10-jointed, the club 3-jointed; the labrum is exserted with the anterior margin coriaceous; the mandibles are short and horny, and more or less exserted with a notch on the outer margin near the tip; the maxillæ are also horny and truncated, and with four or six strong teeth at the tip, with the inside sometimes membranous; the labrum is concealed by the mentum; the elytra do not conceal the extremity of the abdomen; the thorax is transverse-quadrate; the scutellum large and distinct; the mesosternum is anteriorly produced between the base of the middle legs; the legs are robust, with the posterior femora sometimes greatly thickened; the claws of the tarsi are generally unequal in size, and occasionally divided; the clypeus commonly exhibits a transverse section, dividing as it were into two parts before the eyes. (Westwood.) The head and thorax are identical in both sexes.

With a few exceptions, the *Rutelidæ* are confined to the equatorial regions of America.

Hexodon, Oliv., composed of two African species, *Cyclocephala*, Latr. (*Chalepas*, M'Leay), *Rutela*, Latr., *Pelidnota*, M'Leay (*Ophognathus*, King), *Macraspis*, M'Leay, *Chasmodia*, M'Leay, *Ometis*, Latr., &c., belong to this family.

Two of the most remarkable species are the *Chrysophora chrysochlora* [CHRYSOPHORA], and the *Scarabæus Macropus*, which was depicted long since by Francillon under the name of the Kangaroo-Beetle.

XYLOPHYLLA, a genus of Plants belonging to the natural order *Euphorbiaceæ*. The species of this genus are shrubs, with a hard and rigid foliage. They are natives of the West Indies, where they are known by the name of Sea-Side Laurels and Love-Flowers.

XYLO'PIA, a genus of Plants belonging to the natural order *Anonaceæ*. It has a 3-5-lobed calyx, with ovate coriaceous acutish segments; 6 petals, of which the 3 outer ones are largest; numerous

stamens inserted into a globose receptacle; from 2 to 15 carpels on short stipes, flattened, 1-celled, 1-2-seeded, sometimes dehiscent, sometimes baccate; the seeds obovate, shining, furnished with an aril. About twelve species of this genus have been described, all of them natives of South America. They are trees or shrubs, with oblong or lanceolate leaves, and axillary, bracteate, 1- or many-flowered peduncles. The wood of all is bitter, hence they are called Bitter-Woods.

X. frutescens, Shrubby Bitter-Wood, is a native of Brazil and Guyana. The leaves and wood are aromatic. The seeds also contain an acid aromatic oil, and are used in Guyana by the negroes as a substitute for pepper.

X. glabra is a native of the islands of Barbadoes and Jamaica. The wood, bark, and berries have an aromatic bitter taste resembling that of the orange seed. Pigeons feed on the berries, and the flesh of these birds is improved in flavour during the season they eat this fruit. When fresh gathered from the tree the berries have an agreeable flavour, and may be eaten with impunity. The wood readily communicates its bitter flavour. Sugar sent to this country in hogsheads made of it could not be sold on account of the bitter flavour it had acquired. Articles of furniture made of it are proof against the attacks of insects. Persons who work the wood complain of the bitter taste which it produces in their mouths from the dust.

X. sericea is a native of Brazil. It is called in Brazil Páo d. Embeira and Pindaïba. The bark is fibrous and tough, and is used for making cordage and cables. The fruit is highly aromatic, with the flavour of pepper, for which it might be advantageously substituted. Most of the other species possess the toughness of the bark and the aromatic properties of the fruit.

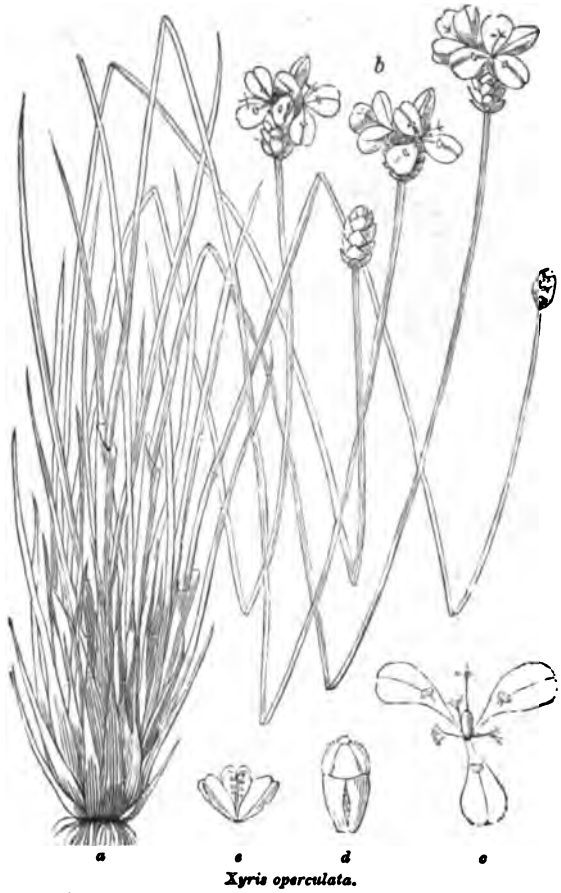
XYLOTOMA. [LEPTIDES.]

XYPHOSOMA. [BOIDÆ.]

XYRICHTHYS, a genus of Fishes allied to the *Labrus*, or Wrasse, which the species resemble in general form, but are much compressed and have the head suddenly truncate in front. Their bodies are covered by large scales, but their heads are usually naked. A species which is esteemed as an article of food inhabits the Mediterranean.

XYRIDA'CEÆ, *Xyrids*, a natural order of Endogenous Plants. The species are herbaceous plants with fibrous roots. The leaves are radical, sword-shaped, scarious, dilated and equitant at the base. The flowers are arranged in terminal naked imbricated heads; the calyx is glumaceous, 3-leaved; the corolla petaloid, coloured, with 3 petals; the stamens 6; 3 fertile, inserted upon the claws of the petals; 3 sterile, alternate with the petals; the anthers 2-celled, and turned outwards; the ovary single, the style bifid; the stigmas multifid or undivided; the capsule 1-celled, 3-valved, many-seeded, with parietal placentæ; the seed with the embryo on the outside of the albumen, and at the end most remote from the hilum.

As at present constituted this order comprises only the genera *Xyris* and *Abolboda*. The species of these genera are found generally in the hotter parts of the world, chiefly in the tropics of America, Asia, and Africa. Some of the species of *Xyris* are found in the southern states of North America. *X. Indica* is said by Agardh to be used as a remedy in itch and leprosy.



Xyris operculata.

a, an entire plant; *b*, heads of flowers; *c*, flower separated; *d*, fruit; *e*, the lower part of the pericarp.

XYRIDALES. [ENDOGENS.]

Y

YAK. [BOVIDÆ.]

YAM. [DIOSCOREA.]

YAPOCK. [MARSUPIATA.]

YARR. [SPERGULA.]

YARROW. [ACHILLEA.]

YEAST, a substance found on the surface of fermenting liquids, and when removed capable of producing fermentation in other liquids susceptible of this action. On placing Yeast under the microscope it presents a number of cells immersed in a mass of amorphous matter. The cells are sometimes single, and at other times several are united together in a kind of chain. These cells are supposed to partake of a fungoid character, and they have been called the Yeast-Fungus, or Ferment-Cells. A genus and species have been constituted for the reception of this organism, under the name of *Saccharomyces Cerevisiæ*.

This plant has been supposed to be the active cause of fermentation, and the carbonic acid given off during that process has been regarded as the result of the growth of the plant. This seems to be a misinterpretation of the phenomena, as the plant is probably the result of the carbonic acid given off during the process of fermentation rather than its cause. Schleiden supposes that these ferment-cells originate in liquids, independently of other cells, and are truly instances of the formation of cells in a free fluid. He observes however that they have no power of reproducing other cells. The whole subject of the nature of these cells, their mode of production, and the history of their development, as well as the phenomena of fermentation in general, require further elucidation.

(Schleiden, *Principles of Scientific Botany; Micrographic Dictionary*, articles 'Fermentation,' 'Torula,' 'Yeast.')

YELLOWHAMMER, the common name for the *Emberiza citrinella*, Linn.

Pennant quotes the Bruant' of Belon ('L'Histoire de la Nature des Oyseaux,' p. 366) as this species, and the description seems to warrant the quotation. Belon considers the bird to be the "*Ayber* of

Yellowhammer (*Emberiza citrinella*).

Aristotle ('Hist. Anim.,' ix. 1), and remarks that the Greeks of his time did not call it by the ancient appellation in their tongue, but by the Latin name *Florus*, "car ils ont esté dominez par les Latins, dont ils ont retenu telle diction." It is the Bruant of the French generally; Serramolle and Zivolo di Testa Gialla of the Italians; and, according to the 'Portraits d'Oyseaux,' Hortolano, Cia, Megliarina, Verzerot, Paierizo, and Spaiarda of the same people. It appears to be the Groning and Golspink of the Swedes; Goldammer, Ammering, and Goldammering of the Germans; Geel-Gerst of the Netherlanders; Yoit, Yellow-Yoldrin, Yellow-Yowley, and Yellow-Yeldrock of the English: and Llinos Felen of the Welsh.

These birds are caught and fatted for the table with the Ortolan in Italy, whence probably one of the Italian names above noticed.

YELLOW-WORT. [CHLORA.]

YENITE. [IRON.]

YEW. [TAXUS.]

YTTRIA. [YTTRIUM.]

YTTRIUM, a peculiar metal discovered in the state of oxide, or earth, and named *Yttria;* it was found by Gadolin in 1794 in a mineral from Ytterby in Roslagen, Sweden; this was at first called *Ytterbite*, and afterwards *Gadolinite*, by which name it is now generally known.

The minerals which contain Yttrium, or rather its oxide, Yttria, are as follows:—

Gadolinite occurs crystalline and massive. Primary form an oblique rhombic prism. Cleavage imperfect, so that its direction has not been ascertained. Fracture flat, conchoidal, sometimes splintery. Hardness 6·5 to 7·0. Colour greenish-black, very dark. Streak greenish-gray. Lustre vitreous, inclining to resinous. Opaque, translucent on the edges. Specific gravity 4·238.

The massive variety is amorphous, structure compact. Before the blow-pipe it decrepitates if not cautiously heated, and does not melt except in small splinters. If heated with precaution on charcoal it incandesces at once, and its colour becomes paler. In nitric acid it loses its colour, and gelatinises.

Gadolinite is found at Ytterby near Stockholm, and at other places in Sweden, and also in Greenland.

This mineral has been repeatedly analysed, and with somewhat varying results: thus, it was examined by Ekeberg, Klaproth, and Vauquelin, without the detection of oxide of cerium, which was found by Berzelius, who gives the following as the composition of the mineral from Broddbo:—

Silica	24·16
Yttria	45·93
Oxide of Cerium	16·90
Oxide of Iron	11·34
Moisture	0·60

In a specimen from Karafvet, Berzelius found 2 per cent. of glucina, and rather more than 3 per cent. of lime. Other analysts have obtained a much larger portion of glucina. Scheerer has more lately detected 4·75 per cent. of oxide of lanthanum in the Gadolinite from Hitterön.

Tankelite, Phosphate of Yttria, occurs crystallised and massive. Primary form a square prism. Cleavage parallel to the lateral faces of the primary crystal. Fracture uneven, splintery. Hardness 4·5 to 5. Colour yellowish-brown. Streak pale brown. Lustre resinous. Opaque. Translucent, in thin splinters. Specific gravity 4·557. Acids do not act upon this mineral. Before the blow-pipe infusible per se on charcoal. With borax dissolves slowly into a colourless glass. It yields no water when heated. It is found in Norway. It contains phosphoric acid, Yttria, and di-phosphate of iron.

Yttro-cerite.—It occurs crystallised and massive. Primary form the cube. Fracture uneven. Hardness—scratches fluor-spar, and is scratched by quartz. Colour violet-blue, grayish-blue, grayish-red, and grayish-white. Opaque. Specific gravity 3·447.

Massive Varieties.—Structure granular, compact. Before the blow-pipe infusible, but loses its colour and becomes white. Acted upon by acids, and the solution gives a precipitate soluble in carbonate of ammonia. Found at Finbo and Broddbo in Sweden. It contains fluoric acid, yttria, oxide of cerium, and lime.

Columbate of Yttria. [FERGUSONITE.]

Titaniate of Yttria. [POLYMIGNITE.]

Yttro-columbite; Yttro-tantalite; Yellow Yttro-columbite.—It presents no trace of crystallisation. It is found between felspar in the state of lamellæ, sometimes in grains not exceeding the size of a peppercorn. The longitudinal fracture of the lamellæ is foliated, the cross-fracture fine-grained. Lustre resinous on the surface, vitreous in the fracture. Colour yellowish-brown, accidentally with green spots or stripes. Streak white. Opaque. Scratches glass with difficulty, but is very distinctly scratched by it. Specific gravity 5·882.

Dark Yttro-columbite occurs with the preceding, commonly in thin laminæ, seldom in grains. Fracture conchoidal in one direction, fine-grained in another. Lustre intermediate between vitreous and resinous. Colour brownish-black. Streak white. Very small fragments are translucent, almost colourless, sometimes a little yellowish. Hardness equal to that of the preceding.

Black Yttro-columbite:—Indistinct traces of crystallisation. Fracture lamellar in one direction, coarse granular in another. Disseminated, seldom the size of a hazel-nut. Lustre imperfect metallic. Opaque. Colour black. Streak gray. Brittle. Scratches glass. Specific gravity 5·395. (Haidinger, 'Mineralogy,' vol. iii., p. 173.)

Analysis of the above by Berzelius:—

	a Yellow.	*b* Brown.	Black.
Columbic Acid	60·124	59·50	51·815	57·00
Tungstic Acid	1·044	1·25	2·592	8·25
Yttria	29·780	29·90	38·515	20·25
Lime	0·500	3·29	3·260	6·25
Oxide of Uranium	6·622	3·23	1·111	0·50
Oxide of Iron	1·155	2·72	0·555	3·50
	99·225	99·89	97·848	95·75

Before the blow-pipe they are all infusible per se, but decrepitate and acquire a lighter colour. They are not acted upon by acids.

The above minerals all occur at Ytterby, and in the neighbourhood of Fahlun in Sweden. [PYROCHLORE.]

YTTRO-CERITE. [YTTRIUM.]

YTTRO-COLUMBITE. [YTTRIUM.]

YTTRO-ILMENITE. [URANIUM.]

YTTRO-TANTALITE. [YTTRIUM.]

YUCCA, a genus of Plants belonging to the section *Asparageæ*, of the natural order *Liliaceæ*. The corolla is inferior, bell-shaped, its segments without nectaries; stamens club-shaped; style none; berry hexagonal, of six cells; seeds numerous, flat.

Y. gloriosa, Common Adam's-Needle, is a caulescent plant, with lanceolate straight furrowed leaves, their edges smooth and entire. This handsome plant is a native of Peru and North America. It grows on the shores of Carolina, where it blossoms in July and August, its panicle of elegant flowers attaining a height of 10 or 12 feet. In British gardens the stem of this plant does not attain a height of more than 2 or 3 feet.

Y. aloifolia, Aloe-Leaved Adam's-Needle, has linear-lanceolate even straight leaves, with the edges bordered by fine callous notches. This plant is a native of North and South America.

Y. draconis, Drooping-Leaved Adam's-Needle, and *Y. flamentosa*, Thready Adam's-Needle, are cultivated in this country. The latter grows in the open air, and blossoms in the autumn. Its flowers are panicled and pendulous, and of a cream-colour. The leaves have their edges beset with long recurved threads.

YUNX, a genus of Birds. The bill is short, straight, depressedly conical. Nostrils basal, naked, partly closed by a membrane.

Wryneck (*Yunx torquilla*).

Tongue long, vermiform, with a horny point. Wings moderate, second quill longest. Tail-feathers flexible. Feet with two anterior toes joined together at their origin, and two behind unconnected.

Yunx torquilla. This is the Ἴυγξ of the Greeks. Aristotle has well described the bird, its long tongue, its power of protruding and retracting it, and the writhing snake-like motion which it can impart to its neck without moving the rest of the body. ('Hist. Anim.,' ii. 12.) It has been made familiar to most of our literary readers by the adjuration in the second Idyll of Theocritus ('Pharmaceutria'). It is also the *Iynx* of the Romans. (Pliny, xl. 47.) *Yunx* is the form used by Linnæus and zoologists generally, but it ought to be *Iunx*, or *Iynx*. The Wryneck is the Torcol of the French, and also the Tercou, Torcou, Turcot, Tercot, and Torcot of the same, according to Belon; Torcicollo, Collatorto, Stortacoll, Capetorto, Vertilla, and Formicula, of the Italians; Gjoktyta of the Swedes; Bende-Hals of Brunnich; Natterwindl, Wendhals, Wendehals, and Dre-Hals, of the Germans; Long-Tongue, Emmet-Hunter, Snake-Bird, Cuckoo's-Mate, Cuckoo-Maid, Cuckoo's-Maid, and Cuckoo-Fool (two last Gloucestershire) of the English; Gwas y Gôg and Gwddfdro of the Welsh; Arizui of the Japanese.

The male has the ground-colour of the plumage of the upper parts rusty ash-colour, irregularly spotted and speckled with brown and black; a large brown streak extends from the occiput to between the scapulars; on the external barbs of the wing-feathers rusty squared spots; tail-feathers bounded with black zig-zags; throat and front of the neck pale rusty, with small transverse black lines; bill and feet olive-brown: irides hazel or yellow-brown. Total length 7 inches. It is found in Denmark, Sweden (May), Germany, Holland (where it is rare), France, Spain, and Italy (summer); England, and Wales, Scotland (rare in the last and in the north of the first—summer); Kamtschatka (Vieillot), Japan, Himalaya Mountains. Winter residences, North Africa and warm parts of Western Asia.

When the Cuckoo is heard, the Wryneck may be looked for; and from their advent and departure at about the same time, some of the English names and one of the Welsh appellations, Gwas y Gôg, must have originated, for in other respects there is no relationship or similarity between the birds.

Caterpillars and a variety of insects form the food of the Wryneck, and it is a great devourer of ants and their eggs. Elderberries have been mentioned as being a part of its diet.

Colonel Montagu says that the Wryneck makes a noise very like the smaller species of Hawks, frequently repeating it in spring. Mr. Yarrell describes the note as a sharp sound, repeated several times, and not unlike the whistle of a kestrel.

In captivity the Wryneck is a favourite, and the bird soon becomes reconciled to the half-reclaimed state in which English and French boys are fond of keeping it, taking it out to the woods with a long string tied to its leg, and suffering it to ascend trees and forage for food generally, within the length of its tether, and letting it climb at intervals about their dress.

In the 'Portraits d'Oyseaux' the following quatrain is printed under the cut of this species:—

> "Le Tercot est au pic verd ressemblant,
> De naturel et non de corpulence,
> Sa langue longue hors de trois doigts il lance,
> Ayant en ce du serpent le semblant."

The two last lines are very nearly a translation from Aristotle.

Z

ZA'MIA, a genus of Plants belonging to the natural order *Cycadaceæ*. The species of this genus are trees with a single cylindrical trunk, increasing by the development of a single terminal bud, and covered by the scaly bases of the leaves; the wood consists of concentric circles, the cellular zones between which are exceedingly loose, the ligneous tissue having the tubes marked by circular discs; the leaves are pinnated, not articulated, and have a gyrate vernation. The flowers are dicœcious; the male flowers are arranged in tessellated catkins with abrupt scales, the anthers oval, sessile at the under side of each scale. The female flowers are in tessellated catkins, the scales peltate, drupes two at the under side of each scale. The species are found in the tropics of America and Asia, and also at the Cape of Good Hope and in Australia.

Z. spiralis has numerous leaflets, linear, very smooth, somewhat curved, with a few spinous teeth at the extremity; the catkins smooth, with pointed scales in the female, and wedge-shaped ones in the male flowers. This plant is a native of New South Wales. The cone is about half the size of a man's head, and composed of nuts about the size of a chestnut. These nuts are eaten by the natives of Australia, but on being tried by English settlers produced sickness. Their flavour is not unlike that of chestnuts.

Z. cycadis, Bread-Tree Zamia, has lanceolate spinous smooth entire leaflets tapering at the base; the scales of the catkins abrupt, obtuse, pointless. It is a native of the south-eastern parts of southern Africa. The stem is thick and scaly, and attains a height of six or seven feet. Thunberg states that when the stems become old they are broken through by the Kaffres and Hottentots, who collect the pith and tie it up in the skin of a sheep or calf which has been previously well rubbed with grease. It is then buried in the ground, and after remaining there till it becomes putrefied, it is taken up and bruised between two stones, and then formed into little cakes about an inch in thickness. These are baked in wood-ashes, and are esteemed by those who prepare them as a great luxury, though they are not at all palatable to a European taste.

About seventeen species of the old genus *Zamia* have been described. Eight of these are now placed in the genus or sub-genus *Arthrozamia*, which is characterised by having the leaflets articulated with the rachis of the frond-like midrib; there is also a preparation in the rudimentary stamen to form a 2-celled anther, while in *Zamia* the leaflets are confluent, and the pollen is not disposed in 2-lobed masses. A fine collection of these plants exists in the Royal Gardens at Kew, and another has been made by Mr. Yates at Lauderdale House, Highgate.

The genus *Zamia* has many representatives in a fossil state. Of the sixteen species that have been discovered, twelve resemble so nearly the recent species that they have received the same designation. The remaining four differ in the exsertion and venation of their leaves, and hence they are placed under the fossil genus *Zamites*. The principal forms of these genera have been found in the lias and oolitic formations. Two fossil stems nearly resembling those of *Zamia* were found by Dr. Buckland in Portland stone. These are made by Bronguiart to constitute the genus *Mantellia*, a name given in honour of Dr. Gideon Mantell. He has also included in the same genus a stem found in shelly limestone near Luneville.

ZAMI'TES, a genus of Fossil Cycadeous Plants from the Oolitic, Wealden, and Cretaceous formations (Presl.), synonymous with Mantellia of Bronguiart.

ZANCLOSTOMUS. [Cuculidæ.]

ZANNICHELLIA, a genus of Plants belonging to the natural order *Naiadaceæ*, named after John Jerome Zannichelli, a botanist. The flowers in this genus are monœcious. The male flowers have neither calyx nor corolla, with a single elongated filament surmounted by an oblong anther; the female flowers have a calyx consisting of a single leaf, no corolla, the germens four or more, the stigmas peltate, and the capsules sessile.

There is but one species of this genus, *Z. palustris*, the Marsh Horned-Pondweed. It is a native of ponds, ditches, and rivulets in most parts of Europe.

ZANO'NIA, a genus of Plants belonging to the natural order *Cucurbitaceæ*, named after James Zanoni. The only species belonging to this genus is *Z. Indica*, the Climbing Indian Cucumber. The fruit is described by Rheede as obscurely triangular, and having the flavour of the cucumber.

ZANTHOMIZA. [Xanthomyza.]

ZANTHORNUS. [Sturnidæ.]

ZAPORNIA, Leach, a genus of Birds belonging to the family *Rallidæ*. The beak is slender, shorter than the head, acuminated, compressed, acute; upper mandible gradually incurved; nostrils linear, lateral, placed at the base of the beak. Legs long, slender, cleft, with three toes in front; the hinder toe elevated from the ground at its base; the tibiæ half naked. (Gould.)

Z. porzana, the Spotted Crake. This is the Petit Rale d'Eau, Caouchouan, and Marouette of the French; Porcellana, Porzana, Grugnetto, Porciglione, and Gallinella, of the Italians; Punktierter Rohrhuhn and Kleines Gesprenkeltes Wasserhuhn, of the Germans; Speckled Water-Hen and Skitty, of the English; and Dwfriar Fannog of the Welsh.

Adult and Old Male.—Forehead, eyebrows, and throat leaden-gray; sides of the head ash marked with black; upper parts olive-brown, but all the feathers black in the centre and variegated with small spots and stripes of pure white; breast and lower parts olive, shaded with ash and marked with white spots—these spots are rounded on the breast, but disposed on the sides in transverse bands; middle tail-feathers bordered with white; lower tail-coverts pure white; bill greenish-yellow, red at the base; feet greenish-yellow; iris brown. Length about 9 inches.

Adult Female.—Ash-colour of the throat and neck less extensive; sides of the head with brown spots; base of the bill with rather less red.

It is found in Sweden (summer visitor, rare); Southern Russia; north of Germany and Holland (rare); France, Provence, and to the Mediterranean (more common). It is of most frequent occurrence in the south and east of Europe; it has been seen at Smyrna in the winter, and is stated to extend to India. It is a summer visitor in

England, Scotland, and Wales, but is not common; and is occasionally found in Ireland in the summer.

Although the Spotted Crake is not common in these islands, there is no doubt that it breeds here, the eggs and young having been found in the Norfolk marshes and in other localities. Mr. Selby, accompanied by a shrewd dog that was up to their tricks, sometimes flushed as many as six in the large Northumbrian morass in his neighbourhood, just before their autumnal migration, and the majority were young birds of the year.

The fine flavour of this bird is well known and appreciated in France. Few, if any, of the aquatic, or indeed of any tribe, can match it in autumn as a rich morsel for the table, especially if it be young. Colonel Hawker, speaking of the Common Water-Rail and this species, truly says, "Notwithstanding these two are seldom regarded by sportsmen, yet there is scarcely a greater delicacy than either the one or the other." Both are indeed first-rate, but the Spotted Crake for choice.

Spotted Crake (*Zapornia porzana*).

There are two other European and British *Zaporniæ*, namely, the Little Crake, or Olivaceous Gallinule (*Zapornia pusilla*), and Baillon's Crake (*Z. Baillonii*); of both these M. Temminck says that the specimens found in Japan are the same with those killed in Europe.

ZEA, a genus of Plants belonging to the natural order *Graminaceæ*. The name is identical with the Greek Ζειά, but the Greek plant was a species of *Triticum* or *Hordeum*, and not at all agreeing with the present genus, which is entirely American.

The plants belonging to this genus are monœcious. The male flowers are in distinct spikes; the calyx consists of a 2-flowered blunt glume; the corolla of a blunt glume. In the female flowers the calyx is a 2-valved glume; also the corolla; the style is single, filiform, pendulous; the seeds solitary, immersed in an oblong receptacle. There are two species.

Z. Mays, Common Maize, or Indian Corn, which is known by its entire leaves. It is a native of America, and is cultivated there, as in most countries of Southern Europe. Like the species of *Triticum*, those of this genus present almost innumerable varieties, from the cultivation to which they have been submitted. As an article of food the fruit is much inferior to that of the *Triticum*, nor will it ripen its fruit fully in high northern latitudes.

Z. Curagua, Chili Maize, or Valparaiso Corn, is distinguished by its serrated leaves. It is a smaller plant in all its parts than the foregoing, and is a native of Chili. A sort of religious reputation is attached to this plant on account of the grains when roasted splitting into the form of a cross. [MAIZE, in ARTS AND SC. DIV.]

ZEAGONITE, a Mineral identical with *Phillipsite*. [PHILLIPSITE.]

ZEBRA. [EQUIDÆ.]

ZEBU. [BOVIDÆ.]

ZEDOARY. [CURCUMA.]

ZEMNI. [MURIDÆ.]

ZENAIDA. [COLUMBIDÆ.]

ZENIK. [VIVERRIDÆ.]

ZEOLITES, a family of Minerals, so named because the species generally melt and intumesce before the blow-pipe, the term being derived from the Greek ζέω, to boil. They consist essentially of silica, alumina, and some alkali, with more or less water. The most of them gelatinise in acids, owing to the separation of the silica in a gelatinous state.

They occur filling cavities in rocks, constituting narrow seams, or implanted on the surface, and rarely in imbedded crystals; and never disseminated through the body of a rock, like crystals of garnet or tourmaline. All occur in amygdaloid, and some of them occasionally in granite or gneiss. *Heulandite*, *Laumonite*, *Apophyllite*, and *Stilbite* have a strong pearly cleavage, and do not occur in fine fibrous crystallisations; when columnar, the structure is thin lamellar. Excepting *Laumonite*, these species dissolve in the strong acids, but do not gelatinise. The species *Natrolite*, *Scolecite*, *Stellite*, and *Thomsonite*, are often fibrous, and the crystallisations generally slender. The remaining species, *Harmotome*, *Analcime*, *Sodalite*, *Hauyne*, *Lapis-Lazuli*, and *Chabazite*, occur in short or stout glassy crystals, and are seldom fibrous. These minerals are described under their proper names.

(Dana, *Manual of Mineralogy*.)

ZERDA. [VULPES.]

ZEUGLODON. [CETACEA.]

ZEUS, a genus of Fishes belonging to the family *Scomberidæ*. The Boar-Fish of English writers is referred by Jenyns and others to this genus, but Cuvier, Lacépède, and Yarrell refer it to *Caproe*. [CAPROS.]

ZEUXITE. [PREHNITE.]

ZEUZERA, a genus of nocturnal *Lepidoptera*. The male antennæ are furnished at the base with a double row of teeth, which are terminated by a thread: those of the female are single at the base.

Z. Æsculi, the Wood-Leopard, is a rare species, of a white colour, with numerous steel-blue spots. The larvæ are found in the interior of decaying trees.

ZIBETH, or ZIBET. [VIVERRIDÆ.]

ZIMB, an Insect translated Hornet in Scripture (Exodus, chap. xxiii., ver. 28; Deut. vii. 20; Joshua xxiv. 12). The Hebrew name is 'tzirah,' and probably expresses its loud buzzing noise. The account which Bruce has given of the 'zimb,' or Dog-Fly, of Abyssinia, offers such striking analogies to the insect specifically termed 'tzirah,' and included in the more general term 'zebub' of the Hebrew Scriptures, that very little doubt exists regarding the identity of the two. It is difficult to conceive that Isaiah could have had in view any other insect when he says—"The Lord shall hiss for the fly that is in the uttermost part of the rivers of Egypt" (Isaiah vii. 18). The original word rendered 'fly' in our translation is 'zebub,' and, as Bruce observes, "The Chaldee version is content with calling this animal simply 'zebub,' which signifies the fly in general, as we express it in English. The Arabs call it 'zimb' in their translation, which has the same general signification. The Ethiopic translation calls it 'tzaltzalya,' which is the true name of the particular fly in Geer, and was the same in Hebrew." Bruce has given a graphic account of this fly, and there can be little doubt that this insect is related to the family of *Oestridæ*.

The Latin *Asilus* and the Greek *οἶστρος* were probably only different pronunciations of the same term 'ha-tzirah,' as this fly is called both by Moses and Joshua. Mr. Bracy Clark, in the 9th volume of the 'Linnæan Transactions,' part ii., 1843, refers the fly alluded to by Moses (and said to "hiss and make a noise") to *Œstrus bovis*, and remarks on Bruce's figure, that it has no resemblance to the genus of flies the *Œstrebra*, but is rather, though with something fictitious about it, allied to the genus *Stomoxys*, or perhaps *Tabanus*, both of which genera are certainly silent flys in their attacks on cattle.

There can be no doubt that the *οἶστρος* was a perfectly distinct insect from any of the modern *Œstridæ*.

(Kirby and Spence, *Introduction to Entomology*.)

ZINC. This metal, in commerce frequently called *Spelter*, was first mentioned by Paracelsus, in the 16th century, under the name of *Zinetum*. It does not occur in the native state, but is obtained from its ores, which are chiefly the Sulphuret and Carbonate of Zinc.

Sulphuret of Zinc; *Blende*.—It occurs crystallised and massive. Its primary form is the cube. Cleavage parallel to the planes of the rhombic dodecahedron. Fracture conchoidal. Hardness: scratches carbonate of lime, and is scratched by phosphate of lime. Rather brittle. Colour white, and various shades of yellow, green, red, brown, and black. Streak varying with the colour from white to reddish-brown. Lustre adamantine. Transparent, translucent, opaque. Specific gravity 4·07. Massive varieties amorphous; structure crystalline, granular, compact, globular, botryoidal, reniform, stalactitic, fibrous. Before the blow-pipe it does not melt per se; but when heated on charcoal, fumes of oxide of zinc form a white coating upon it. When nearly or quite pure, it forms a colourless solution in nitric acid with the separation of sulphur. It is found in great abundance in many countries, both in primary and secondary formations, and both in veins and beds. It abounds in Cornwall and several of the northern counties of England: the white variety occurs in New Jersey, North America. Large quantities of the ores of zinc are met with and worked in Germany; they occur also in various other parts of the earth. It contains—

Sulphur	33·66
Zinc	66·34
	——100·0

Some varieties contain small portions of iron and cadmium.

Oxysulphuret of Zinc; *Voltzite.*—It occurs in the form of small hemispheres, which are divisible into thin layers. Fracture conchoidal, irregular. Hardness 4·5. Colour yellowish-red, interspersed with brown bands. Lustre pearly on the natural layers, but vitreous or resinous in the other directions. Slightly translucent, opaque. Specific gravity 3·66. It occurs in Cornwall (?), and at Roziers, department of Puy-de-Dôme, France. Analysis by M. Fournet:—

Sulphuret of Zinc	81·0
Oxide of Zinc	15·0
Oxide of Iron	1·8
Organic Matter	2·2
	—100

Carbonate of Zinc; *Calamine.*—It occurs crystallised and massive. Its primary form is a rhomboid. Cleavage parallel to the primary planes. Fracture uneven, conchoidal. Hardness: scratches fluor-spar, but is scratched by apatite. Colour white, yellowish-white, gray, brown, and green. Streak white. Lustre vitreous. Translucent. Opaque. Specific gravity 4·442. Massive varieties amorphous; structure granular, compact, reniform, botryoidal, stalactitic; fibrous. This ore occurs rather abundantly, and is found both in veins and beds in various parts of England, France, and in America. Analysis by Smithson, (1) from Somersetshire, (2) from Derbyshire:—

	(1)	(2)
Carbonic Acid	35·2	34·8
Oxide of Zinc	64·8	65·2
	—100	—100

Soluble, with the extrication of carbonic acid gas, in acids.

Hydrous Carbonate of Zinc; *Hydrous Calamine.*—It occurs usually massive or incrusting other minerals. Texture fine-grained and close. Hardness 2 to 2·5. Colour white or grayish or yellowish-white. Dull; opaque. Specific gravity 3·584 to 3·598. It frequently accompanies the preceding species. It is soluble in acids with the extrication of carbonic acid gas. It contains:—

Carbonic Acid	13·52
Oxide of Zinc	69·36
Water	15·10
	—97·98

Sulphate of Zinc; *Listerite.*—It occurs crystallised and massive. Primary form a right rhombic prism. Fracture conchoidal. Hardness 2·0 to 2·5. Brittle. Colour white, sometimes inclining to peach-blossom-red and violet-blue. Streak white. Transparent; translucent. Lustre vitreous. Specific gravity 2·036. Soluble in water. Taste astringent, nauseous, and metallic. Massive varieties amorphous; structure granular, compact, botryoidal, reniform, stalactitic, fibrous; sometimes investing other bodies. Before the blow-pipe froths, and covers the charcoal with white flocks. It is found at Holywell in Flintshire, Fahlun in Sweden, at Rammelsberg in the Harz, and Schemnitz in Hungary.

Beudant's analysis of the substance from Schemnitz, gives—

Sulphuric Acid	29·8
Oxide of Zinc	28·5
Oxide of Manganese	0·7
Oxide of Iron	0·4
Water	40·8
	—100·2

Phosphate (?) of Zinc; *Hopeite.*—It occurs crystallised. Primary form a right rhombic prism. Cleavage parallel to the great diagonal, distinct. Fracture uneven. Hardness, scratches gypsum, is scratched by fluor-spar. Colour white, grayish-white. Streak white. Lustre vitreous, pearly on the cleavage plane. Transparent; translucent. Specific gravity 2·46. Before the blow-pipe yields water, but no carbonic acid; becomes milk-white, and melts into a clear colourless glass. Soluble without effervescence in nitric or hydrochloric acid, and slowly in sulphuric acid. It has been found hitherto only in the calamine-mines of Altenberg, near Aix-la-Chapelle. It consists of oxide of zinc, a little cadmium, an earth, and much water, probably combined with phosphoric acid.

Silicate of Zinc; *Willemite.*—It occurs crystallised and massive. Primary form an obtuse rhomboid. Cleavage easy, in a direction perpendicular to the axis. Transverse fracture conchoidal. Hardness, readily scratches glass and phosphate of lime; is scratched by the knife. Colour usually yellow, brownish, or reddish-yellow, sometimes white and transparent. Specific gravity 4·18. Before the blow-pipe, the crystals partly lose their transparency; with borax, a globule is obtained, which is transparent, with a small nucleus of silica floating in it. It is found at Moresnet, Aix-la-Chapelle, and contains—

Silica	72·33
Oxide of Zinc	27·67
	—100

Hydrous Silicate of Zinc; *Smithsonite; Electric Calamine.*—It occurs crystallised in attached and globular and botryoidal aggregations of crystals. Primary form a right rhombic prism. Cleavage parallel to the lateral planes. Fracture conchoidal, uneven. Hardness, scratches fluor-spar, and is scratched by felspar. Brittle. Colour white, blue, green, yellow, and brown. Streak white. It becomes electric by heat. Lustre vitreous. Transparent; translucent. Specific gravity 3·379. When heated in a glass-tube yields water, and becomes milk-white. When heated before the blow-pipe with borax, it dissolves into a colourless glass, which does not become milky on cooling. When powdered and heated in hydrochloric acid, the oxide of zinc is dissolved, and the silica gelatinises on cooling. It is found at Matlock in Derbyshire, and other parts of England; in Scotland, Germany, and many other parts of Europe. It contains—

	Smithson.	Berthier.
Silica	25·0	25·0
Oxide of Zinc	68·3	66·0
Water	4·4	9·0
	—97·7	—100

Aluminate of Zinc; *Automalite.* [GAHNITE.]

Oxide of Zinc and Oxide of Manganese; Red Oxide of Zinc; *Spartalite.* It occurs in imbedded small nodules and massive. Cleavage parallel to all the planes of a regular hexagonal prism. Fracture conchoidal. Hardness 4 to 4·5, easily scratched by the knife. Brittle. Colour bright-red. Streak orange-yellow. Lustre adamantine. Translucent. Specific gravity 5·4 to 5·5. Massive varieties amorphous, structure crystalline, granular. Before the blow-pipe infusible per se; but with borax gives a yellow transparent glass. In nitric acid dissolves without effervescence. It is found only in New Jersey, North America. It contains—

Oxide of Zinc	88
Sesqui-Oxide of Manganese	12
	—100

Sulphuret of Zinc and Iron; *Marmatite.*—This is a definite compound of sulphuret of zinc and of sulphuret of iron; its structure is lamellar, and colour black; indeed it appears to be black blende united with sulphuret of iron. It is found at Marmato, province of Popayan, South America. It contains silica, which is a mere accidental admixture.

Bi-Seleniuret of Zinc and Protosulphuret of Mercury; *Riolite.*—It occurs massive. Structure granular. Lustre metallic. Colour light-gray. Opaque. Specific gravity 5·56. Before the blow-pipe burns with a fine violet-coloured flame, and exhales a strong smell resembling that of decayed cabbage. When heated in a retort, selenium, mercury, and a little sulphur sublime, and there remains oxide of zinc, which is readily dissolved by acids. It contains lime, which must be considered as an accidental impurity.

Bi-Seleniuret of Zinc and Bi-Sulphuret of Mercury; *Culebrite.*—It occurs massive. Fracture earthy. Dull. Colour dull-red. Specific gravity 5·66. It is found at Culebras, Mexico.

Oxide of Zinc, Oxide of Iron, and Oxide of Manganese; *Tephroite.* It occurs massive. Compact. Cleavage perfect in several directions, two of them meeting at right angles. Fracture uneven. Hardness 5 to 6. Lustre adamantine. Colour ash-gray, tarnishing black. Streak paler. Specific gravity 4·10. Before the blow-pipe it forms a black slag. It occurs with *Franklinite* and *Spartalite* at Sparta, United States.

ZINC SPAR. [ZINC.]

ZI'NGIBER. [ZINGIBERACEÆ.]

ZINGIBERA'CEÆ, *Gingerworts*, a natural order of Endogenous Plants. The plants belonging to this order are herbaceous, possessing a creeping and often jointed rhizoma. Their stem is formed of the cohering bases of the leaves, and is never branched. The leaves are simple and sheathing, the blade being often separated from the sheath by a taper neck; they have a single midrib, from which diverge at an acute angle numerous simple crowded veins. The flowers are arranged in a dense spike or raceme, or a sort of panicle, which is either terminal or radical. The flowers are supplied with spathaceous membranous bracts, which usually lie in pairs. The calyx is superior, tubular, 3-lobed, short. The corolla is tubular, irregular, with six segments in two whorls; the outer whorl is 3-parted, nearly equal; the inner is also 3-parted, and represents three stamens, the intermediate segment is larger than the rest, and called the labellum, and is often 3-lobed; the lateral segment is sometimes nearly abortive. The stamens are three, distinct, of which the two lateral are abortive, and the intermediate one fertile; this is placed opposite the labellum, and arises from the base of the intermediate segment of the outer series of the corolla; the filament is not petaloid, and often extends itself beyond the anther in the shape of a lobed or entire appendage; the anther is 2-celled, and opens longitudinally, the lobes often embracing the upper part of the style. The pollen is light, granular, globose, and smooth. The ovary is 3-celled; the ovules attached to a placenta in the axis; the style filiform, and the stigma dilated and hollow. The fruit is usually a 3-celled capsule, and sometimes from abortion 1-celled. The seeds are roundish or regularly angled, and sometimes with an aril; the albumen flowery; the embryo inclosed within a peculiar membrane called Vitellus, and Membrane of the Amnios by Brown.

This order of plants has been mostly placed with *Marantaceæ.* It was first constituted by Brown, who pointed out the difference between it and *Marantaceæ.* The distinguishing characters of *Zingiberaceæ* are—first, the structure of the seed, in which a fleshy body is interposed between the embryo and the albumen, entirely enveloping

the former. This body is called Vitellus by Brown, and is the remains of the innermost integument of the ovule, which is unabsorbed during the progress of the seed to maturity. A second peculiarity consists in the 2-celled anthers; and with this structure is combined decidedly aromatic properties. But the distinction between *Marantaceæ* and *Zingiberaceæ* depends, as pointed out by Lindley, on more important considerations than these. "In true *Zingiberaceæ*," he says, "as Brown has observed, the stamen is always placed opposite the labellum, or anterior division of the inner series of the corolla, and proceeds from the base of the posterior outer division; while the sterile stamens, when they exist, are stationed right and left of the labellum. But in *Marantaceæ* the fertile stamen is on one side of the labellum, occupying the place of one of the lateral sterile stamens of *Zingiberaceæ*. This peculiarity of arrangement indicates a higher degree of irregularity in *Marantaceæ* than in *Zingiberaceæ*, which also extends to the other parts of the flower." It contains 29 genera and 247 species.

Nearly all the species are tropical plants, and by far the greater number inhabit various parts of the East Indies; they are also found in Africa and America.

The plants belonging to this order possess great beauty, on account of the development of their floral envelopes and the rich colours of their bracts. They are also employed to a considerable extent in medicine and as condiments, on account of their aromatic stimulating properties. [Curcuma; Amomum; Alpinia.]

Zingiber is known from the other genera by the inner limbs of the corolla having but one lip, and the anther having a simple recurved horn at the end.

Z. officinalis, the Narrow-Leaved, or Common Ginger, has subsessile, linear-lanceolate, smooth leaves, elevated oblong spikes, acute bracts, and a 3-lobed lip. The root-stock of this plant is the ginger of commerce. It is imported into England from various quarters of the world, but more especially the East and West Indies. This plant is now grown in almost all parts of the globe in tropical climates, but it seems to have been originally indigenous in the East Indies. [Ginger, in Arts and Sc. Div.]

2 1 3

Zingiber officinalis.

1, plant, showing the rhizoma and inflorescence; 2, flower separated, showing spathaceous bracts; 3, the perfect 2-celled anther with styles.

Ginger is one of the most agreeable of the hot aromatics, and is consequently much used as a condiment. It also enters into the composition of many medicines, where it acts as a carminative.

Z. Zerumbet, the Broad-Leaved Ginger, is a native of the East Indies, and has delicate stems; bifarious, sessile, lanceolate leaves; broad obovate bracts, and a 3-lobed lip. This plant is much used in the east for cataplasms and fomentations, but is not taken internally.

ZINKENITE. [Antimony.]

ZINNIA, a genus of Plants belonging to the natural order *Compositæ*, named after Dr. John Godfrey Zinn. It has a chaffy receptacle, the seed-down consists of two erect unequal awns, the calyx imbricated, somewhat ovate, the florets of the radius 5-10, permanent and undivided. All the species are natives of South and North America; they are annuals, and form handsome border-plants in gardens. They resemble *Rudbeckia*.

ZI'PHIUS. [Cetacea.]

ZIRCON—*Hyacinth; Jargoon*—a Mineral occurring in attached, imbedded, and loose crystals. Primary form a square prism. Cleavage parallel to the lateral planes, indistinct. Fracture conchoidal, undulating, brilliant. Hardness, scratches quartz. Brittle. Colour white, gray, red, reddish-brown, brownish-orange, yellow, pale-green; streak white. Lustre adamantine. Doubly refractive in a very high degree. Transparent; translucent; opaque. Specific gravity 4·505. Before the blow-pipe infusible, but loses its colour; with borax fuses into a transparent glass. It is found at Expailly, in France; Ceylon; at Friedrichsvarn, Norway; Greenland, the United States, &c. It contains—

Silica	33·3
Zirconia	66·7
—[Titanium.]	——100

ZIRCO'NIA. [Zirconium.]

ZIRCO'NIUM, a peculiar Metal obtained from the earth or metallic oxide zirconia. [Zircon.]

ZIZA'NIA, the Greek name of *Lolium temulentum*, the modern Darnel. This plant has always been troublesome amongst wheat, and is mentioned in the New Testament, and in the English version *Zizanium* is translated 'Tares.' The name has now been adopted by Gronovius and Linnæus for a very different genus of *Gramineæ*. It is monœcious; the male flowers have no calyx, and their corolla is a 2-valved blunt glume, which are mixed with the female flowers; the female flowers have no calyx, and their corolla is a 2-valved glume, cucullate, and awned; the style is 2-parted; the seed single, enveloped in the plaited corolla.

Z. aquatica is the Canadian Wild-Rice. It has a pyramidal compound panicle, with numerous male flowers in the lower part; spiked and female above. This plant is common in all the waters of North America from Canada to Florida. It flowers in July and August, and is known by the name of *Tuscarora*, or Wild Rice. It was introduced into this country by Sir Joseph Banks, in 1793, who cultivated it for many years in the ponds of his villa at Spring Grove. The seeds of this plant afford a nutritious article of diet, and are eaten by the wandering tribes of North-West America. The water-fowl of North America also feed on the grains of this plant.

ZI'ZYPHUS, Ζίζυφον, a genus of Plants belonging to the natural order *Rhamnaceæ*. It has a 5-cleft spreading calyx; 5 obovate unguiculate convolute petals; a pentagonal flat disc, expanded and adhering to the tube of the calyx; a 2-3-celled ovary immersed in the disc; the styles 2-3; the fruit fleshy, containing a 1-2-celled nut; the seeds sessile, compressed, and very smooth. The species of this genus are shrubs, with alternate 3-nerved leaves, spiny stipules, and mucilaginous fruit, which is eatable.

Z. vulgaris, the Common Jujube, has ovate-retuse toothed smooth leaves; prickles absent or twin; and an ovate-oblong drupe. This plant is a native of Syria, whence it has been introduced into Europe. It is now cultivated in many parts of the south of Europe, where its fruit is known by the name of Jujube. It has yellow-greenish flowers, two or three of which grow together. The fruit is of a blood-red or saffron colour, and has a sweet granular pulp. In Italy and Spain it is eaten as a dessert when fresh, and in the winter season as a dry sweetmeat. It is also sold in great quantities in the markets of Constantinople. The Jujube is commonly planted by the Turks of Constantinople before their coffee-houses for the sake of its shade.

Z. Spina-Christi, Christ's Thorn, has ovate-toothed smooth leaves, pubescent beneath; prickles twin, one straight, the other incurved; the peduncles corymbose; the drupe ovate-globose. This plant is about eight feet high, and is a native of the north of Africa of Palestine, Ethiopia, and Egypt. The flowers are yellowish-green. The fruit is oblong, about the size of a sloe, and much eaten in Egypt and Arabia. This plant has pliant branches, and is covered with thorns; and being not uncommon in Palestine, has been supposed by Hasselquist to have afforded materials for the crown of thorns with which Jesus Christ was crowned. The *Paliurus aculeatus* however is the more common thorny plant in that country. [Xalle.]

About 40 other species of *Zizyphus* have been described; amongst them the *Z. lotus*, which is the Lotus of the ancients. [Lotus.] Many of them are natives of the Himalayas. Wherever they grow, they produce a fruit which may be eaten with impunity, although it varies much in its grateful and nutritious properties. *Z. Napeca* grows in Ceylon; *Z. xylophorus*, in Coromandel; and *Z. Jujuba* in China, yields edible fruits.

ZOANTHA'RIA ('Animal Flowers,' from the Greek ζῶον and ἄνθος), the third class of true Zoophytes, in the arrangement of De Blainville, and defined by him thus:—"Body regular, flower-shaped, more or less elongated, free or fixed, very contractile, furnished with an intestinal canal, without distinct walls, having a single large terminal opening surrounded by variously-shaped tentacula, which are always tubular and in communication with the musculo-cavernous parenchyma of the skin." The terms of this definition are in part incorrect, there being no intestinal canal properly so called, but a large bag-shaped stomach having distinct walls, for a representation of which see Actinia.

The *Zoantharia* correspond to the *Zoophyta Helianthoida* of Dr. Johnston, and includes the sea-anemones and the greater number of the coral animals. The anatomical structure of the latter is essentially the same with that of the former, however different the aspect of the gorgeous madrepores of the Tropical seas may be from that of the soft and fleeting sea-flowers of the north. The beauty of the

creatures included in this order, and the important part they have played in the formation of the crust of the earth, have rendered them favourite objects of study with both zoologists and geologists, whilst the size to which they attain, greatly exceeding that of most other zoophytes, has enabled the anatomist to investigate their internal organisation in a very satisfactory manner. In the present state of our knowledge of their structure their essential characters may be summed up as follows:—Polypes separate or conjoined, free or attached, more or less cylindrical or expanded, mostly regular and circular, the parts arranged around a centre; mouth contractile at one extremity of the axis, opening into a large stomach capable of protrusion, terminating in a 'cul de sac,' and furnished laterally with longitudinal folds. Between the walls of the stomach and the epidermis are numerous muscular lamellæ, and in the interspaces are the ovaries and (cœcal?) filamental appendages. The mouth is surrounded by a disc, usually tentaculiferous (in some species the tentacula are obsolete). Tentacula simple or pinnate, hollow, their internal walls clothed with vibratile cilia, which also are found on the ovaries.

The state of the nervous system is still doubtful. Wagner has lately asserted the bi-sexuality of these zoophytes.

The posterior extremity of the body is in some species elongated and acute, in others it forms a suctorial disc; in a great number it secretes in its tissues calcareous matter, which is disposed in regular form, and constitutes the coral or polypidom, and in the group of Coriaceous *Zoantharia* expands into a leathery fixed crust, which forms a common base for several individuals.

The *Zoantharia* may be grouped under four very natural families, namely:—

I. *Lucernariadæ*, the animals included in which are soft and simple, fixed by a small base or free, and having the tentacula in groups at regular distances on the margin of a campanulate disc, in the centre of which is the mouth.

II. *Actiniadæ:* animals all soft and simple, fixed or free; when fixed, adhering by a broad base; the tentacula in most species developed and surrounding the margin of the oral disc.

III. *Zoanthidæ:* animals coriaceous, simple or compound, fixed; tentacula marginal, surrounding the mouth.

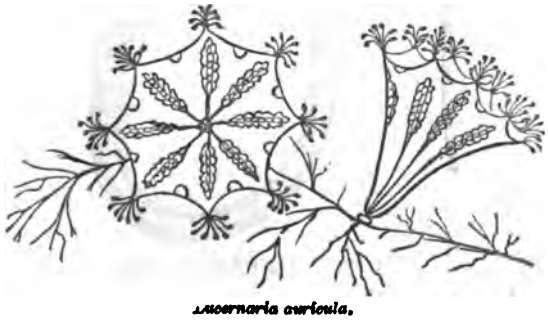
IV. *Madreporidæ* (including the *Madrephylliæa* of De Blainville): animals forming a solid calcareous polypidom; in other respects they resemble the *Actiniadæ*.

Family I. *Lucernariadæ*.

The animals of this family belong to a single genus, that of *Lucernaria*, established by O. F. Müller. They are campanulate, and fixed to sea-weeds by a narrow disc or stalk, from which they expand into a broad octagonal disc, in the centre of which is a quadrangular mouth, and at each angle a bundle of tentacula. In the intermediate spaces are little coloured lobes, which have been regarded by some naturalists as organs of vision; surrounding the mouth festoons of ovaries are seen. All the species known are inhabitants of the British and Norwegian seas. The largest measure about an inch in height. They are of various colours, but usually pink. They swim with rapidity, by alternately dilating and contracting their bodies, but usually adhere to sea-weeds, where they feed on small *Crustacea*, which Lamouroux asserts they perceive in the water and endeavour to seize. Their habits have been observed by Otho Fabricius, Montagu, Flemming, and Dr. Johnston, whose work on British zoophytes contains a good account of the several species.

Although Cuvier, Blainville, Ehrenberg, and Johnston have all placed the *Lucernaria* among the fleshy polypes, some writers dissent from such an arrangement. M. Dujardin remarks, "We ought to draw a great distinction between the papilliform tubercles of the arms of *Lucernaria*, and the extensible tentacula of *Actinia*. Perhaps when the structure and quaternary arrangement of their ovaries, approaching that of the *Medusæ*, are considered, they ought to be approximated to the latter type."

L. auricula is the best known species. [HYDROZOA, SUPP.]



Lucernaria auricula.

Family II. *Actiniadæ*. [ACTINIADÆ.]

Family III. *Zoanthidæ*.

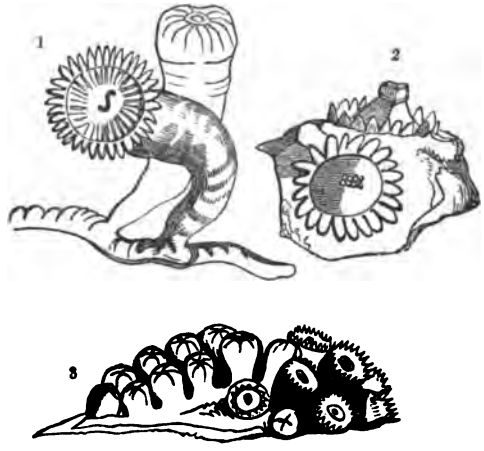
It comprises the following genera:—

Zoanthus, Cuvier.—The body is elongated, conic, and pedunculated, springing from a base common to several individuals. The mouth is linear and transverse, in the centre of a disc bordered by short slender tentacula.

Z. Couchii of Johnston is the only European representative of this family. It is found on the British coasts.

Mammilifera, Lesueur (*Polythoe*, Lamouroux).—The body is coriaceous, short, and mammiliform; slightly enlarged at its buccal extremity, and provided with several rows of marginal tentacula. It is sub-pedunculated at the base, and springs from a common expansion.

M. auriculata is a native of the West India Islands.



1, *Zoanthus Solanderi*; 2, *Corticifera glareola*; 3, *Mammilifera auriculata.*

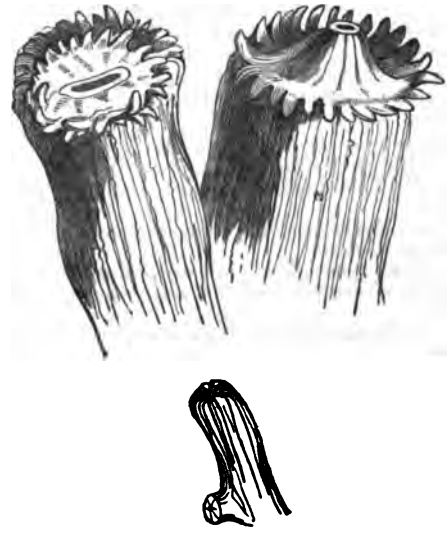
Corticifera, Lesueur.—Body short, cylindrical, having a longitudinal mouth surrounded by petaliform tentacula at one extremity, and merged at the other into a common mass with numerous similar individuals, so that a solid polypiferous crust is formed. Thus there is a transition through this genus from the soft *Actiniæ* to the Corals.

C. glareola is found in Guadaloupe.

The best account of the *Zoanthidæ*, with excellent figures, will be found in the papers of Lesueur, in the first volume of the 'Transactions of the Philadelphia Academy.'

Family IV. *Madreporidæ*.

The animals which form the harder and larger corals closely resemble the *Actiniæ*. Generally, as far as they have been examined, there is but little variety among them; but judging from the differences presented by one or two types, it is probable that future researches will show a greater diversity of form in this family than is at present admitted. Thus, though the usual form of the coral animal is that of a cylinder terminated by a disc surrounded by simple tentacula, in *Fungia* we have the tentacula irregularly scattered over a broad expansion; and in *Desmophyllum* they are reduced to the appearance of irregular folds. [POLYPIFERA; MADREPHYLLIGÆ; MADREPORÆA; ASTRÆA.]



Animal of *Cladocora cæspitosa.* (From an original drawing.)

ZOARCES, a genus of Fishes belonging to the family *Gobiadæ*. It has an elongated body, covered with a mucous secretion; the head

is smooth, muzzle blunt; ventral fins situated before the pectorals; dorsal, anal, and caudal fins united; all the fins very thick; vent anterior to the middle of the body, its situation marked by a tubercle; teeth conical, placed in a single row; branchiostegous rays six in number.

Z. viviparus, the Viviparous Blenny, differs from the other British Blennies in the circumstance to which its name refers—that of bringing forth its young alive, which seem perfectly able to provide for themselves the moment they are excluded. The ventral fins of this fish assume the appearance and perform the functions of the legs of higher animals. It is said to use these limbs for the purpose of climbing on the rocks out of the water, where it will remain exposed to the air for some time, thus forming an approach to the reptile forms of life. When boiled, the bones of this fish are green; hence its name of Greenbone.

ZOISITE. [EPIDOTE.]

ZONOTRI'CHIA (Swainson), a sub-genus of *Fringilla*. [FRINGILLIDÆ.]

ZONURIDÆ, a family of Saurian Reptiles possessing the following characters:—Head pyramidal or depressed, covered with regular many-sided shields. Tongue flat, nicked at the tip. Scales of the back and tail large, rhombic. Sides with a distinct longitudinal fold, covered with small granular scales. Ears distinct. Eyes with two valvular lids. Limbs four, strong, or rarely entirely wanting or hid under the skin.

The following is a synopsis of the genera from the British Museum Catalogue:—

A. Femoral pores distinct. Nasal shield without any or only one pair of supra-nasals. Legs four. Occipital shields few. It inhabits the Old World.

a. Tail spinose. Head depressed. Fronto-parietal and parietal plates forming a large square. Tongue velvet-like. Collar none, with a slight cross fold on the side of the neck. Femoral pores numerous.

Cordylus.—Scales of back and sides square, in close cross series. Lower eyelid transparent. Nasal small: supra-nasals square, contiguous.

Zonurus.—Scales of back and sides square, keeled, in close cross series. Lower eyelid opaque. Nasal triangular: supra-nasal none.

Hemicordylus.—Scales of back small, square, in cross rows; of the sides granular. Nasal triangular: supra-nasal none.

Pseudocordylus.—Scales of the back suboval, in cross rows, surrounded with granules, with a fold on each side of the neck. Nasal triangular: supra-nasal none.

b. Tail unarmed. Head pyramidal. Tongue scaly. Supra-nasal none.

Platysaurus.—Toes 5-5. Head depressed. Fronto-nasals two, fronto-parietals and parietals distinct, equal. Body fusiform.

Cicigna.—Toes 5-5. Head square. Fronto-nasals two, fronto-parietal and parietal united on each side. Body fusiform.

Gerrhosaurus.—Toes 5-5. Head square. Fronto-nasals two, fronto-parietals and parietals distinct, equal. Body fusiform.

Pleurostrichus.—Toes 5-5. Head square. Fronto-nasals none, fronto-parietal and parietals equal. Body and tail elongate.

Saurophis.—Toes 4-4, very short. Body and tail elongate.

Caitia.—Feet undivided, front very slender, elongated, hinder compressed, thick. Body and tail elongate. Femoral pores 2-2.

c. Tail unarmed. Head pyramidical, elongate. Collar distinct, of keeled scales. Inguinal pores 2-2.

Tachydromus.—Ventral shields keeled. Throat with keeled scales.

Tachysaurus.—Ventral shields smooth. Throat granular in front.

B. Femoral pores none. Nasal plates with two or more pairs of supra-nasal shields above. Occipital plates numerous. Collar none. Throat shielded.

a. Limbs four. Body fusiform. Tongue velvety. It inhabits the Western Hemisphere.

Abronia.—Head depressed. Inter-nasal small, distinct. Scales of back smooth.

Gerrhonotus.—Head pyramidical. Inter-nasal small, supra-nasal large. Scales of the back keeled.

Elgaria.—Head pyramidical. Inter-nasal large, supra-nasal very narrow. Scales of the back keeled, of sides smooth. Tail elongate, slender.

Barisia.—Head pyramidical. Inter-nasal plates none. Scales of back keeled.

b. Legs two or none. Body snake-like.

Pseudopus.—Limbs two, posterior, undivided.

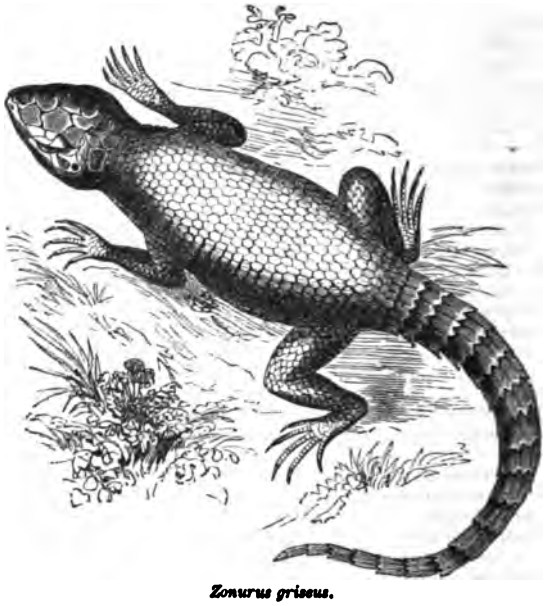
Ophisaurus.—Limbs none.

A. Femoral pores distinct. Supra-nasal shields none or only one pair. Occipital shields few. Legs four. It inhabits the Eastern World.

a. Tail spinose. Head depressed, broad. Fronto-parietal and parietal plates large. Tongue velvet-like. Collar none, or only a slight fold on each side of throat. Nostrils in a single plate. Femoral pores numerous.

We now proceed to give a few illustrations of the species of this family, of which thirty are described in the 'British Museum Catalogue.'

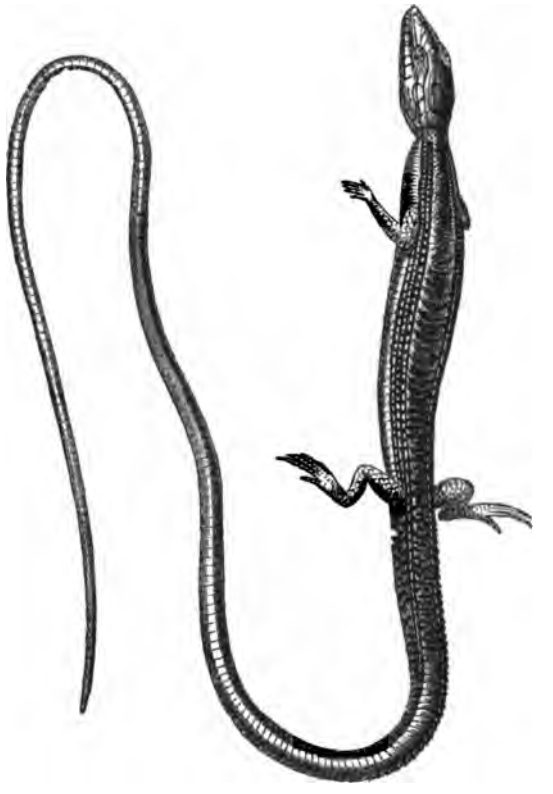
Zonurus griseus has the lower lid squamous and opaque. It is a native of the Cape of Good Hope and Senegal.



Zonurus griseus.

This is the *Cordylus griseus* of Cuvier, and the *Zonurus Cordylus* of Merrem.

Tachydromus sexlineatus, the Tachydrome, is a tropical form of this family, and is found in Cochin-China, China, Borneo, and Java.

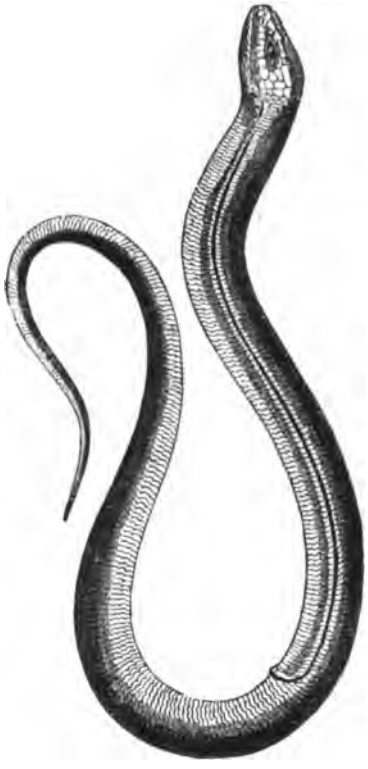


Tachydrome (*Tachydromus sexlineatus*).

Pseudopus Pallasii, the Sheltopusik, or Scheltopusik, is the only species of *Pseudopus*. It is remarkable for the slight development of its extremities, as seen in the figure of the vertebra (*a a*). Cuvier classed this animal with the *Ophidia*, at the head of the Orvets; but there can be no doubt of its connection with the *Sauria*, and the nature of its vertebral development is interesting in relation to the

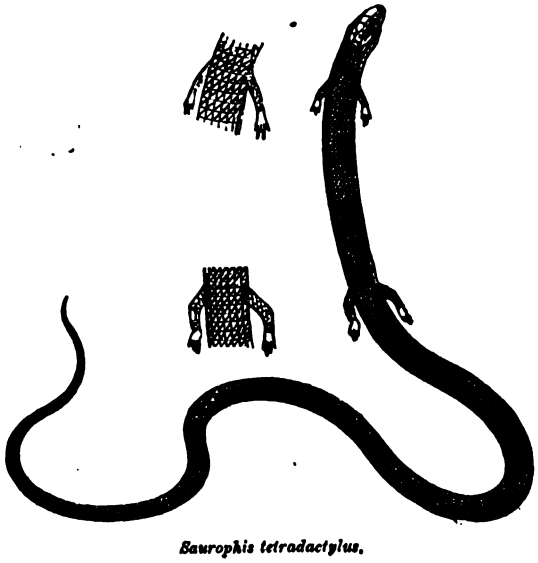
theory of the vertebrate nature of the limbs of the higher animals. [VERTEBRA.]

Pelvis of Scheltopusik, showing at *a a* the rudiments of the posterior extremities.



Scheltopusik (*Pseudopus Pallasii*).

Saurophis tetradactylus is the *Tetradactylus Chalcididus* of Merrem, *Lacerta tetradactyla* of Lacépède, and *Saurophis Seps* of Fitzinger. It is a native of the southern point of the African continent.

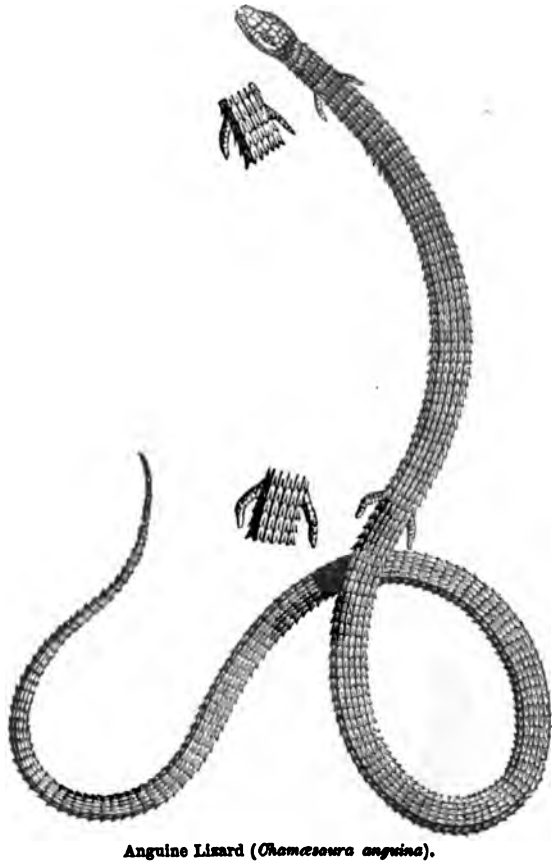


Saurophis tetradactylus.

The genus *Chamæsaura* approaches the *Zonuridæ*, but Dr. J. E. Gray has constructed for this genus a distinct family, with the following characters :—

Chamæsauri (*Chamæsauridæ*).—Head covered with regular many-sided shields; tongue nicked; palate toothless; temple scaled like the back; eyelids distinct, lower scaly. Body subcylindrical, elongate, the whole except the head covered with rings of elongate keeled scales, forming longitudinal series; limbs rudimentary. Ears distinct, small; no lateral groove; sides rounded, covered with scales like the back. It is a native of Africa.

The only genus and species is the *Chamæsaura anguina*, the Anguine Lizard. It is the *Lacerta anguina* of Linnæus, and is an inhabitant of the Cape of Good Hope.



Anguine Lizard (*Chamæsaura anguina*).

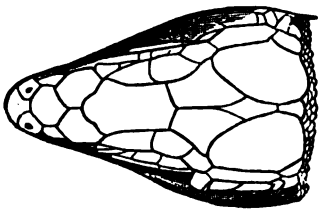
It is interesting to trace in the Saurians the gradual deterioration and abolition of the extremities till the form becomes completely serpentine. In *Heterodactylus* there are still five fingers; but the first finger of the anterior feet is so very short as to be rudimentary. In *Chalcis* (*Cophias*, Fitzinger) there are five toes before, but only three, reduced to tubercles, behind. In *Saurophis* the toes on each of the feet are reduced to four. In *Chamæsaura* there is but one on each foot. In *Chirotes* the anterior extremities are short indeed, but 5-toed; the posterior extremities are altogether absent. In *Bipes* the hind feet are each terminated by two unequal processes or toes. In *Pygopus* the anterior extremities are also lost, and the posterior extremities appear in the form of a foot in which no toe is to be seen externally; and in the Scheltopusiks all trace of external extremities is lost, though the rudiments of posterior extremities may be seen attached to the pelvis. [CHALCIDES; CHIROTES; BIPES.]

ZONURUS. [ZONURIDÆ.]

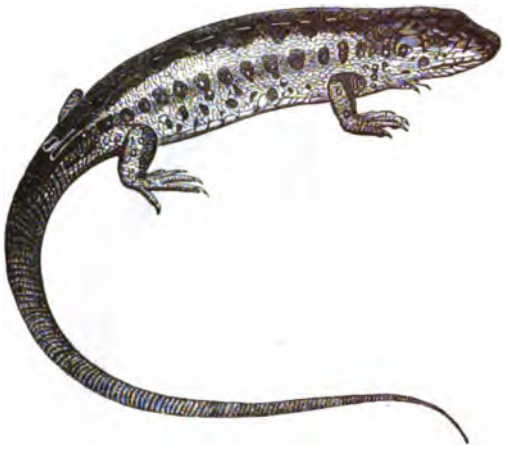
ZOOCARPES, a group of Cryptogamic Plants, so named on account of the locomotive character of their spores. [ALGÆ; DIATOMACEÆ; DESMIDEÆ.]

ZOO'PHYTA (from ζῷον, animal, and φυτόν, plant). This is the title most generally employed for the Radiated and Phytoid forms of animal life, included by Linnæus in his great divisions of *Vermes*, namely, *V. Mollusca*, *V. Lithophyta*, and *V. Zoophyta*. Under this title Cuvier ranked the Intestinal Worms, which are more analogous to *Annulosa;* and most writers include Sponges and Corallines, which others rank with plants. [POLYPIFERA; POLYZOA.]

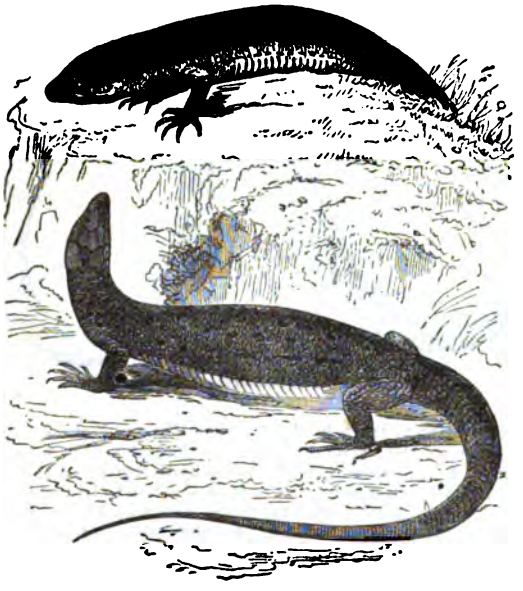
ZOOTOCA, a genus of terrestrial *Sauria*, nearly allied to *Lacerta*. Both these genera are described in the article SAURIA. As they have both of them British representatives we here present engravings of them.



Head of *Lacerta*, seen from above. (Bell.)



Lacerta agilis.



Zootoca vivipara.

For a full account of these creatures see Professor Bell's interesting 'History of British Reptiles.'

Professor Owen ('Trans. Geol. Soc.') has described a fossil obtained from the Lower Chalk, which seems to have been closely allied to the existing small Lacertine Saurians.

Side view of portion of lower jaw of Lacertian reptile from the Lower Chalk near Cambridge.

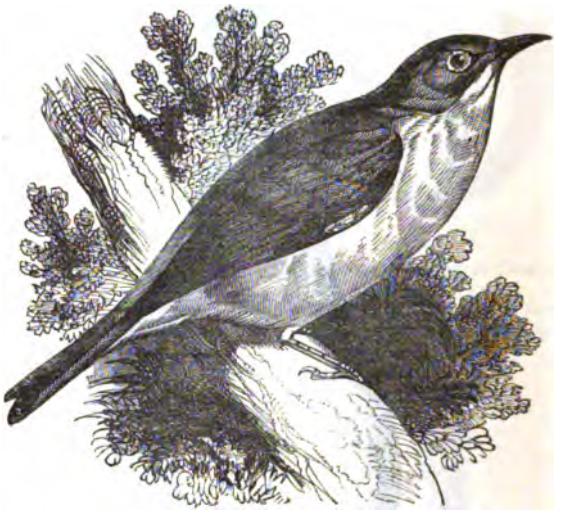
ZOSTERACEÆ, *Sea Wracks*, a natural order of Endogenous Marine Plants, resembling sea-weeds, and living among them. The species have grassy thin leaves, sheathing at the base. The flowers are very minute, absolutely naked, or surrounded by three scales. If we are to find anywhere a positive intercalation of flowering with flowerless plants, it is here, where, with naked flowers but distinct sexes, the pollen is in a condition that may be compared to the elaters of *Marchantia* and its allies, and totally different from all that is known of other flowering plants. The habit too is quite that of sea-weeds. The manner in which fertilisation takes place among these plants is unknown. The bottom of the ocean is their locality, and they occur from the North Sea to the Mediterranean, the Indian Ocean, and the coasts of Arabia. One species only is seen on the shores of Australia, and another in the West Indies.

Zostera marina, the Sea Wrack, is a British species, and is used as a common material for packing, and for stuffing cottagers' cushions; it has also been used medicinally as a poultice.

ZOSTEROPS, a genus of Insessorial or Perching Birds, placed by Mr. Swainson in his sub-family *Parianæ*. [SYLVIADÆ.]

The bill is rather stouter than in *Sylvicola*, acutely conic, almost entire. Rictus smooth. Wings moderate, pointed; the first quill rather shorter than the three next. Tail as in *Sylvicola*. Feet strong. Tarsus longer than the middle toe. Lateral toes unequal. Eyes encircled with compact white feathers. (Sw.) It is a native of India, Africa, America, and Australia.

Z. flava (Sw.), Yellow White-Eye, may be regarded as an example.



Yellow White-Eye (*Zosterops flava*).

Mr. Swainson, in his 'Birds of Western Africa,' observes that the species of this genus are all of small size, and nearly intermediate in their affinities between the Warblers and Titmice. He states his belief that only one species is found in the New World; the others, about twelve in number, being restricted to the warm latitudes of Asia, Africa, and Australia. One of these, *Zosterops curvirostris*, Swainson (*Dicæum chloronotus* of the Paris Museum), has, he remarks, the bill nearly as much curved as some of the Honey-Suckers.

Mr. Swainson adds that the general plumage of all those hitherto discovered is green above and yellowish beneath; so that the species, otherwise well marked, possess a strong mutual resemblance in the general cast of their colours. He thus describes *Zosterops flava*:—

Size of *Zosterops dorsalis*, an Australian species, but the bill, which is black, is larger. The upper plumage is of a bright greenish-yellow, the under pure and bright yellow, uniform in all its parts; the quills and tail are blackish edged with yellow; the snow-white ring round the eye is very conspicuous, and it is connected to the base of the bill by a deep black line; the tail, although divaricated, is even, and the bill and feet blackish. Total length 4¼ inches. (Sw.)

It is a native of Senegal.

ZO'ZYMUS (Leach), a genus of Brachyurous *Crustacea*, placed by M. Milne-Edwards in the division of Cryptopod Cancerians, between the genera *Carpilius* and *Lagostoma*.

Zozymus is hardly distinguishable except by the form of the claws, the extremity of which is enlarged and deeply hollowed out into a spoon-shape, a disposition which most influences the habits of the animal. It tends also, in his opinion, to establish the passage between the genera *Cancer* and *Xantho*; for he finds no character sufficiently precise to separate from it certain species, the general form of which is slightly less oval than that of the crabs properly so called, and the latero-posterior borders of whose carapace are nearly as long as the antero-posterior borders, which become strongly dentilated.

Z. æneus has the carapace moderately large, convex, very unequal, strongly embossed, and nearly tuberculous at its posterior part; front slightly advanced and indistinctly divided into four lobes; latero-anterior borders of the carapace not prolonged beyond the level of the genital region, and armed with four very wide teeth, compressed