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I

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

"................ per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 115. JULY 1867.

I.—*On the Annelid Genus* Sphærodorum, Œrsted, *and a new Representative of it,* S. Claparedii. By Dr. Richard Greeff*.

[Plate I.]

Under the name of *Sphærodorum*, Œrsted, in 1844†, founded a new genus of Annelids, characterized by the spherical form of the dorsal cirri, and by numerous papillæ standing on the fore part of the head. This was afterwards described by Johnston‡ under the name of *Pollicita* (*peripatus*), and lately more carefully by Claparède §, and, with especial reference to the structure of the characteristic globular dorsal cirri, by Kölliker ||.

During a short residence in Dieppe last year, I found in the oyster-basin of that place a small Annelid which showed a near relationship to the genus in question, but at the same time differed from it in several points, and which, moreover, in other respects seems to me to present some very interesting pecu-

* Translated from Wiegmann's Archiv, 1866, pp. 338–351, by W. S. Dallas, F.L.S., &c.

† "Zur Classification der Annulaten," Wiegmann's Archiv, 1844, p. 108.

‡ Annals & Magazine of Natural History, vol. xvi. p. 5, pl. 2. figs. 1–6.

§ 'Beobachtungen über Anatomie und Entwickelungsgeschichte wirbelloser Thiere,' Leipzig, 1863, p. 5, taf. 11. figs. 8–18.

|| "Kurzer Bericht über einige vergl.-anat. Untersuchungen," Würzburger naturwiss. Zeitschrift, 1864, Band v. p. 240, taf. 6. fig. 1.

liarities that may render it worth a particular description *. I will revert at the conclusion of my communication to the characters common to this worm and to *Sphærodorum*, as also to those by which it differs therefrom, in order the better to effect a comparison between them.

The little animal measures scarcely 2 millims. in length, but is of considerable comparative breadth, attaining nearly 0·6 millim. in the middle regions of the body. It is narrowed before and behind in such a manner that the general form of the body, leaving out of consideration the external appendages, approaches an oval; nevertheless the narrowed anterior part of the body is shorter and more rounded, whilst the hinder part appears more drawn out. The skin has a general light brownish-yellow colour, with dark-brown marks (*plaques*) distributed singly over the whole surface of the body; these acquire the most various forms, and possibly represent the secretion produced by the cutaneous glands. At no part is there a transverse segmentation of the body indicated by external furrows. The segmentation, however, is sufficiently indicated by the external appendages, according to which the entire body is divisible into 18 segments. The cephalic segment (see Pl. I. fig. 1), which at first sight almost presents a greater resemblance to that of a mollusk than to that of an annelid, is the longest of all; its somewhat truncated frontal margin presents in the middle a distinct but not deep notch forming the two lateral lobes of the head. On each lobe are seated two clavate tentacles—one placed more towards the upper surface, the other lower down towards the mouth; so that, in all, four cephalic or frontal tentacles are present—two superior, and two inferior. The bases of these, as also the space between them, are densely set with small papillæ, likewise more or less clavate, which are distinguished from the true tentacles by nothing but their smaller size; so that the tentacles, from their whole habit and when compared with the small papillæ surrounding them, might likewise be characterized as papillæ projecting, in consequence of especial development, from the midst of the numerous smaller but otherwise perfectly similar structures. But their constant occurrence on the above-mentioned spots on the head, their size, and mobility justify their receiving the denomination of tentacles.

Further back, at about half the length of the head, there are

* I have already made a brief communication upon this subject, at the Meeting of the Niederrheinischen Gesellschaft für Natur- und Heilkunde (Bonn) on the 8th February, 1866, where I also exhibited the drawings relating to it (Kölnische Zeitung, 31st March, 1866, No. 90).

two more tentacles, one on each side, which might be denominated posterior cephalic tentacles or *tentacular cirri;* so that we have in all six tentacles on the head—four anterior, and two posterior. The small clavate papillæ mentioned above as occurring in the spaces between the anterior tentacles, extend also into the region of the posterior tentacles, but are not so closely approximated, and from this point begin to change from the elongate clavate to a more globular form. I call attention at once to this change, as it indicates at the same time a change in the function of these cutaneous appendages, the anterior clavate appendages being, in my opinion, organs of touch, whilst the posterior globular ones are to be regarded as glands. The middle part of the cephalic segment bears two reddish-brown eyes, which are placed a little within the bases of the two lateral posterior tentacles. The segment of a spherical lens projects from each eye forward and outward.

The cephalic segment, as already remarked with regard to the segmentation in general, is not separated by any transverse furrow from the first segment of the body, but passes into it without any definite boundary. The first body-segment is therefore determined partly by the inferior setiferous pedal tubercles, and partly by the large globular cutaneous appendages which at this spot pass like a ring round the whole body. I say like a ring, and must call particular attention to this, because, singularly enough, these appendages are not only arranged transversely upon the dorsal surface between the two lateral rudimentary feet, but occupy the ventral surface also in the same manner*. As regards the number, however, there is a noticeable difference between those standing on the dorsal and ventral surfaces; for whilst on the back there are six of these globular bodies in a row, there are only four on the ventral surface. This condition, of course, tends greatly to suggest the notion that the two outer lateral processes situated upon the back over the pedal tubercles are to be regarded as the two true dorsal cirri. But the two lateral structures are perfectly similar to those standing in a row between them, both in size and form. As regards their function, moreover, there is no distinction; all, as we shall see hereafter, are glands. If, therefore, we were to call the two lateral processes dorsal cirri, this might also be required for the other similar appendages situated on the back, and, in the same way, we should also have to name the transverse rows situated on the ventral surface ventral cirri. It would be no obstacle to such a conception

* In *Sphærodorum peripatus,* as is well known, only *one pair* of these globular cutaneous appendages is situated upon each segment—one on each side of the back.

that all these appendages, as already stated, are glands; for the cirri of the Annelids in general are not to be regarded merely as organs of touch or motion, but may apparently be subservient to very various purposes *.

If we now examine these globular cutaneous appendages more closely, we observe, even with a low power, that their cavities are occupied by a coil of tortuous vermiform bodies, which Œrsted † has already detected and described in the dorsal cirri of *Sphærodorum*, and with regard to which he proposes the question whether they may not be ovaries. These peculiar structures seem to have entirely escaped Johnston ‡, which I can only explain by supposing that he did not examine them in a fresh state; for if the animals under examination be dead, or if they have been exposed for some time to pressure for the purpose of observation, nothing remains of the original appearance, in consequence of the breaking up of the vermiform bodies. Johnston regards the globular appendages in *Sphærodorum* (*Pollicita peripatus*) as branchiæ. To Claparède belongs the merit of having first more accurately grasped the morphological nature, although he could not arrive at any definite opinion as to the physiological signification of these organs. He thought that he could see an orifice § in the papilliform process which occurs on the upper part of the globular dorsal cirri in *Sphærodorum*, but not in our animals, but found that the capsule was closed in other respects; in this, however, as Kölliker has proved, he was in error.

Kölliker|| first placed their histological and by that means also their physiological character in the proper light, when he found that the papilliform process in *Sphærodorum* is not perforated, but that each of the vermiform bodies situated in the interior of the capsule opens externally by an orifice of its own. He regards the individual bodies as *tubular glands*, which "apparently consist entirely of rounded-angular, dark, cell-like structures."

As regards my own observations, I have but little to add to Kölliker's statements in relation to the structure of these organs. The mammilliform process occurring upon the capsules in *Sphærodorum* is entirely wanting in our animals; so that I can express no opinion as to the perforation which Claperède describes, but, according to Kölliker, has no existence; I can, however, completely confirm Kölliker's results, according to which each of

* See Ehler's 'Die Borstenwürmer,' p. 22.
† "Zur Classification der Annulaten," Wiegmann's Archiv, 1844, p. 108.
‡ 'Annals,' vol. xvi. p. 5, pl. 2.
§ Beobacht. über Anat. der wirbell. Thiere, p. 21, taf. 11. figs. 12, 13.
|| Würzb. naturw. Zeitschrift, 1864, p. 240, taf. 6. fig. 1.

the tubular glands opens externally by a separate orifice (Pl. I. figs. 10–14).

With regard to the contents of the individual tubes, these frequently consist of densely compressed, small, more or less roundish, sharply defined corpuscles: these were seen by Claparède; and Kölliker, as already stated, calls them "cell-like structures." Even by the employment of high powers I could detect no nucleiform structures, or anything of the sort, in the individual corpuscles.

Kölliker's interpretation of the structures in question as tubular glands is the only admissible one; it is especially founded on the above-mentioned opening of each tube separately at the external surface.

Thus (to return to the description of our little animal) we have ten of these large globular glandular capsules surrounding the periphery of the first segment of the body, and that of each following one, in two transverse rows, one on the dorsal, the other on the ventral surface. It is only on the last segments that the number diminishes by one or two capsules in each row. Between the regular rows of these large cutaneous appendages there are distributed over the whole surface of the body a very great number of irregularly arranged smaller but likewise globular capsules, the size of which varies greatly among themselves. They all, like the above-described larger structures, represent cutaneous glands; and by their careful examination we may, it appears to me, carry out the very interesting observation of the complete development of the glandular bodies in question. I have figured some of the principal forms and stages of development, so far as the limited material permitted this to be done (Pl. I. figs. 3–9). The first (and smallest) of these forms (fig. 3) represents a vesicle of only 0·009 millim. in diameter, in the interior of which a tolerably sharply marked compact nucleus is situated: there are often two, or even three of these nuclei; but one of them is usually remarkable for its size. A further-advanced form (fig. 4) shows the vesicle enlarged to nearly double the diameter, as also the enclosed nucleus, which has also become filled with a finely granular substance. This type is also retained by the following stage, except that the granular substance of the nucleus becomes more dense, and some granules shine out of it like dimly lustrous globules. When a certain size has been attained, a roundish perforation of the nuclear substance itself takes place at some spot, usually near the periphery of the nucleus, so that the nucleus appears as if pierced at this point. This first hole is often followed by a second in close juxtaposition with it. As this opening enlarges, the bridge situated towards the periphery, corresponding with the narrowest border of the orifice, breaks through, and the two ends then separate from each other; so that instead of the round hole in the nuclear substance we have a deep indentation of the nuclear substance penetrating from the circumference towards the middle. By this simple process therefore, as may be readily seen, the form of the above-mentioned glandular tube is very soon produced: at first, by the two ends becoming rounded, it has nearly the appearance of a sausage with two surfaces in apposition; and it frequently retains this form even in the fully developed state. But generally, during the further growth of the tube, its two extremities separate more or less, and then one of them becomes bent or rolled up, so as even to embrace the neighbouring tubes; and thus the position and form of the individual glands is altered in many ways, and the above-described appearance of the vermiform, tortuous, glandular coil as the contents of the capsule is produced.

As regards the further histological differentiation of the individual glandular tubes, these, during the processes just described, become more and more filled with darkly granular substance, in which afterwards larger pale bodies make their appearance; these gradually increase, until finally the whole tube is filled with the roundish corpuscles, or, as Kölliker calls them, cell-like structures, above described. The perfectly formed glandular tube is attached by one end, or frequently, as it seemed to me, by both ends, to the wall of the capsule; but only one extremity, and with it the wall of the capsule at the same spot, exhibits a roundish external orifice.

The number of glands enclosed in a capsule is not constant. The above-mentioned large capsules standing in regular transverse rows generally contain three or four, rarely more (figs. 10 to 14); the smaller only one, or, at the utmost, two tubes.

On various parts of the surface of the body, partly upon and partly between the vesicles, and sometimes even within them, we frequently see dark-brown marks (*plaques*), forming the most multifarious figures, which are often, in consequence of their tenacious consistence, much elongated, and only connected by narrow bridges. These substances appear to have nothing to do with the pigment-structures which so frequently occur in the skin of Annelids; but whether they are, as I suppose, to be regarded as the secretion furnished by the glands, and what purpose is served by it in this case, I cannot decide.

I have already called attention to the gradual transition from the small clavate cutaneous structures, resembling the tentacles which stand upon the anterior portion of the head, to the globular ones which succeed them, and indicated that a change of func tion is connected with the change of form. This opinion is founded upon the circumstance that in the small papillæ of the cephalic segment I have never detected structures resembling the above-described developmental stages of the glands, or the latter with their openings. On the other hand, it appeared to me that fine filaments penetrated into some of them from below, and passed at the top into granular inflations: these therefore might be regarded as the extremities of nerves. I believe, therefore, that these small papillæ of the cephalic segment are to be regarded as tactile organs, in contradistinction to the globular appendages seated upon the rest of the body, which, as already shown, are cutaneous glands. With reference to *Sphærodorum*, Kölliker remarks that the (whole of the) small papillæ of the skin are not pierced by glands, but contain nerve-terminations—in direct contradiction to Claparède, who found the papillæ of the entire surface of the skin pierced by the efferent ducts of small cutaneous glands in the same animal. As I have at my disposal only a few spirit-specimens of *Sphærodorum*, collected last summer in Heligoland, I cannot decide upon this difference, or whether the above-described distinction between tactile and glandular papillæ exists also in *Sphærodorum*.

Besides the described circlet of globular glandular capsules (or, if it be preferred, the transverse rows of dorsal and ventral cirri), each segment also bears a pair of uniramose pedal tubercles. Each foot (fig. 2) consists of a conical tubercle, at the apex of which there is a pair of lamellar processes or fins and a bundle of about six composite setæ inserted into the tubercle; posteriorly the number of the latter diminishes, so that on the last segments there are only one or two setæ in each tubercle; but these are exactly similar to those of the anterior feet. The pedal tubercles are placed directly beneath the two lateral dorsal capsules, and are usually in part concealed by them.

The alimentary apparatus of our animal commences with a buccal orifice placed on the lower surface of the cephalic segment, towards the anterior margin; this, when retracted, resembles a funnel with numerous folds. The mouth leads at once into a spacious flask-shaped œsophagus (fig. 1) or gizzard with double walls, or rather consisting of two chambers placed to a certain extent one within the other. By compression, the inner part can be pushed out; but whether it can be voluntarily extended, and is consequently to be regarded as a trunk, I was unable to determine by observation. The œsophagus is directly followed, and, indeed, embraced, by a rather wide, dark-brown intestine, which lies loose in the body-cavity without any attachments or constrictions, and makes about four or five convolutions before reaching the anus, which is situated at the posterior extremity of the body.

With regard to the sexual conditions, I can only state that one of the animals examined I found filled pretty closely with roundish discoid ova, which lay perfectly loosely and irregularly in the body-cavity, and, surrounding the intestine on all sides, were driven to and fro in the cavity of the body by the movements of the intestine and the general movements of the animal.

If we now glance back at the zoological characters of our animal, especially in comparison with those of the genus *Sphærodorum*, we shall be at once struck by certain points common to both. The most prominent of these are the globular cutaneous appendages occupied by glands, and the form of the cephalic segment, with its peculiarly formed tentacles and papillæ. Further points of union are presented by the form and composition of the feet, which in both consist of simple conical fins having a bundle of composite setæ. Œrsted* indeed ascribes to *Sphærodorum* a multifid fin (*pinna unica multifida*); but this notion, as Claparède correctly observes, has evidently arisen from the fact that Œrsted regarded the glandular appendages which are frequently seated upon the pedal tubercles as parts or branches of the fin. Besides these characters, the two have in common the absence of any external segmentation of the body, or annulation of it by means of transverse furrows, as also, in connexion with this, no internal constrictions of the intestine are present, but the latter in both constitutes a loose tube laid together in several convolutions.

When we consider those properties of our animal which remove it from *Sphærodorum*, we find, in the first place, that whilst *Sphærodorum* bears *only one pair* of the large globular cutaneous appendages upon the back of each segment, in our animal *ten of these stand upon each segment*—six on the back, and four on the ventral surface. There is also a difference in the form of these appendages; for in *Sphærodorum* there is a papilliform process upon the globular capsule, whilst in our animal, in which this process is deficient, the globular form of the structures in question is much more clearly shown. In the presence and even the form of the four frontal tentacles of the buccal segment both agree; but we have described two posterior tentacles or tentacular cirri, exactly like the frontal tentacles, which are wanting in *Sphærodorum*, where their place is taken by two mere rudimentary glandular appendages.

Of subordinate distinctions we find that in our animal there are at the apices of the pedal tubercles two lamellar fins, which are absent in *Sphærodorum*; whilst, on the other hand, the

* *Loc. cit.* p. 108.

peculiarities which Claparède describes in the feet of some of its segments (the third, fourth, &c.) are wanting in our animal. Further, according to the statements of all authors, *Sphærodorum* has four eyes, whilst our animal only shows two. The accordance of the true intestine has already been pointed out; but we find essential differences in the anterior part of the alimentary tube, as in *Sphærodorum* this consists of three successive divisions (see Claparède, Anat. &c., p. 51), which cannot be made to agree with the structure of the œsophagus &c. described by us.

Lastly, as regards the external form of the body in general, this, again, is extremely different in the two animals. Œrsted says of *Sphærodorum*, "corpus lineare teretiusculum;" Johnston, "body serpentiform;" and, lastly, Claparède describes *Sphærodorum* as a cylindrical worm of 2 inches long. If we contrast with this the little animal above described, scarcely 2 millims. in length, and comparatively very broad and nearly oval, the difference becomes very striking.

Nevertheless, notwithstanding all these differences, the affinities first indicated lead me to prefer uniting our animal, at least provisionally, with *Sphærodorum* to form a single genus, for which purpose, however, the generic characters given by Œrsted and others must undergo some modifications. I would define the genus as follows:—

Genus Sphærodorum, Œrsted.

The more or less elongated body, which is always narrowed before or behind, nowhere shows any transverse annulation or segmentation indicated by external furrows, although this is defined by the outer appendages. The buccal segment bears on the anterior margin of the small and not deeply divided cephalic lobes four clavate and anteriorly somewhat inflated frontal tentacles, the bases of and intervals between which are closely set with small but also clavate papillæ. Further back, likewise on the buccal segments, there are two tentacular cirri, one on each side, which sometimes resemble the frontal tentacles, and in this case are to be regarded as true tentacles also in respect of their function, sometimes in form and signification approach the globular cutaneous appendages of the following segments, and must then pass as glandular organs. The first body-segment and all the following ones are characterized by large globular cutaneous appendages occupied by tortuous tubular glands. Of these either each segment bears only two upon its back, namely, one on each side over the pedal tubercle (dorsal cirri), or the whole segment is surrounded by a circlet of these appendages, which are placed at regular intervals, and form a transverse row upon the back and another on the belly. Between the large cutaneous appendages there are numerous small ones irregularly scattered over the body. Feet simple, containing a bundle of composite setæ.

1. *Sphærodorum flavum*, Œrst.

Annulat. Danicor. Conspectus, fasc. i. p. 43, pl. 1. fig. 5, pl. 6. figs. 92, 101. Archiv für Naturg. 1844, i. p. 108.

Corpore $1\frac{1}{2}''$ longo, $\frac{3}{4}'''$ lato, teretiusculo, flavescente, utrinque fere æqualiter attenuato, segmentis 150, duplo latioribus quam longis, papillarum 12–16 in margine anteriore capitis, duabus paulo longioribus; oculis quatuor quadratum formantibus; pinnis abbreviatis, 7–8-fidis, setis 5–7 uncinatis.

The preceding character of Œrsted's species must certainly undergo some alterations in accordance with the above observations. As, however, *S. flavum* does not appear to have been observed by any one since Œrsted, I leave his description unaltered for the present. It is possible, moreover, that there is no specific difference between *S. flavum* and *S. peripatus*.

2. *Sphærodorum peripatus*, Grube.

(Die Familien der Anneliden, p. 67.)

Pollicita peripatus, Johnston, Ann. Nat. Hist. vol. xvi. p. 5, pl. 2. figs. 1-6.

Sphærodorum peripatus is the species investigated by Claparède and Kölliker, as has already been repeatedly stated.

3. *Sphærodorum Claparedii*, sp. n. Pl. I.

I venture to name the new species described in detail in this paper after the indefatigable observer who has done so much for the natural history of the Annelida.

EXPLANATION OF PLATE I.

Fig. 1. *Sphærodorum Claparedii*, magnified about 40 diameters.
Fig. 2. Foot with the bundle of composite uncini, magnified 300 diameters.
Figs. 3–9. Developmental stages of the glandular appendages, magnified about 600 diameters.
Figs. 10–14. Developed glandular capsules with the tubes contained in them, and opening externally by a fine orifice in the wall of the capsule; magnified about 600 diameters.

II.—*On the* Menispermaceæ.

By John Miers, F.R.S., F.L.S., &c.

[Continued from vol. xix. p. 330.]

50. Pycnarrhena.

This genus was established by me in 1851 upon an Indian plant in the Wallichian Collection. It is easily recognized by its oblong, acuminated, simply penninerved leaves, upon short and remarkably tumid petioles: this manner of nervation, though less frequent, is not rare among the *Menispermaceæ*, for it occurs also in *Hyperbæna, Antitaxis, Penianthus, Clambus, Elissarrhena, Spirospermum*, and *Rhaptonema*. It is also remarkable for having nine stamens almost without filaments, or, rather, as many 2-celled anthers, crowded in three series so as to form a sessile central head, after the manner of *Anamirta*; the anthers are transversely oval, 2-valved, gaping by a common horizontal suture. The drupe is oval, with the vestige of the style placed a little above the middle on the ventral face; the putamen is reniformly oval, somewhat compressed, thin and testaceous, the seed being appended to the slight intrusion of an almost obsolete condyle on the ventral side; the embryo is exalbuminous; the cotyledons, occupying almost the whole space of the cell, are very fleshy, accumbent, lunately incurved at the apex towards the ventral face, where the minute radicle points to the persistent style. The genus comes near to *Antitaxis*.

Pycnarrhena, nob.—*Flores* dioici. *Masc. Sepala* 6–9, ternatim disposita, exteriora gradatim minora et bracteiformia, 3 interiora multo majora, cuneatim ovalia, valde concava, æstivatione imbricata. *Petala* 6, sepalis breviora, cuneata, transversim latiora, apice subtruncata, lateribus paulo oblique involutis, membranacea. *Stamina* 9, in glomerulum centralem crebriter aggregata; *filamenta* brevissima, tenuia, fere obsoleta; *antheræ* subglobosæ, cruciatim sulcatæ, septo transverso bivalvatim hiantes, loculo antico septulo verticali diviso, hinc inæqualiter 3-locellatæ.—*Fl. Fœm.* ignoti. *Drupa* gibboso-ovata, styli vestigio facie ventrali supra medium notata, glabra: *putamen* subreniformi-ovatum, paulo compressum, læve, chartaceo-testaceum, 1-loculare; *condylus* e sinu ventrali intra loculum paulo intrusus, hinc convexiusculus. *Semen* loculo conforme, exalbuminosum; *integumentum* tenuiter membranaceum, facie ventrali condylo affixum: *embryo* loculum implens; *cotyledones* magnæ, carnosæ, accumbentes, apice incumbentim incurvæ, radicula minima supera ad stylum spectante multoties longiores.

Frutices *Indiæ orientalis et insularum indigeni;* rami *rigidi,* *flexuosi, axillis nodosis et approximatis;* folia *oblonga, utrinque subacuta, lucida, glaberrima, penninervia, supra in nervis sulcata,* petiolo *brevi, apice valde tumido et cavo:* paniculæ ♂ *perplurimæ vel pauciores, supra-axillares, fasciculatæ, interdum brevissimæ et crebriter subglomeratæ, aut laxe ramosæ et petiolo paulo longiores; floribus parvis: in* ♀ pedicelli *pauci, axillares, et* 1-*flori.*

The characters of the following species will be given in the third volume of the 'Contributions to Botany:'—

1. *Pycnarrhena pleniflora,* nob. in Ann. Nat. Hist. 2 ser. vii. 44; —Pycnarrhena planiflora, *Hook. & Th. Fl. Ind.* i. 206;—Cocculus planiflorus, *Wall.* (*pro errore typographico vice* pleniflori).—In India orientali: *v. s. in herb. Soc. Linn.* ♂, Sylhet et in hort. Bot. Calc. cult. (Wall. Cat. 4961); *in herb. Hook.* ♀, Bengal (Griffiths).
2. —— *tumefacta,* nob.—In Borneo: *v. s. in herb. Hook.* ♂, Bangarmassing (Motley, 357).
3. —— *mecistophylla,* nob.—In Himalaya: *v. s. in herb. Hook.*, Assam (Griffiths, 1264).

51. Antitaxis.

This genus was proposed by me in 1851 for a plant collected in Malacca by the late Mr. Griffiths, with male flowers. It is only lately that I have seen other specimens in fruit. It has large lanceolate leaves, with alternate pinnate slender nerves, anastomosing towards the margin, and with rather short petioles: in the ♂ it has a few slender 1-flowered pedicels, fasciculated in each axil; in the ♀ the inflorescence is similar. The ♂ flower has eight sepals decussately arranged in opposite pairs, the two inner series being larger, equal in size, and imbricated in æstivation; it has two petals alternate with the inner pair of sepals, and somewhat smaller than these, four stamens cruciately placed opposite the petals, with filaments somewhat shorter than they, fleshy, thickening upwards, the anthers partly immersed in their summits, globular, 1-lobed, opening somewhat extrorsely by a diagonally transverse fissure, showing two gaping lips, as in *Anelasma* and *Elissarrhena.* The ♀ flower is unknown; but the drupes are subglobose and tomentose, with a somewhat reniform putamen, which is chartaceous and brittle, with an almost obsolete condyle in the sinus of the ventral side; the embryo is exalbuminous, reniformly orbicular, with large, fleshy, curving, accumbent cotyledons which nearly fill the cell, and a very minute, somewhat superior radicle. The leaves are coriaceous, glabrous, shining, having a peculiar nervation resembling that in *Pycnarrhena, Clambus,* and *Penianthus.* In its inflorescence, with several 1-flowered pedicels fasciculated in each axil, it resembles *Pycnarrhena,* as well as in its globular anthers opening extrorsely by a gaping fissure—a feature repeated in *Anelasma, Jateorhiza,* and *Elissarrhena.* The chief peculiarity of *Antitaxis* is in the dimerous arrangement of its floral parts; but the *Menispermaceæ* are far from constant in their usual ternary disposition, as we find also binary sepals and petals in *Antizoma, Clypea, Peraphora,* and others of the *Cissampelidæ,* while in several genera of the family the floral parts are found in numbers varying between two and seven, or even beyond this. When I published the synopsis of the genera (*huj. op.* xiii. 124), a separate section was made to include all those of which (for want of sufficient evidence) the tribe to which they belong could not be determined; to this section *Antizoma* was then referred. Since that time I have seen its fruit, which closely resembles that of *Pycnarrhena* and other genera of the *Pachygoneæ;* consequently *Antitaxis* must now find its place in that tribe: its wood is unmistakeably of Menispermaceous structure. The authors of the 'Nova Genera' (i. p. 33), in one sentence, expel this genus and *Odontocarya* from this family, because they appeared to them to offer no character distinct from the *Euphorbiaceæ,* and because they differ from *Menispermaceæ* in their inflorescence and in their habit. The strong evidence afforded here and elsewhere completely disproves all these inferences.

Antitaxis, nob.—*Flores* dioici. *Masc. Sepala* 8, per paria decussatim opposita, 2 exteriora bracteiformia, extus longe pilosa, 2 sequentia late obovata, apice truncata, ciliato-fimbriata, 4 interiora paulo majora, æqualia, suborbicularia, concava, carnosula, glabra, æstivatione imbricata. *Petala* 2, tenuiora, obovata, apice truncata, sepalis 2 interioribus alterna et paulo breviora. *Stamina* 4, cruciatim disposita, petalis opposita et paululo breviora; *filamenta* carnosula, sursum gradatim incrassata; *antheræ* filamenti vertice semiimmersæ, subglobosæ, carnosæ, 1-lobæ, subextrorsæ, rima subobliqua transversim et bivalvatim hiantes. *Ovarii* rudimentum nullum.—*Fœm. Flores* ignoti. *Drupæ* 3, aut abortu pauciores, subglobosæ, exsiccæ, velutinæ, styli vestigio facie ventrali notatæ; *putamen* subreniformi-ovatum, tenuiter chartaceum, fragile, 1-loculare; *condylus* parvus, internus, intra loculum sinum versus paulo intrusus aut fere obsoletus. *Semen* reniformi-globosum, exalbuminosum; *integumentum* membranaceum, sinum versus *chalaza* majuscula notatum: *embryo* reniformi-globosus, loculum implens, *cotyledonibus* magnis, carnosis, crassis, accumbentibus, curvatis, *radicula* minima supera ad styli vestigium spectante multoties longioribus.

Frutices *Asiatici, forsan scandentes;* ramuli *pubescentes, demum glabri, cupuloso-nodosi; axillis approximatis;* folia *oblonga vel oblongo-lanceolata, glaberrima, nervis impari-pinnatis;* petiolo *subbrevi, imo apiceque subtumidulo:* pedicelli ♂ *axillares, plurimi, fasciculati, gracillimi,* 1-*flori, internodiis sæpius æquilongi;* ♀ *axillares, pauciores, crassiores,* 1-*flori;* drupæ *subglobosæ.*

Descriptions of the following species will be found in the third volume of my 'Contributions to Botany:'—

1. *Antitaxis fasciculata,* nob.—In peninsula Malayana: *v. s. in herb. Hook. et meo* ♂, Malacca (Griffiths).
2. —— *cauliflora,* nob.—In Java: *v. s. in herb. Mus. Brit.,* Java, ♀ (Horsfield, 3 et 4).
3. —— *lucida,* nob.;—Cocculus lucidus, *Teysen et Bennings, Nat. Tijdsch.* iv. 397.—In Java: *v. s. in herb. Hook.* ♀ in hort. Bogor. cult. (T. Anderson).
4. —— *longifolia,* nob.;—Cocculus longifolius, *DC. MS.*—In insula Timor: *v. s. in herb. Mus. Paris.*

52. Spirospermum.

This genus was founded, in 1806, upon a Madagascar plant, by Du Petit-Thouars, who gave a very meagre description of it. De Candolle, in 1818, arranged the genus in *Menispermaceæ,* in his 'Systema,' comprising all the details afforded by Thouars within the space of six lines, and that is all we know of the plant since that time. In my prefatory remarks on this order (*huj. op.* 3 ser. xiii. 125), not having then seen the plant, I excluded the genus from the family, on account of the spiral form of its embryo, and upon the following grounds. In every instance throughout the *Menispermaceæ* I had found the embryo always more or less incurved, the degree of its curvature invariably corresponding with the extent of excentric growth of the ovary and fruit, the cotyledonary end of the embryo being seen invariably in close proximity to the basal point of attachment of the fruit, while the radicular extremity as constantly points to the vestige of the deflected style, the latter being generally drawn down near to the basal point of attachment: hence, in the most extreme cases, the embryo never completes an entire circle; and from the constancy of this feature, it was naturally inferred that a spiral embryo could not occur in *Menispermaceæ.* A subsequent examination of the seed convinced me that I was quite mistaken in this conclusion, and that *Spirospermum* offers a very anomalous departure from the above-mentioned otherwise universal rule. Here, although the radicular end of the embryo remains in its normal position, its cotyledonary extremity is not directed as usual to the point of attachment of the fruit, but it wanders to some uncertain station through a helical channel. The putamen contains a single orbicular seed, which is greatly flattened and covered by a thin membranaceous integument; from a point on its periphery, just below the persistent style, and close to the basal attachment of the putamen, the cell begins to be intercepted by a thin partition, which curves spirally until it terminates in the exact centre of the seed, thus completing in its course two and a half gyrations, and the embryo is found within the spiral cell of the integument, without any albumen. This spiral division is, in fact, the condyle, which at its commencement is like that seen in *Tiliacora, Diploclisia,* &c. —where, terminating a little beyond the middle of the cell, it divides it into a bimarsupial or hippocrepiform pouch; but in *Spirospermum* this septiform condyle is continued far beyond that point, in an extremely attenuated state, under the form of a spiral coil, which reaches the centre in the manner before described. This septiform line is attached to the two opposite inner faces of the putamen, as in the other genera; and when a knife is passed round the periphery of the putamen, its two flattened sides are easily torn away from the adherent edges of the condyle, leaving a corresponding helical cicatrix upon the two faces, and showing correlative grooves on the outer surfaces of the putamen. We might suppose that the embryo would fill the entire length of the helical cavity of the integument; but it was otherwise in the specimens I examined; for although this spiral cavity consisted of nearly three gyrations, the elongated slender embryo only extended through half of the first turn, the remaining two gyrations being quite empty; the radicular end, however, touched its normal point on the periphery, at the beginning of the first coil.

I have explained how the development in *Tiliacora, Diploclisia,* &c. takes place by the simple process of excentric growth; indeed in all the genera of the family, even in the more extreme cases just mentioned, the amount of curvature of the integument and seed is coequal and symmetrical with the unequal expansion of the ovary, and therefore of the pericarp and putamen; but in *Spirospermum* the one greatly exceeds the ratio of the other, as is shown above; and this forms a solitary exception to the otherwise general rule.

It would be instructive if we could ascertain the cause of this singular growth. In all cases the original ovular integument grows lengthways; and in *Spirospermum* we might suppose that it grows into a very slender elongated tube within the cell of the ovary, gradually extending itself till it completes a circle, and that at that point, meeting with obstruction, it would be turned aside and carried forward in an inward spiral coil for nearly two other gyrations, terminating in the centre: in this case the entire coiling tube ought to be free; but we see the reverse; for its adjacent sides are found agglutinated together and also with the interposing spiral condyle, which has simultaneously accompanied it in its growth. By what means this is accomplished appears an enigma very difficult of explanation.

The only species of *Spirospermum* is a tree of low stature, or a shrub with pendent branches charged with large, lanceolate-oblong, coriaceous, polished, glabrous leaves, with many parallel oblique nerves, which anastomose near the margin; the petiole is short and stout; the inflorescence is a terminal panicle, twice the length of the leaves, pendent, and, with the fruit, becomes black in drying; it is copiously branched, its ultimate branches bearing, in the ♀ plant, two long fructiferous pedicels, swollen at their summit into a receptacle, which carries nine crowded stipitate drupes, all being glabrous, bractless, and black. The drupes are exsiccous, orbicular, extremely compressed, acutely carinated on the margin, on which, close to the base, is seen the remnant of the persistent style, and on each flattened face, near the carinated margin, is a prominent ring: the putamen is thin and coriaceous, quite flat and discoid in the centre of each face, where it is marked by a spiral furrow corresponding with the line of condyle already described.

In the ♂ plant the inflorescence is in axillary panicles, which are as long as the leaves, having a slender rachis provided at each of its alternate axils with two slender branches of unequal length, all dichotomously divided, the ultimate branchlets bearing two equal 1-flowered pedicels, all quite glabrous. The flowers are small, consisting of:—six obovate sepals, in two series, the three inner being twice the length of the three outer ones; six equal oblong petals, one-third the length of the inner sepals, having their lateral margins inflected; six stamens, in two series, the length of the petals, the three outer ones free, with slender filaments, the three inner filaments being united for half their length into a monadelphous column; each stamen provided with two free, distinct, erect anther-lobes.

Spirospermum, Thouars.—*Flores* dioici, ubique glabri. *Masc. Sepala* 6, biseriata, obovata, fusco-nigrescentia, quorum 3 interiora duplo majora. *Petala* 6, biseriata, æqualia, oblonga, sepalis interioribus 3-plo brevioribus, lateribus inflexis. *Stamina* 6, biseriata, petalis æquilonga; *filamenta* filiformia, erecta, 3 exteriora libera, 3 altera fere ad medium in columnam centralem coalita; *antheræ* didymæ, lobis parvis, oblongis, liberis, erectis, apice paulo divaricatis, rima laterali longitudinaliter dehiscentibus.—*Fœm.* ignoti. *Drupæ* 9, supra receptaculum parvum crebriter erectæ, longiuscule stipitatæ, exsiccæ, orbiculares, valde compressæ, basin versus stylo persistente notatæ, nigræ, rugulosæ, glabræ; *putamen* sarcocarpio sicco tenaciter adherente vestitum, orbiculare, valde compressum, carina peripherica tenui latiuscula munitum, utraque facie marginem versus lira annulari prominente signatum, disco planum et sulco spirali notatum, tenuiter chartaceum; *condylus* internus, septiformis, primum angustus, demum filiformis, a basi ortus, deinde ex anfractibus 3 spiraliter convolutis in centro terminatus. *Semen* loculum implens, exalbuminosum, valde compressum; *integumentum* conforme, membranaceum, condylo spirali interseptatum: *embryo* valde elongatus, pariter teres, *radicula* basi proxima, ad stylum persistentem spectante, *cotyledonibus* linearibus accumbentibus vagis paulo breviore.

Frutex vel suffrutex *Madagascariensis, crebre ramosus;* rami *longi, teretes, iterum ramosissimi, pendentes, glaberrimi,* ramulis *ultimis* pedicellos 2 *unifloros gerentibus:* flores *parvi, glabri.*

The following species will be described in the third volume of my 'Contributions:'—

Spirospermum penduliflorum, Thouars, Gen. Madag. p. 19. no. 63; DC. Syst. i. 515, Prodr. i. 96.—In Madagascar: *v. s. in herb. Hook.* ♂ et ♀ (Gerard, 32).

53. Detandra.

This genus was proposed by me, several years ago, for two plants in the herbarium of Prof. DeCandolle, both natives of the province of Bahia in Brazil; its characters were sketched more than three years since in my synopsis of the genera of the family (*huj. op.* xiii. p. 124). One of these plants, in the size, shape, and texture of its leaves, offers some resemblance to *Chondodendrum tomentosum,* R. & P., with which it also agrees in the more than usual number of its imbricately disposed sepals; but it differs in the form of its six petals, and in having only three stamens, whose filaments are united into a central column, leaving the anthers almost sessile on its furcated summit*; the two cells of each anther are laterally imbedded in the nearly obsolete points of the filaments, the intermediate connective being very shortly and obtusely excurrent beyond their apex; and they burst by a

* This feature of the agglutination of the stamens suggested the generic name, from δετὸς, *ligatus*; ἀνὴρ, *mas.*

longitudinal suture corresponding with a narrow semiseptum, which renders them 2-locellate. We may perceive in the above peculiar characters some analogy towards *Parabæna* and *Syrrhonema,* from which genera it differs in many respects.

I have here described two species, one of which Dr. Eichler has made a third species of his genus *Sychnosepalum*; but I have shown, under my description of the latter genus, how much dissimilarity exists between them: it differs in its habit, its subpeltate leaves, its inflorescence and the structure of its flowers. The *Somphoxylon* of the same botanist is at variance with *Detandra* only in its more expanded panicle, minute flowers, and the smaller number of its sepals (frequently an inconstant character); it agrees in the number, shape, and relative size of the petals, and exactly in its three monadelphous stamens.

The species of *Detandra* have somewhat oval, subpeltate, coriaceous, 5-nerved leaves, which are glabrous and polished above, pale and tomentose beneath, on rather slender petioles: the inflorescence is a panicle shorter than the petiole, with short alternate branches, each bearing one to three alternate pedicellated flowers; the flower has fifteen to eighteen closely imbricated sepals becoming gradually smaller externally (the upper moiety of the six interior and larger ones expanding horizontally, as in *Chondodendrum*), six petals in two series, which are oblong or lanceolate, unguiculated at the base, and entire or denticulated on the margin; the stamens are already described.

Detandra, nob.—*Flores* dioici. *Masc. Sepala* 14–17, in ordine ternario ad torum subcylindricum imbricatim disposita, quorum 2–5 exteriora minutissima et bracteiformia, 6 intermedia ovato-oblonga et extus pilosiora, 6 interiora cuneato-oblonga, cum apicibus rotatim reflexis, omnia extus leviter tomentella et ciliolata. *Petala* 6, biseriata, subæqualia, sepalis dimidio breviora, unguiculato-oblonga vel lanceolata, erecta, glabra. *Stamina* 3, alte monadelpha, petalis longiora; *filamenta* in columnam centralem fere ad summum coalita, apice hinc crassiuscule et brevissime trifurca; *antheræ* bilobæ, lobis ovatis, majusculis, segregatis et in filamentum lateraliter semiimmersis, connectivo intermedio paululo excurrente, bilocellatis, 2-valvatis, rima longitudinali dehiscentibus.—*Fl. fœm.* ignoti.

Frutices *Brasilienses scandentes;* rami *striati, ad axillas cupuloso-nodosi;* folia *alterna, petiolata, subpeltata, ovata vel ovato-oblonga, imo rotundata vel sinu levi subtruncata, integra, coriacea, 5-nervia, supra glabra, subtus pallide tomentosa:* panicula *axillaris, petiolo brevior, tomentosa, alternatim ramosa,* ramis *brevibus, corymbuloso-paucifloris, pedicellis* 2–3, *fasciculatis ;* flores *parvi.*

The descriptions of the two following species will be given in the third volume of the 'Contributions to Botany:'—

1. *Detandra latifolia,* nob. in Ann. Nat. Hist. ser. 3. xiii. 124.—In Brasilia: *v. s. in herb. DeCand.* ♂, Bahia (Blanchet).
2. —— *ovata,* nob., *loc. cit.*;—Sychnosepalum microphyllum, *Eichl. in Mart. Fl. Bras.* fasc. xxxviii. p. 204, tab. 44. fig. 5. —In Brasilia: *v. s. in herb. De Cand.* ♂, Bahia (Blanchet, 3178 A).

54. Syrrheonema.

This genus was proposed by me for a climbing plant having roundish cordate leaves, with a supra-axillary inflorescence, consisting of from three to six short fasciculated peduncles bearing generally three sessile flowers, which are small, with six tomentose imbricated sepals, no petals, and three stamens united for half their length into a central column*, the free portions being nearly erect, fleshy, and semiterete, each having four distinct anther-lobes quadrately disposed and imbedded introrsely in their summits. There is some resemblance in this latter feature to the stamens of *Jateorhiza*; but the analogy extends no further.

The genus approaches *Detandra, Aristega,* and *Desmonema* in having three monadelphous stamens; but it differs from them in having no petals and in other particulars. In its inflorescence (consisting of several fasciculated, axillary, simple peduncles) it offers some analogy with *Pycnarrhena* and *Antitaxis*; but there the peduncles are 1-flowered, while here they bear from three to six crowded, sessile, very small flowers.

Syrrheonema, nob.—*Flores* dioici. *Masc. Sepala* 9, quorum 3 exteriora minora et bracteiformia, 3 interiora majora, ovata, acuta, concava, membranacea, extus pilosa. *Petala* nulla. *Stamina* 3, sepalis longiora, monadelpha; *filamenta* ad medium in columnam centralem coalita, sursum libera, crassiuscula, fere erecta, intus plana, extus valde convexa; *antheræ* omnino introrsæ, loculis 4, parvulis, quadratim discretis, 2 inferioribus minoribus, singulis subglobosis, filamento semiimmersis, rima obliqua hiantibus.—*Fl. fœm.* ignoti.

Suffrutex *scandens insulæ Fernando Po indigenæ*; ramuli *teretes, tomentosi*; folia *alterna, ovata, subcordata,* 5-*nervia, reticulata, subtus pubescentia,* petiolo *pubescente, limbo breviore :* pedun-

* Hence the generic name, from συῤῥέω, *confluo*; νῆμα, *filamentum.*

culi ♂ *breves, 3 vel plures, supra-axillares, fasciculati, pilosi, apice* 3–4-*flori*; flores *sessiles, parvi, cano pubescentes.*

The following only known species will be described in the third volume of my 'Contributions to Botany:'—

Syrrheonema fasciculatum, nob. in Ann. Nat. Hist. ser. 3. xiii. 124.—In insula Fernando Po: *v. s. in herb. Hook.* (Mann, 192).

[To be continued.]

III.—*List of Coleoptera received from Old Calabar, on the West Coast of Africa.* By Andrew Murray, F.L.S.

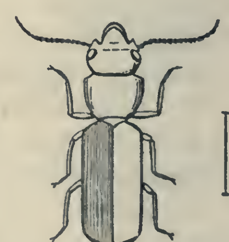
[Continued from vol. xix. p. 340.]

Cucujidæ.

Cheilopoma*, nov. gen.

Maxillæ membranaceous, not concealed by jugular pieces; mandibles unequally trilobed at the apex (the lobes or teeth unequal in length), and tridentate on the inner side and with a membranous plate at the base; ligula with its apex bilobed and membranaceous; both labial and maxillary palpi subcylindrical, moderately stout; labium entire. Clypeus very large, prominent, triangular, and projecting, almost covering the mandibles. Labrum almost imperceptible, narrow and membranaceous. Antennæ as long as the head and the thorax, and moniliform; all joints nearly equal, except the last and first two; the first is pear-shaped, the second a little longer, and the last twice the length of any of the rest. Anterior tarsi tetramerous (in the male?), middle tarsi pentamerous, and posterior probably also pentamerous, but broken off in the only specimen received; first article smallest; the last article in the anterior tarsi twice the length of the last article in the middle tarsi; femora and tibiæ short. Body flat, depressed, and with the sides parallel. Head rather broad. Thorax with parallel sides, rounded posteriorly.

Cheilopoma castaneum.



Dilute castaneum vel testaceo-ferrugineum, nitidum, leviter punctatum; elytris striato-punctatis, interstitiis irregulariter punctatis.

Long. $4\frac{1}{2}$ lin., lat. $1\frac{1}{3}$ lin.

* From χεῖλος, *a lip*, and πῶμα, *a lid*, in allusion to the large clypeus covering the greater part of the mandibles.

Pale chestnut or testaceo-ferruginous in colour, with tip of the mandibles black; shining, finely punctate. The head rather broad, with a marginal projection in front of the eye; the clypeus lower than the rest of the head, and also separated from it by a further depression; there is a very shallow depression on each side, between the eyes, which are rather strongly granular; punctuation fine. Thorax nearly a third broader than long, smooth and flat, with shallow depressions towards the posterior angles; sides parallel; apex truncate; anterior angles, as seen from above, right-angled, posterior rounded except at the angle of the base, where there is a slight projection; base and sides margined, the margin visible from above at the posterior half of the thorax, not visible on the anterior half, it being turned in below. Scutellum small, transversely ovate, rounded; the apex slightly indicated, very slightly punctate. Elytra punctate-striate, the striæ becoming evanescent towards the apex, the interstices punctate; shoulders not prominent, sides subparallel; slightly narrower behind the shoulders, and becoming broader again behind the middle; apex rotundato-truncate, sides margined, but the margins not seen from above. Underside very shining and smooth, more finely punctate than above.

I have only received one specimen of this species; and even it was somewhat imperfect, the posterior tarsi having been lost; but it appeared such an interesting addition to the genera of Cucujidæ that I have had no hesitation in describing it from my materials such as they are.

The only forms which we have hitherto known of this little family are the true *Cucujus*, with its dull opaque texture and usually bright-red colour, of which species occur in Europe, America, and Australia. In looking at the section from my present point of view, the Australian *Platisus* clearly goes along with the typical *Cucujus*. The Brazilian *Palæstes*, bright and shining, forms a different section; and the present genus a third.

It has a certain degree of superficial resemblance to *Trogosita*.

Silvanidæ.

Silvanus frumentarius, Fabr. Syst. El. ii. 557. 11; Erichs. Ins. Deutsch. iii. 336.

In the packing of boxes from Old Calabar.

Cryptophagidæ.

Cryptophagus sericeus.

C. bicolori affinis, thorace angulis anticis in dentem acutum producto dignoscitur; oblongo-ovalis, piceo-ferrugineus; elytris et pedibus testaceis, sericeo pubescens, levissime punctatus.

Long. lin., lat. lin.

Allied to *C. bicolor* of Sturm, in the text of his Deutschlands Fauna, vol. xvi. p. 107 (*C. rufipennis,* Dej., of Sturm, in plate, *op. cit.* pl. 319), but is readily recognized by having a projecting triangular tooth at the anterior angles of the thorax. It is more shining silky and finely pubescent than most of the other species, and its punctuation is so fine as to be almost imperceptible. The thorax, besides the projecting tooth at its anterior angles, has a very slight prominence on the surface a little behind it. The tooth is triangular in shape, and points obliquely outwards.

In the packing of boxes from Old Calabar.

Murmidius ovalis, Beck (*Ceutocerus advena,* Schuppel), Germar, Ins. Nov. i. p. 85.

In the packing of boxes from Old Calabar.

Lathridiidæ.

Holoparamecus Kunzei, Aubé, Ann. Soc. Ent. Fr. 1843, p. 245.

Readily distinguished from the other species described by its having a longitudinal dorsal fovea in the middle of the disk of the thorax.

Alive in the packing of boxes from Old Calabar. This species was first found by M. Kunze in fungi coming from Brazil. Its mode of occurrence throws some uncertainty on its aboriginal habitat.

Dermestidæ.

Dermestes subcostatus.

Supra totus brunneus, punctatus, pube brunnea et grisea pubescente; elytris subcostatis, apice rotundato; abdomine pube cinerea vestito, utrinque bitessellato.

Long. lin., lat. lin.

Above concolorous, dark brown, clothed with dark and paler brown pubescence mixed, producing a dark-brown pubescence; punctate. The thorax is twice and a half the length of the elytra, and has the usual round depression at the base between the middle and the posterior angles. The elytra are subcostate, but the punctuation continues irregularly over all. The underside is clothed with cinereous whitish pubescence, and the anterior part of each segment of the abdomen has on each side a mark clothed with dark-brown pubescence, next the margin of the abdomen, and another between it and the middle, giving the abdomen the appearance of a double row of tessellation on each side of the middle; the outer mark is bilobed, the lobes pointing backwards; the inner mark is more or less triangular, the apex pointing backwards. In none of my specimens is there any appearance of the fossette which Erichson uses as a character to divide the genus into two sections, according as the males have a fossette on the fourth segment or on the third and fourth segments of the abdomen.

The species is otherwise not difficult to distinguish. Its upper surface being concolorous reduces the number with which to compare it to a few; the ordinary proportions between the elytra and the thorax remove it from the Chilian species; and the double tessellation of the pubescence on each side of the abdomen distinguishes it from the Australian, Natal, and Siberian species.

If we except one or two of the species which are established and go everywhere in ships, the members of this genus do not appear to be so cosmopolitan as is generally supposed. At any rate, the other species come constantly from the countries to which they are ascribed.

[To be continued.]

IV.—*Remarks on the Potton Sands, in reply to Mr. Walker's Paper in the 'Annals of Natural History' for November 1866.* By Harry Govier Seeley, F.G.S., of the Woodwardian Museum in the University of Cambridge.

In July 1866 I wrote to the editors of this Magazine a letter on the fossils of the sands at Potton, expressing a few results of investigations into the nature of the sands between the Kimmeridge Clay and what are usually called the Middle Cretaceous beds*. My friend Mr. Walker, apparently misunderstanding my paper, and being zealous for the geological honour of our University, at once wrote a refutation of my mistakes, and published it in various sections of the British Association and in this Magazine. However, the only mistake in my letter was the statement that "*Gryphæa dilatata* is perversely wanting," which, indeed was then true; for before the end of July it occurred in great plenty, and was exhibited in the Woodwardian Museum.

* A portion of my results were given in a paper "On the Carstone and its Southern Extension," read in the Geological Section of the British Association at Nottingham; and the whole of them, with the method on which they depended, were given in a paper "On the Potton Sands," read before the Cambridge Philosophical Society, Nov. 12, 1866.

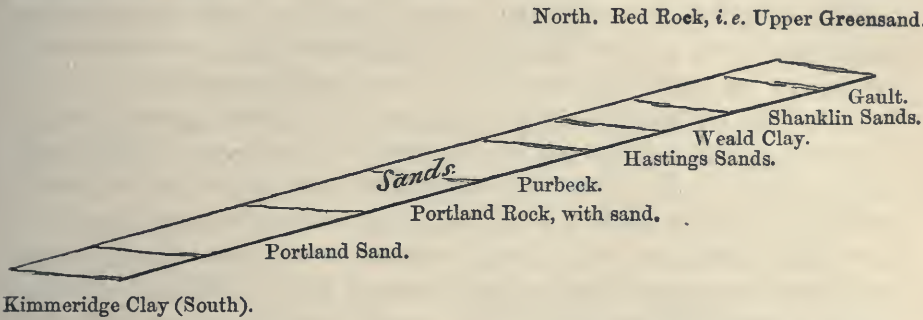
With this confession I now proceed to examine Mr. Walker's paper.

I. The deposit in which the phosphate-bed occurs he names the Lower Greensand. The Shanklin (or Lower Green) Sand, as I understand it, is the series of beds between the Weald Clay and the Gault. But these sands at Potton are between the Gault and the Oxford Clay; and, so far as I remember, the only fossil previously recorded from the beds in this district is *Ammonites biplex,* mentioned in my paper on the Cretaceous beds at Ely,—neither of which facts offers any presumptive evidence of the deposit being Shanklin Sands.

To assume the age is, no doubt, an easy way of settling an exceedingly complicated problem, and at the same time enables us to assert with confidence that all fossils except those previously found in similar deposits must be extraneous fossils, derived from the denudation of older beds, or, if need be, of newer ones. But even if the Potton Sands had been Lower Greensand, for which there is not an atom of evidence published, I am not aware that there would be anything more wonderful in the occurrence of *Gryphæa dilatata* in such a bed than there is in the occurrence of *Ammonites Lamberti,* a lower Oxfordian species, in the Kimmeridge Clay of Ely and in the Lower Greensand of Atherfield, or in the finding of the eminently Cretaceous *Neithea quinquecostata* in the Kimmeridge Clay of Weymouth.

II. A paragraph further on, Mr. Walker calls the phosphatic deposit a conglomerate. The idea conveyed by the term to most men who have seen conglomerates is a deposit formed by the wearing up of older strata into rounded masses, which have often become cemented together. But this Potton bed is a quantity of rolled concretions of tolerably pure phosphate of lime with a quantity of rolled masses of sand, sometimes concreted with phosphate of lime, sometimes with iron, rarely with silex, and a small proportion of old rocks: these are oftenest loose in sand, but sometimes bound into a hard mass by oxide of iron. The term conglomerate applied to this bed is calculated to mislead; for, involving the idea of denudation of older beds, these might furnish our author with his would-be extraneous fossils.

III. The author then questions my reference of this stratum to the *Carstone.* That name I have since proposed to restrict to the sands of Yorkshire, Lincolnshire, and Norfolk which occur between the Upper Greensand (Hunstanton Limestone) and the Kimmeridge Clay. But though I abandon the term, I do not abandon the idea; for what I wanted to express may be shown by this diagram of the succession of sands in this part of our series of strata:—



In the south the sands pass insensibly down into the Kimmeridge Clay, in the north they rise insensibly up into the Upper Greensand; and the further one travels from the elevation of the Purbeck-Wealden area, the more thoroughly do those and all the cognate beds become represented by marine sands.

IV. What I meant by the deposit reproducing earlier in time the *conditions* of the Cambridge Greensand is not what our author is at such pains to show (that the Potton bed is sand, and does not effervesce with hydrochloric acid, while the Cambridge bed is a marl which does effervesce with hydrochloric acid), but that both were formed on a long low shore during a protracted period of time, that both derived their phosphoric acid from the growth and decay of sea-weed, that both were open to the actions which furnished the Greensand with its wonderful erratics*.

V. Our author then reminds us that in one analysis of a sample from this Potton phosphate bed there was as much as 6·64 per cent. of alumina, magnesia, and fluorine, and adds, "this would indicate that the phosphatic nodules had been formed of clay soaked in decomposing animal and vegetable matter." The author does not tell us whether this has been determined by experiment or evolved by some other method; but it is certainly a notable discovery that by soaking six or seven parts of alumina in decomposing animal and vegetable matter till they increase to 100, you will produce a nodule of *phosphate of lime*. What, meanwhile, would become of the clay, or in what reservoir all this soaking was to be done, are matters as to which we are left in ignorance.

VI. I am then criticised for saying that I had gathered no extraneous fossils from the bed. This, with diffidence, on account of the state of the specimens, I still repeat. And it is one of those things which have surprised me most; for I have

* See Geol. Mag. July 1866, "On the Cambridge Greensand."

long been in the habit of teaching that sands and sandstones are formed during upheaval, and therefore we may expect in them fossils denuded out of older strata; but we shall also almost inevitably have in the bed, of contemporary age, a mixture of the life of the preceding and of the succeeding periods*.

VII. The author then says that the phosphatic casts of shells in their general aspect resemble those of the Kimmeridge and Oxford Clays. Had he taken the trouble to get a few of them named, he would have found that they were Portland species; he would, moreover, have found that a large number of the casts are in sand cemented with phosphate of lime, and that species which are usually preserved as internal moulds occur with the shell preserved when contained in hard sandy nodules.

VIII. Many of the Mollusca, as Mr. Walker has stated, occur with the shell replaced by oxide of iron. They are all in exactly the same state of preservation; but since our author imagined the bed to be Shanklin Sand, he selects a few which have affinities with Lower Greensand species, and discards the remainder as extraneous—a way out of a difficulty, as I imagine, hardly in accordance with scientific method.

IX. Our author's list of Mollusca, as far as it goes, is given with some approach to correctness. I have seen no *Terebratula*, however, which corresponds with Prof. Morris's *celtica*. But *T. celtica*, *T. prælonga*, *T. sella*, *T. tamarindus*, and *T. depressa*, with some few others, will, I apprehend, hereafter be regarded as varieties of one species; so that it is one of those shells which it would not be surprising to find.

Pecten Robinaldinus is not a bad identification. But *P. Robinaldinus*, *P. interstriatus*, *P. Galliennei*, and several others are, I believe, only varieties of the *elongatus* of Lamarck, separated, like the Terebratulæ, because the series at the describer's command was too small to show the gradations of one form into another.

Ostrea macroptera.—Although this is the name used by me for this fossil, as a variety of the *O. frons* of Parkinson, it is a form limited, so far as I know, to the Portland Rock, being usually attached by the whole of one valve, and having the other valve nearly smooth—very unlike Sowerby's typical *O. macroptera*. *O. frons* and *O. gregaria* are not to be separated as species.

Pleurotomaria Deshayesii, though resembling that shell, is a variety of *P. gigantea*, intermediate between that species and *P. rugata*.

* "The Laws which have determined the Distribution of Life and of Rocks." Read before the Cambridge Philosophical Society, Nov. 12, 1866.

Not having seen Mr. Walker's specimens, I am unable to speak with confidence on the other species named; but no such shells as *Exogyra conica, Modiola æqualis,* and *Myacites plicata* have come under my notice, though I have long had other species of those genera in the Woodwardian Museum.

X. The author's list of fish and reptiles needs but brief comment, the names being in part identical with those which have for years been attached to similar fossils in the Woodwardian Museum; but it can hardly be necessary to assure any one that the genera *Pycnodus, Hybodus, Lepidotus, Gyrodus,* &c. are just as little found only in the Kimmeridge Clay as are the species *Asteracanthus ornatissimus* and *Lepidotus* (*Sphærodus*) *gigas,* and that there can be no reason for thinking them other than tenants of the sea of the time. Had the author availed himself more fully of the collections to which he appears to have had access, he might have chronicled a more wonderful series of fossils than those enumerated—a series as rich perhaps in genera and species of fossil reptiles as any known geological fauna.

XI. The author quotes the existence, in the Woodwardian Museum, of shelly limestone containing *Cyrenæ,* and uses this as evidence for inferring some of the fossils to have been derived from the Wealden. I can confidently say that no such specimens have ever been found; and the concretions which were supposed to be the said shelly limestone, on being broken, are found full of *Cardium, Cytherea,* &c. Moreover I have shown, in my paper on these beds, that the material of the deposit came from the east.

XII. Finally, Mr. Walker has described and figured (pl. 13) two shells. The one referred to *Sphæra Sedgwickii* is not a *Sphæra,* but a *Cyprina,* and only differs as a variety from *C. angulata* (Sow.), a type prolific in varieties. The form figured is not typical. The species referred to *Pholas Dallasii* may be new. As every one is aware, all the secondary *Pholades* belong to the genus *Pholadidea.* This species burrows in wood, and lines its burrow with shell, and rather approximates to *Xylophaga* and *Teredina* than to *Pholas.* It has no affinity to D'Orbigny's *P. Cornueliana.*

The age of the beds to which Mr. Walker's paper relates is a difficult problem, and not one that can be solved by an appeal to fossils, or mineral character, or superposition. And it is intimately bound up with questions of great interest, such as the age of the Farringdon beds and the nature of the marine equivalents of the Purbeck and Wealden strata. For I have found to the north of Cambridge most of the Farringdon fossils in a bed inseparable by any great distinction from, and under, sands full of the Potton-Sand fossils*.

A discussion of the whole question and descriptions of the fossils are given in my 'Geology of the Country round Cambridge.' It may be here stated that this investigation led to proposing the following classification of the secondary strata:—

Cretaceous...	Chalk.	
	Greensand.	
	Gault.	
Psammolithic (or Siliceous)	Shanklin (or Lower Green) Sand.	
	Wealden	Potton? and Wicken and Farringdon beds?
	Purbeck	
	Portland.	
Pelolithic (or Felspathic)...	Kimmeridge Clay.	
	Coral Rag and Gamlingay Clay.	
	Oxford Clay.	
Oolitic	Great Oolite.	
	Inferior Oolite.	
	Lias.	
	Trias.	

While these divisions mark approximately the greater physical breaks and the periods when great changes were made in physical geography, it happens almost as a necessary consequence that there is a linking of the life between each of the six great groups of formations here indicated.

V.—*Remarks on* Pyrula (Fulgur) carica (*Lamarck*) *and* Pyrula (Fulgur) perversa (*Lamarck*). By T. Graham Ponton.

Although fully alive to the responsibility which rests upon any one who presumes to doubt the specific value of old and well-known forms, I nevertheless venture to submit the few following remarks to the consideration of other conchologists.

Having for some time past been engaged in re-arranging the collection of shells in the museum of this city, and having paid particular attention to the species comprised in the Lamarckian genus *Pyrula*, I have reluctantly come to the conclusion, for reasons to be afterwards mentioned, that *Pyrula perversa* (La-

* At the meeting of the Cambridge Philosophical Society, May 27, 1867, a paper was read "On the association of Potton-Sand fossils with those of the Farringdon Gravels in a phosphatic deposit at Upware on the Cam; with an account of the superposition of the beds, and the significance of the affinities of the fossils." This series I propose to name the Wicken and Herrimere group. I have already obtained 120 species, including many continental species not previously recorded in Britain.

marck) is not a distinct species from *P. carica* (Lamarck), but simply a reversed form of that shell.

The chief distinctions relied on for the discrimination of the two species, independently of the difference in the direction of the whorls, are

1. The comparatively greater breadth of the shell in *Pyrula carica.*

2. The orange-red colouring of the columella in the same species.

Now let us see how far these distinctions are worthy of reliance.

1. On measuring a number of both shells, I find that in shells of either species in which the *length* is equal, the *breadth* is also equal.

2. As to colouring: in specimens of *P. carica,* in this museum and other collections which I have examined, the colour of the columella varies from the typical deep orange, through various shades of yellow more or less intense, to, in one instance, a pure white—this individual being young, but not very small. Again, in specimens of *P. perversa,* I find that the colouring of the columella varies from the normal white to a yellow, in some instances deeper than that of many specimens of *P. carica.*

Another distinction sometimes relied on is, that the interior of the aperture in *P. carica* is merely striated, whereas in *P. perversa* it is grooved; but here, again, this appears to be an individual character, depending more on age than anything else; for the aperture of young specimens of *P. carica* is distinctly *grooved;* and the grooves in the aperture of mature individuals of *P. perversa* become in most instances almost obliterated, degenerating into mere striations.

The characters of the two species based on the form of the spire and the external coloration and sculpture of the shell are so variable that they must, I think, be regarded rather as individual than specific.

There is one obstacle, however, to the admission of the specific identity of the two forms—namely, the difference of locality, *P. carica* being usually considered to be confined to the more northern seaboard of America, and *P. perversa* to the more southern. This fact might seem to take the case out of the ordinary one of reversed shells; nevertheless a parallel case might, I think, be found in the differences caused by locality in *Purpura lapillus, Buccinum undatum,* &c. The fact itself, moreover, in the case under consideration requires confirmation; and it is by no means certain that *P. perversa* and *P. carica* are not both found in the West Indies. There is, indeed, in the collection of this museum a specimen of *P. perversa* said to have been brought from South Carolina; but I should not like to lay much stress upon this, as the localities given, in collections, for foreign shells are too often, alas! not to be depended on.

I may add that my notes on these species were submitted to Dr. Eduard von Martens, of Berlin; and it is at his suggestion they are published.

In conclusion, I would suggest the following amended diagnosis of the shells in question:—

Pyrula carica (Lamarck).

Shell pyriform, ventricose, tumid, rather thick, more or less transversely striated; whorls *dextral,* more or less depressedly angled round the upper part, armed at the angle with large flattened spines; interior of the aperture striated or faintly grooved; columella varying in colour from deep orange to white; exterior of the shell white, variously streaked and banded with reddish brown.

Hab. South Carolina, West Indies?

Var. α. The *Pyrula perversa* of Lamarck.

The shell the same as the last; but whorls *sinistral;* aperture more or less distinctly grooved; colour of the columella varying from pure white to deep yellow.

Hab. West Indies, Gulf of Mexico, Florida, South Carolina?

Two other varieties might perhaps be added, namely:—

Var. β. Shell thin; colours pale or uniform; smooth within; dextral.

Var. γ. The shell with large spines, with a rather short but very gibbous and swollen canal.

Hab. Guyana. A specimen in the Museum at Berlin (Dr. von Martens).

Clifton, near Bristol, June 10, 1867.

VI.—*On the Tunnelling Coleopterous Genera* Bledius, Heterocerus, Dyschirius, *and their Danish Species.* By Professor J. C. Schiödte*.

The connexion between these three genera is not of a systematic character, for they belong to three widely different families;

* Translated from the Danish original in 'Naturhistorisk Tidsskrift,' 3 ser. vol. iv. p. 171. Copenhagen, 1866.

but they are closely connected by their habits, living together as they do on the shores of fresh and salt waters, where they excavate tunnels and galleries, which betray their presence on the surface by small heaps of earth, like diminutive mole-hills. Besides, *Dyschirii* and their larvæ are specially equipped for hunting the others.

The species of *Bledius* and *Heterocerus* are generally not seen about in the daytime, but leave their habitations on warm summer evenings, after sunset, flying in numbers near the surface. Those few which are observed in the daytime are only such as have been pressed out of the soft ground by footsteps, and hurry away for safety. They may, in fact, be collected in this manner; but very many are thus squeezed to death, and it is better to dig them out. The small heaps indicating their dwelling-places are easily observed, because, consisting as they do of loose particles of earth, they dry soon and distinguish themselves by a lighter colour from the moist ground. The different species of *Dyschirius,* on the contrary, are constantly in motion, both in their galleries and out of them, hunting their prey, love to bask in the sun, and exhibit upon the whole the same wild, restless, insatiably rapacious nature as the shrew-mouse and the mole, which they may be said to represent amongst Carabidæ.

I.

"Oxytelini genuini," Er. (Gen. et Spec. Staphylinorum, 30) forms a well-defined small group of Oxytelini, easily distinguished by triarticulate tarsi; but the views hitherto entertained of the mutual relationships of the genera belonging to this group can scarcely bear a thorough sifting. Thus the existence of two rows of fossorial spines on the anterior tibiæ of *Bledius* is erroneously regarded as the most characteristic peculiarity of that genus (which is more specially than any other constructed for digging); for *Oxytelus* and *Platystethus,* when carefully inspected, exhibit the same structure. On the other hand, it seems to have been overlooked that *Bledius* possesses another character distinctive of its peculiar fossorial type—viz. that the basal joint of the antennæ can be received into a groove situated close in front of the eyes, which therefore in *Bledius* are flatter than in the other genera. Nor is *Bledius* properly placed near *Oxytelus* and *Platystethus*; for that genus really represents the type of the *Carpalimi* modified for tunnelling-purposes. A close inspection will show that the entire group of Oxytelini genuini, Er., naturally divides itself into two subgroups principally distinguished by the structure of the eyes and the position of the coxæ, according to whether they move more on the surface and in daylight, or in darkness and underground. In the first case, as in *Oxytelus* and *Platystethus*, the eyes are finely granulated and naked, the middle coxæ separated from one another by a broad expanse of the sternum; the whole figure is flatter, the integuments with coarser sculpture and less hairy. But in *Carpalimus* *, *Haploderus*, and *Bledius* the eyes are coarsely grained, only fit for near vision, with lashes between the facets; the coxæ are closely approximated to one another, the general figure more cylindrical, the sculpture finer, and the hair more abundant, finer, and closer. The pronotum is more smooth and vaulted, in the same proportion as the animals are more calculated for digging; in those which merely root on the surface, the coxal muscles are weaker, and the prothorax is by external cavities relieved of so much of its inner space as is not required for the neck and its muscles. Those which dig or root in the ground have the tibiæ furnished with spines, whilst in those which merely run about on the surface the tibiæ have fine hairs. The organs of the mouth exhibit a more or less protruding membranaceous labellum divided into two lobes, of which either the external margin alone, or the internal alone, or both margins are fringed or ramified, the ramifications being in some cases several times subdivided; besides, a kind of comb of horny spines is placed at the base of the inner side of each lobe, the two combs meeting in the middle of the labium. The mandibles possess a large rough grinder, and a well-developed, lobated, fringed or ramified inner lobe; its terminal part is slender and provided with few teeth in *Bledius* and others, but very powerful and with many teeth in *Platystethus*, *Haploderus*, and *Carpalimus*. The lingua is broad, with thin integuments, more or less emarginate in front, the corners pointed or (in *Carpalimus*) rounded; the paraglossæ are small, closely united with the lingua, and do not show in front of its corners. In *Bledius* alone the narrow fulcrum linguæ reaches the anterior margin of the lingua or protrudes in front of it as a ligula, carrying on its truncated apex a row of pointed spines.

The mutual relations of the principal genera of the group would therefore appear to be the following:—

* Names suggestive of life under the bark of trees are not to be allowed for animals living in moist places and in vegetable mould (cf. also Linn. Philos. Botan. § 232, and Fabr. Philos. Entom. § 22). The names *Haploderus*, Steph., and *Carpalimus*, Leach, ought therefore to be preferred (though not originally sustained by real characters) to *Phlœonæus*, Er., and *Trogophlœus*, Mannerh.

I. Eyes finely granulated, naked. Middle coxæ distant from one another.
OXYTELUS, PLATYSTETHUS.

II. Eyes coarsely granulated, hairy. Coxæ approximated.
1. No antennal grooves.
a. Legs calculated for rooting; anterior tibiæ with only one row of spines, emarginate at the point. The lateral rib of elytra close to the margin.
HAPLODERUS.

b. Legs calculated for running; tibiæ with fine hairs, not emarginated. The lateral rib of elytra distant from the margin.
CARPALIMUS.

2. Antennal grooves in front of the eyes.
Legs constructed for digging; anterior tibiæ whole, with double row of spines; lateral rib of elytra distant from the margin.
BLEDIUS.

Two attempts have been made at a subdivision of the old genus *Bledius*, Leach; but they have failed to command general support, having been aimed rather at an isolation of some more remarkable species than a careful analysis of the mutual relations of the species in general. Nevertheless such a general analysis, carefully executed, reveals so many important differences between the species, particularly in the structure of the mouth and the prothorax, that it becomes impossible to preserve *Bledius*, Leach, as an undivided natural genus. This will have become manifest already to those who have studied the descriptions and details of the larva which I have given on a former occasion*; and the divisions of the old genus suggested by the differences between the larvæ correspond most closely to those I have now to point out in the perfect insects, and which may be thus summed up:—

I. Terminal part of *mandibles* thick, with a strong sharp tooth behind the apex. Inner lobe of *maxillæ* spinulous, the terminal spines blunt and powerful. Anterior margin of *labium* straight; lobes rounded, their margins ramified all round; the spines of the comb (see above, p. 32) ramified at their points. Posterior corners of *pronotum* rounded, not separated from the posterior margin.

A. Sockets of *first pair of coxæ* externally open.
Lobes of *labellum* with three elongated ramifications, the innermost of which is very long, all profusely subdivided.
Spinulous ridges of *anterior tibiæ* widely separated.
BLEDIUS, s. str.

Danish species:—1. *B. tricornis*, Herbst, fr. Sometimes re-

* In the "Observationes de Metamorphosi Eleutheratorum," in vol. iii. of the 'Naturhist. Tidsskrift,' tab. 12.

markably tenacious of the locality: thus a small colony of this species still existed thirty years ago in the unpaved footpath of a little-frequented street in Copenhagen, which in ancient times was a meadow such as it generally inhabits. 2. *B. bicornis,* Ahrens, m. fr. on marshy soil near high-water mark, in company with *Corophium longicorne*; its tunnels reach a depth of 2 feet, and are of importance for the formation of new alluvium. 3. *B. diota,* n. sp., resembles *B. hinnulus,* Er., but is distinguished by the great size and development of the anterior corners of the forehead, and by the elytra being more sparingly and finely punctate. The larva was described in 'Naturhist. Tidsskrift,' iii. p. 148 as that of *B. hinnulus,* Er., for which the Danish specimens of the imago were first mistaken; and it is Dr. Gerstäcker who kindly undertook to compare Danish specimens with the original specimens of *B. hinnulus* of Erichson in the Berlin Museum, and has thus ascertained that the former belongs to a different species.

B. Sockets of *anterior coxæ* closed.
Lobes of *labellum* with only one long, much subdivided branch.
Spinulous ridges on *anterior tibiæ* close together.

TADUNUS, nov. gen.

Danish species:—1. *T. fracticornis,* Payk., fr. 2. *T. crassicollis,* Boisd. & Lacord., r. 3. *T. atricapillus,* Germ., r.

II. Terminal part of *mandibles* attenuated. Lobes of *labellum* ramified on the outside: ramifications short and of uniform length, some of them bifid or trifid at the apex.
Posterior corners of *pronotum* projecting from posterior margin.
Spinulous ridges on *anterior tibiæ* close together.

A. Inner lobe of *maxillæ* spinulous, the terminal spines strong, blunt.
Labrum with a round emargination. Lobes of *labellum* broadly rounded; the spines of the comb lobate at their points.
Sockets of *first pair of coxæ* externally open.

BARGUS, nov. gen.

Danish species:—1. *B. erraticus,* Er., r. 2. *B. opacus,* Er., m. fr. 3. *B. pallipes,* Gravenh., fr. 4. *B. ratellus,* n. sp., m. fr. 5. *B. terebrans,* n. sp., m. fr. The two new species resemble *B. pallipes,* but are shorter and thicker, the teeth of their mandibles strong and powerful, and placed close behind the point, whilst in *pallipes* they are small and removed from the point; the posterior corners of the pronotum are perceptibly salient in the new species, obtuse in *B. ratellus,* rectangular in *B. terebrans*; the colour of the antennæ and legs is deeper in the two new species, particularly in *B. ratellus.* The latter differs from *B. terebrans* by possessing a small but distinct depression on the top of the head, which is wanting in the latter, and by the elytra being closely and finely punctated in *B. ratellus,* whilst their puncture is much coarser in *B. terebrans.*

B. Inner lobe of *maxillæ* without spines, ending with a brush of bristles.
Lobes of *labellum* elongated, pointed.
a. Sockets of *anterior coxæ* externally open.
Terminal part of *mandibles* with one tooth behind the apex.
Labrum deeply bifid. Tooth of the comb serrate.

ASTYCOPS, Thomson.

Danish species:—1. *A. talpa*, Gyllb., m. fr. 2. *A. subterraneus*, Er., fr.

b. Sockets of *anterior pair of coxæ* closed.
Terminal part of *mandibles* with two teeth behind the apex.
Anterior margin of *labrum* straight. Teeth of the comb with blunt points.

Hesperophilus, Steph.

Danish species:—1. *H. arenarius*, Payk., fr.

II.

The manner in which Erichson, in his work 'Naturgeschichte der Insekten Deutschlands,' has treated of the numerous small Clavicornia has afforded a new starting-point for investigations of the often very difficult natural history of these animals. His principal object being to reduce to order the confused mass of material by settling the species, it was but natural that he should be more successful in distinguishing and separating than in combining. It is therefore to be expected that future more penetrating investigations of the structure and development of these Coleoptera, and more strictly scientific comparisons, will in some cases result in the principal systematic value being attributed to points now less regarded or overlooked, and in essential changes in his classification. The last four families more particularly, Byrrhii, Georyssii, Parnidæ, and Heteroceridæ, exhibit so close a relationship in all essential features, especially in the structure of the mouth, and in all stages of their development, that it is more than probable they will have to be regarded merely as subdivisions of one and the same family, each expressing a peculiar modification of the same fundamental type; for it will be found that all those characters which distinguish these families from one another are merely expressive of the different requirements of movement and respiration in different kinds of localities and different media. In *Byrrhus* we find this Coleopterous type developed for life on land, in shady and moist places, and for feeding on moss. In other genera we find an incipient modification calculated for wetter localities. Still within the pale of *Byrrhi* we meet with *Limnichius*, living on the shore itself, and *Syncalypta*, which is enabled, by club-shaped bristles on the back, to carry about a protecting shield of mud. In *Georyssus** we see the same type

* With regard to the character "prosternum membraneum," on which Erichson lays so much stress as being peculiar to *Georyssus*, it must be observed that the prosternum of these Coleoptera is as hard as any other part of their skeleton; but it is very narrow, owing to the manner in which the head is retracted, and consists only of a narrow, arched, transverse band, which, besides, on account of its hidden position, does not acquire

adapted for a similar life, the beetle wandering about on the shore, protected entirely from the sun and hidden from its enemies by means of a portable roof of clay. *Heterocerus* obtains the same protection by tunnelling the shore, whilst *Parnus* and *Elmis* represent still more decided modifications for living in water, the former crawling about the water-plants under the surface, whilst the latter clings to the under surface of the stones on the bottom. It is one of the most striking examples of typical unity coupled with extreme biological adaptation for different modes of life, that in all these animals the structure of the mouth remains almost entirely the same, even in the smallest details, not only in *Heterocerus* and *Parnus*, but even in the larvæ of *Heterocerus* and *Elmis*. All these Coleoptera are distinguished by the peculiar structure of the mandibles, which, both in imagos and in larvæ, are constructed as pincer-shaped grinding-instruments carrying several teeth on their terminal part. The larvæ possess two maxillary lobes. Hitherto much stress has been laid on their external shape, which is very varying; but this view will have to be abandoned here as everywhere. Even the larva of *Cytilus* is entirely different from that of *Byrrhus* in appearance, being much more like the larva of *Silpha*, though the imagos are so very much alike.

Heterocerus and allied genera occupy exactly the same position with regard to the other Coleoptera we have mentioned as *Bledii* occupy amongst Staphylini, *Scaritini* amongst Carabidæ, *Cebriones* amongst Elateridæ. They exhibit the fossorial modification of the type, are the moles of the family, and form a special group (Heterocerini), which, according to the structure of the mouth and of the antennæ, is distributed into several genera, the characters of which will be explained further on. H. von Kiesenwetter has supplied excellent materials for the difficult distinction of the species, to which we offer some further additions. The principal characters of the group are as follows:—

When the head is pushed forwards, the closed mandibles work both as a wedge and as a shovel. These latter are proportionally long, their upper surface somewhat hollow, the outer margin bent upwards, and with a tooth on the very edge; the terminal part is protruding, carries four teeth, and is (in the males of some species, particularly in large and powerful specimens) prolonged and curved upwards; the inner lobe is greatly developed, with a free apex and the inner margin furnished with spines forming a comb; the molar tooth is very large and grooved; the

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the dark colour of the other integuments. When the head is bent in, the prosternum is covered up by the organs of the mouth, the trochanters of the first pair, and the mesosternum.

labrum is long, hard, rounded in front, the edge slightly emarginate in the middle, with four strong, short, thick and blunt spines on each side. The maxillæ and labium are elongated and narrow; the palpifer of the maxillæ reaches beyond the root of the palpi, forming a protruding point; the maxillary lobes are hard; the anterior angles of the mentum very salient; the lingua is cordate, hard, and spinulous; the stipites of the labial palpi very small, and coalesced with one another as well as with the lingua. The basal joint of the antennæ can be laid into a groove in front of the eye; the club is serrated, arched, calculated for being coiled round the eye. Prothorax narrowed behind, its sides extended so as to form an angle on each side (hitherto erroneously described as the hind corner); the prosternum possesses a short procursus labialis. The legs are constructed for digging, all three pairs of about the same size and shape; the coxæ are transverse; the trochanters support the femora, which are spindle-shaped; the tibiæ broad, with a comb of spines; the spurs long and curved; the feet thin, long-haired, four-jointed, the claws very thin. The body is in general cylindrical, rather flat or vaulted, oblong, with parallel or round sides. The hairy covering double, consisting of an inner coat to which the air clings, and an outer coat of longer bristles standing out from the body; both layers vary according to the closeness and moisture of the soil in which the animal has its home, being finer and closer in those which live in clay, coarser and stiffer in those which dig in sand, those which live in mixed soil presenting intermediate modifications.

These short observations may suffice as an introduction to the following synopsis of Danish species; but there is one rather remarkable point in the structure of these Coleoptera which deserves more special attention.

Erichson pointed out (Naturg. d. Ins. Deutschl. iii. 539) the existence of a peculiar arched ridge on each side of the first (externally visible) ventral segment, and a similar straight and sharp ridge on the inner side of the third pair of femora, which he interpreted as constituting an organ of sound, as indeed it is. It seems, however, that in suggesting this interpretation, Erichson was led rather by a happy instinct than by a careful examination of these parts; for he does not give any account of those peculiarities of structure which really enable the animal to make a sound by means of this apparatus; and those parts to which he draws attention have in fact nothing at all to do with the production of the creaking sound. He says that in some species, the lateral part of the arched ridge is distinctly transversely grooved in both sexes or only in the males*, whilst

* Referring to the descriptions of the species, we find that the lateral

in others it is entirely smooth all over in both sexes; and this is really the appearance presented when the parts are observed through an ordinary pocket magnifier. But whilst, on the one hand, it seems impossible that the friction of the two ridges against one another could produce a sound in those species where they are described as entirely smooth (supposing always the description to be correct), a careful examination shows, on the other hand, that the lateral part of the ridge on the abdomen, which Erichson evidently looks upon as the source of the sound, cannot by any means be concerned in its production. It lacks two essential conditions, being neither in a favourable position nor furnished with transverse grooves sufficiently fine. The creaking sound produced by many insects depends on a very rapid and powerful friction of a very thin edge against a grooved surface, the fine transverse striæ of which catch hold of and again let go the edge. The thinner the edge, the finer the striæ, and the greater the velocity of the movement, the higher is the note; and if the velocity and strength of the movement are small and the grooves coarse, no sound, or a mere low rattling noise, can be produced. But that lateral part of the abdominal ridge which, in some species, under a moderate power, shows transverse grooves is placed so far forward that the ridge on the femur could touch it only when the leg is stretched out, moved by its tensors, when the movements would not by any means be strong or quick enough; and its direction is, moreover, such that the grooves could not alternately catch and let go the ridge on the femur. Besides, these grooves are so distant from each other, so coarse, and so deficient in sharpness, in comparison with the striæ on the creaking-apparatus of other Coleoptera, that even on that account they cannot be regarded as sources of sound. Even in animals so large as *Necrophori* and *Cerambyces*, the striæ on the surface of the creaking-apparatus are so extremely close and minute that they show interferential colours*, and are distinctly observable only by the assistance of a very strong magnifier. The structure does not come out clearly till the parts are examined under the microscope by strong side light and a magnifying-power of 50–100 times. If the creaking-apparatus of *Heterocerus* deserves that appellation, the striæ must be expected to be still more minute, and the surface would appear smooth

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part of the ridge is described as grooved in both sexes of *H. marginatus*, *intermedius*, and *lævigatus*, grooved in the male but smooth in the female of *H. fossor*, *femoralis*, *fusculus*, and *hispidatus*, smooth in both sexes of *H. parallelus*, *obsoletus*, and *sericans*.

* On the creaking-apparatus of *Necrophori*, v. Naturhistorisk Tidsskrift, ser. 2. vol. i. (1844), pp. 61, 69; and on that of *Cerambyces*, Nat. Tid. ser. 3. vol. ii. p. 494 [Ann. & Mag. Nat. Hist. vol. xv. pp. 191, 192].

to the naked eye or even under an ordinary pocket magnifier. Now this is precisely the state of the case. The ridge on the femur is not rubbed by the action of the tensors against the outer lateral part of the ridge, which in some species shows a few coarse transverse grooves (a sort of introduction, as it were, to the structure of the true apparatus), but it is rubbed, by the powerful action of its flexors, against the inner part of the arched ridge, which forms exactly a segment of a circle, the point of the coxa being the centre and the femur the radius, and which, though apparently smooth in all species and both sexes, is covered with transverse striæ as regular, close, and minute, in proportion to the size of the animals, as in any of the larger insects just mentioned. Of course this is not observable except by means of the microscope, by side light and a suitable magnifying-power: it is best seen by a power obtained by using a proportionally strong eye-piece, if the instrument allows it. It is still better to choose specimens for the examination which have just gone through their transformations, and in which the integuments, having not yet acquired their deep colouring, are semipellucid. The first ventral segment should be cut off, carefully separated from the soft parts, cleansed with solution of caustic potash, and examined, under a strong magnifying-power, by transmitted side light, which, of course, ought to be directed along the arched ridge, across the transverse striæ. The preparation repays the trouble, as nothing can be more elegant than the aspect of the striæ, which cover the whole arch in the cases where this, by a low power, appears entirely smooth all over, but only the inner larger portion of it in those cases where the pocket magnifier shows transverse grooves on the outer or lateral part of the arch. Whilst, according to the account given in 'Naturg. d. Ins. Deutschl.,' these latter species would appear to have the most developed creaking-apparatus, the reverse is the case, as it is the apparently smooth part of the arch which produces the sound, not the coarsely grooved part.

It follows that several of the characters for species and sexes which Erichson thought to find in this creaking-apparatus lose very much of their value; but it presents one peculiarity, hitherto overlooked, which more than makes up for the loss, and is of great utility in distinguishing closely allied species. The fore end of the arch, which generally exhibits a few coarser transverse grooves, is the broader of the two; and these two circumstances indicate clearly enough that the friction is calculated to commence at that end and continue inwards, when the femur is inflected, towards the lower or posterior extremity of the arch, which is more and more attenuated, and generally ends at the posterior margin of the segment. But in some species (amongst the Danish in *H. sericans, intermedius, Physites aureolus* and *Augyles hispidus*) the arch is continued as an excessively thin and sharp recurring ridge, as far as the apex of the posterior coxæ, thus completing a larger section of the circle. Intermediate forms between this and the common structure do not seem to occur.

DANISH SPECIES.

Heterocerus, F.

Antennæ 11-jointed, the club abruptly separate; third and fourth joints very small.
Maxillary lobes spinulous.
Inner lobe of *mandibles* membranaceous, with membranaceous comb.

A. Lateral angles of *pronotum* rounded, without marginal groove.
Inner lobe of *mandibles* slightly emarginate in the middle.
Body oblong, with parallel sides, flatly vaulted.
Pronotum in the male broader than the elytra, in the female of the same breadth as these.

a. Arches of *creaking-apparatus* ending in the posterior margin of the first ventral segment.

1. *H. femoralis* (Kiesenw.), fr.

b. Arches of *creaking-apparatus* recurring from the posterior margin of the first ventral segment towards the apex of the third pair of coxæ.

2. *H. sericans* (Kiesenw.), m. fr.

B. Lateral angles of *pronotum* with deep marginal groove.

a. Lateral angles of *pronotum* rounded.
Inner lobe of *mandibles* with a sharp indentation in the middle.
Body oblong, with parallel sides, flatly vaulted.
Pronotum in the male as broad as elytra, in the female narrower.
Arches of *creaking-apparatus* ending in the posterior margin of the first ventral segment.

3. *H. obsoletus* (Curt.), fr. 4. *H. lævigatus* (Panz.), m. fr.
5. *H. fusculus* (Ksw.), fr.

b. Lateral angles of *pronotum* pointed.
Body oblong, rounded, rather high vaulted, almost the same in both sexes.

* Arches of *creaking-apparatus* ending in the posterior margin of first ventral segment.

6. *H. marginatus*, Ksw.

* Arches of *creaking-apparatus* recurring towards the posterior coxæ.

7. *H. intermedius*, Ksw., r.

Phyrites, nov. gen.

Antennæ 11-jointed; the club increasing gradually from the third joint.
Maxillary lobes spinulous.
Inner lobe of *mandibles* bifid, the lower division membranaceous, with membranaceous comb, the outer division horny, with fringed margin, and carrying five or six very thick horny spines.

1. *P. aureolus*, n. sp. (Oblong, rounded sides, highly vaulted; hairy

covering thin, coarse, the hair standing out from the body, brown, in the elytra partly golden, forming three narrow, serrated, golden transverse bands; the outer layer of hairs very long, close, and black; teeth of mandibles very powerful; lateral angles of pronotum pointed, marginated; elytra coarsely punctured, without coloured markings on the integument itself; abdomen underneath with a broad, dark-red margin; arches of creaking-apparatus recurring towards posterior coxæ. $3\frac{3}{4}$–4 millim.), r.

AUGYLES, nov. gen.

Antennæ 10-jointed; club abruptly commencing, third and fourth joints very small.
Maxillary lobes furnished with bristles.
Inner lobe of *mandibles* membranaceous, with membranaceous comb.

1. *A. hispidulus*, Ksw., fr.

III.

Although the representatives of our indigenous genera of Scaritini, *Clivina* and *Dyschirius*, abound everywhere, our knowledge of their natural history seems still open to not unimportant additions. On a previous occasion* I drew attention to several peculiarities in the structure of the mouth not hitherto noticed—for instance, the convenient character for distinction between these two genera, that the anterior margin of the clypeus is merely slightly emarginate in *Clivina*, but bi- or tridentate in *Dyschirius*; and in a paper on the new genera *Niletus* and *Ochyropus* †, I have pointed out that both *Niletus* and *Clivina*, *Dyschirius*, *Oxygnathus*, and *Oxystomus* amongst Scaritini, possess a sharp, hard, horny spine between the claws—a true onychium, the possession of which was formerly looked upon as a principal character of certain Lamellicornia, but which really occurs in many Coleoptera. To these we shall add two other remarks. The inner lobe of the maxillæ in *Dyschirius* is almost straight, and *truncate* at the apex, though it is often described as pointed, owing to some of the terminal spines being mistaken for the apex of the lobe. But in *Clivina* (*fossor*) the lobe terminates, as in other Carabi, with an inwardly bent hook. In *Dyschirius* the two bristles of the lingua are divergent, whilst in *Clivina* (*fossor*) they stand so close together as to look like one thick bristle. The anterior margin of the palpifer is rounded in *Dyschirius*, with finely serrated edge, whilst in *Clivina* it presents an obtuse angle with undulated edge.

In examining the organs of the mouth in a great number of specimens of *Dyschirius*, I observed that in many individuals

* Danmarks Eleutherata, i. p. 110, tab. 4. fig. *a, i.*

† Naturhistorisk Tidsskrift, Række 2. vol. ii. (1846–49), 346; vide Ann. & Mag. Nat. Hist. vol. x. p. 379.

the terminal joint of both pairs of palpi presented a rather peculiar structure. In dry specimens this betrays itself by the joint being somewhat broader than usual; and on the under surface a deep spoon-shaped cavity is observable. In fresh specimens, or such as have been boiled for examination, the hard chitinous integument seems to be wanting in this spot, and to be replaced by a soft membrane, closely covered, as if it were paved, with small black polygonous chitinous warts, pretty regularly disposed in quincunx. It can scarcely be doubted that this is an organ of sense, a secondary palparium; and a dissection of the internal sexual organs shows that the individuals possessing this peculiarity are all males. Hitherto no external marks of distinction between the sexes were known; but these supplementary inferior palparia are found in the males of all species of *Dyschirius* and in many exotic species of *Clivina*, though they are wanting in the males of *Clivina fossor*.

The characters available for the distinction of species are not very many. Originally authors were almost confined to the variations of the external teeth on the tibiæ; Erichson added (Käfer d. Mark Brandenburg) the varying extension of the marginal striæ of the elytra; in 'Danmarks Eleutherata' I pointed out some additional characters derived from the shape of the clypeus; whilst Thomson, in 'Skandinaviens Coleoptera,' drew attention to the marginal striæ of the pronotum, which sometimes are wanting, and, where they exist, extend to a varying distance from the posterior corners. Two new characters may be derived from the different size of the supplementary palparia on the maxillary palpi of the males, and from a small difference in the outline of the ligula (or, rather, fulcrum ligulæ). By combining these characters, the species may be grouped with satisfactory precision. But within the pale of each of these groups the species are so closely connected that it is exceedingly difficult to distinguish them except by a set of characters which are not always as sharp as could be desired; and one is often tempted to look upon many reputed species as mere local variations. But this same uniformity is observable also in other genera of Scaritini, and is, upon the whole, of frequent occurrence in Arthropoda which dig or burrow in the ground, within such genera as have a very wide geographical distribution. If, then, those species of *Dyschirius* which dig their tunnels on the shores of the Ganges, or in the salt-moors of Tranquebar, and along the rivers of America, when carefully examined, differ as little from our indigenous species as these latter do from one another, we must be content to leave the matter as it is, in spite of the dearth of specific characters.

DANISH SPECIES.

DYSCHIRIUS.

A. *Superior palparia* on both pair of palpi of the male very large, extending over the whole length of the joint.

a. *Clypeus* tridentate. *Ligula* extended at the apex, with pointed corners. *Marginal striæ of pronotum* continued past the second pair of bristle-points. *Marginal striæ of elytra* continued to the base of the latter. External teeth of *anterior tibiæ* pointed. *Pronotum* round. *Elytra* ovate.

1. *D. thoracicus,* Fabr., fr. 2. *D. obscurus,* Gyllh., fr.

b. *Clypeus* bidentate. *Ligula* gradually attenuated, with round apex. *Marginal striæ of pronotum* terminating in the second pair of bristle-points. *Marginal striæ of elytra* ceasing at the shoulder. External teeth of *anterior tibiæ* pointed. *Pronotum* oblong, round. Striæ of *elytra* deeply punctate, smooth towards the apex.

3. *D. æneus,* Dej., fr. 4. *D. salinus,* Er., fr.

c. *Clypeus* bidentate. *Ligula* gradually acuminated, with round apex. *Marginal striæ of pronotum* wanting. *Marginal striæ of elytra* ceasing at the shoulder. External teeth of *anterior tibiæ* obtuse.

5. *D. gibbus,* Fabr.

B. *Superior palparia* on the labial palpi very large, extending over the whole length of the joints, those on the maxillary palpi reduced to a small spot behind the apex of the joint.

Clypeus bidentate. *Ligula* gradually acuminate, with round apex. *Marginal striæ of pronotum* continued beyond the second pair of bristle-points. *Marginal striæ of elytra* ceasing at the shoulder. External teeth of *anterior tibiæ* indistinct. *Pronotum* oblong.

6. *D. inermis,* Curt., r. 7. *D. politus,* Dej., m. fr. 8. *D. impunctipennis,* Daws. (Geod. Brit. 29. 6 = *arenosus,* Putz., *lævistriatus,* Fairm. & Laboulb.), fr.

VII.—*Description of a new Australian Tortoise* (Elseya latisternum). By Dr. J. E. GRAY, F.R.S. &c.

IN the 'Annals and Magazine of Natural History' for 1863, vol. xii. pp. 98 & 246, I described a species of *Chelymys* under the name of *Chelymys dentata.* In that paper I proposed to divide the genus into two sections, the one having and the other being destitute of a nuchal shield. In the collection from North Australia there are two specimens of the animal in spirits, which show that the animals of the *Chelymydes* without a nuchal shield differ greatly from those of the typical *Chelymys*; and they are particularly interesting (as forming a passage between the *Hydraspides* of Australia and South America) in having a pair of beards in the front of the chin, a warty upper surface to the neck, and scaly temples—all characters absent in most of the Australian species, but generally present in those genera of the family peculiar to South America. They thus combine with the habit and structure of the Australian genera some of the technical characters of the South American.

I am therefore inclined to form for these a new genus, which I propose to name (after my late friend, who lost his life in attempting to increase our knowledge of the zoological productions of Australia) Elseya, and which may be thus characterized:—

Nose and crown of the head covered with a smooth skin; temple, cheek, and throat covered with flat polygonal plates; tympanum flat; chin two-bearded; upper side of the neck warty. Shell convex, expanded and subdentate behind; sides slightly revolute; nuchal shield none; front of the cavity rather contracted. Vertebral column short, keeled within; sternum solid, rather narrow, with shelving side-wings; gular shield elongate, small, marginal. Tail short, thick, concave; claws 5/4, acute.

Hab. Australia.

This genus contains two species:—

1. *Elseya dentata.*

Chelymys dentata, Gray, Ann. & Mag. Nat. Hist. 1863, vol. xii. pp. 98, 246.

The front of the sternum narrow, half-ovate, with the sides rapidly contracted in front; the gular shield very narrow, elongate.

Hab. North Australia, Upper Victoria (Dr. Elsey).

There is a series of three shells of this species in the British Museum, young, middle-aged, and adult. The plates of the under surface of the two younger specimens are pale, and do not appear to have a dark edge as is the case with the two half-grown specimens of the next species. The adult shell is black brown above and below, varied with pale brown on the middle of the sternum.

2. *Elseya latisternum.*

The front lobe of the sternum broad, nearly semicircular in front; the gular shield as broad as the side shield, and rather short; the plate on the under surface yellow, with narrow dark edges to the shields; hinder margin of the shell dentated.

Hab. North Australia.

There are two specimens of this species in the Museum; they are at once known from *E. dentata* by the greater comparative breadth of the sternum, which is most marked in the form of the front lobe, though common to all its parts.

The shells of the two specimens vary considerably in form, one being much broader compared with the length than the other; and also, on the surface, one has the shields of the back of the shell nearly smooth, and the other covered with close sunken dots.

The animal is dark slate-coloured above, and paler grey beneath. There is a broad well-marked white streak from the hinder angle of the mouth, margining the underside of the tympanum and extending nearly to the middle of the base of the front legs; the hind legs have a series of rather large prominent scales from the outer side of the knee to the base of the outer toes, which are largest near the toes; tail short, with two series of shields on the underside, behind the vent.

VIII.—*Additions to the knowledge of Australian Reptiles and Fishes.* By Albert Günther, M.A., M.D., Ph.D., F.R.S.

The British Museum has received in the course of the last three or four years various collections of reptiles and fishes from Australia, and quite recently one made at Champion Bay and Nicol Bay (Western and North-western Australia) by Mr. Duboulay, and two others brought by Hr. Dämel from Cape York and Port Denison. The following notes were made during the arrangement of these specimens; and, besides the new species, only those are mentioned which were either previously desiderata in the British Museum, or for which new localities can be given.

TORTOISES.

1. *Elseya latisternum.*

See the preceding paper by Dr. Gray.

LIZARDS.

2. *Odatria punctata* (Gray).

West and North Australia.

Var. *timoriensis*. Timor, Torres Straits.

3. *Odatria ocellata* (Gray) = ? *O. tristis* (Schleg.).

West and North-west coast of Australia (Nicol Bay, Duboulay).

Distinguished by the large spines of the tail.

4. *Pygopus lepidopus* (Lac.).

Pygopus squamiceps (Gray).

Swan River, Champion Bay, Sydney, Van Diemen's Land.

5. *Lygosoma laterale*, sp. n.

Habit slender; limbs feeble, fore limbs equal in length to the distance of the ear from the snout; toes very unequal in length. Nasals slightly in contact behind the rostral; central occipital not much larger than a præoccipital. Eyelid with a transparent disk; ear-opening very small. Body surrounded by twenty-two series of scales; sixty-seven scales in a series between the axils of the fore and hind limbs. Two large præanal scales. A deep-black band, two scales broad, runs from behind the eye along each side to the root of the tail.

South Australia. $5\frac{1}{2}$ inches long (Krefft, 47).

6. *Lygosoma australis* (Gray).

Swan River, Cape York.

7. *Delma Fraseri* (Gray).

Champion Bay and Nicol Bay.

8. *Lialis Burtonii* (Gray).

Scales in seventeen rows. Swan River, Houtman's Abrolhos.

Var. with the ornamental colours very pale; chin not dark-coloured. Champion Bay.

9. *Lialis punctulata* (Gray).

Scales in nineteen rows. Sydney, Port Essington.

Var. *bicatenata*. Port Essington.

Var. uniformly coloured. Sydney, Cape York.

10. *Rhodona punctata* (Gray).

Swan River.

11. *Rhodona Gerrardii*, sp. n.

Rhodona punctata, var. *Gerrardii*, Gray.

Nasals slightly in contact with each other; upper labials six; frontal triangular, thrice as large as the central occipital. Body surrounded by twenty-one longitudinal series of scales; seventy-one scales in a longit. series between the axils of the fore and hind limbs. Two large præanal scales. Ear-opening small, covered by scales. Fore limb very small, single-toed on one side, and with two toes on the other. Two toes behind, the outer more than twice as long as the inner. Body with three black longit. bands, one along the middle, and one on each side of the back.

Swan River, Champion Bay. 5 inches long.

The fore limb of *Rhodona punctata* is about as large as a scale, that of *Rhodona Gerrardii* equals the length of six scales; *Rh. punctata* has only one large central occipital, *Rh. Gerrardii* one central and a pair of præoccipitals. The eyelid has a transparent disk in the middle.

12. *Rhodona punctato-vittata*, sp. n.

Nasals forming together a broadish suture; upper labials six; frontal triangular, twice as large as the central occipital. Body surrounded by seventeen longit. series of scales; eighty-two scales in a longit. series between the axils of the fore and hind limbs. Two large præanal scales. Ear-opening small, covered with scales. Fore limb minute, tapering, terminating in a straight minute claw, with scarcely an indication of a second claw. Two toes behind, the outer more than twice as long as the inner. Each scale on the upperside with a black dot, the dots forming six or eight longit. lines.

Queensland. 5 inches long.

13. *Anomalopus Verreauxii* (Dum.).

Brisbane, Clarence River, New South Wales. Specimens from the last two localities through Mr. Krefft.

The eyelid is scaly, as observed by Prof. Peters in 'Monatsber. Ak. Wiss. Berl.' 1867, p. 24. All our specimens are distinguished by the light occipital cross band, which is pure white in young examples, but only faintly marked in adults of twelve inches in length.

14. *Hinulia fasciolata*, sp. n.

Ear-opening small, rounded, and not denticulated in front. Nasals separated by the præfrontal, which is of a triangular shape. Postoccipitals forming a suture together behind the central occipital, which is a little smaller than the præoccipitals. Body surrounded by thirty-three longit. series of scales, the vertebral scales being scarcely larger than the others; there are fifty scales in a longit. series between the axils of the fore and hind limbs. Subcaudal scales broad. Each series of scales on the upperside of the tail with a low ridge. Six præanal scales, the central pair being much the largest. Limbs rather feeble; tail of moderate length, but very thick. Body with narrow, black, rather irregular cross bands, some of them obliquely descending forwards.

Rockhampton, Port Curtis. 8 inches long.

15. *Hinulia branchialis*, sp. n.

Ear-opening small, rounded, and not denticulated in front. Nasals forming together a suture; the central occipital separating entirely the postoccipitals. Body surrounded by twenty-four longit. series of scales, of which the vertebral pair is broadest; there are fifty scales in a longit. series between the axils of the fore and hind limbs. Subcaudal scales broad. Four præanal scales, the central pair largest. Limbs rather feeble; tail of moderate length. Three black transverse spots on each side of the neck.

Three specimens, 4 inches long, from Champion Bay, north-west coast of Australia.

16. *Hinulia Richardsonii* (Gray).

Abrolhos, Champion Bay.

17. *Hinulia* (*Hemisphæriodon*) *Gerrardii* (Gray).

Rockhampton (Krefft, 43, 512).

18. *Cyclodus gigas.*

The stomach contained the remains of crabs and a fungus.

19. *Cyclodus occipitalis* (Ptrs.).

Adelaide, Swan River.

20. *Cyclodus Adelaidensis* (Ptrs.).

Adelaide (Krefft, 40).

21. *Tropidolepisma nitidum* (Gray).

Swan River.

22. *Tropidolepisma majus* (Gray).

Rockhampton.

23. *Mabouia macrura*, sp. n.

Tail strong, much longer than the body; limbs rather feeble. Supranasals separate. Præfrontal forming a long suture with the rostral and parietal, separating the postfrontals, which are small. Central occipitals three, of nearly the same size; post-occipitals forming a short suture together behind the central occipital. Anterior margin of the ear-opening with very small denticulations. Body surrounded by twenty-eight longit. series of scales, the vertebral pair being broadest. There are forty-eight scales in a longit. series between the fore and hind limbs. Eight præanal scales nearly equal in size. Uniform brownish-olive above, white below.

Cape York. $14\frac{1}{2}$ inches long, the length of the tail being 9 inches.

24. *Tetradactylus decresiensis* (Péron).

Kangaroo Island, Swan River, Champion Bay.

Young specimens with a very distinct and well-defined black lateral band from the snout to the end of the trunk.

25. *Hemiergis polylepis*, sp. n.

Very similar to *H. decresiensis*, but with smaller scales, the body being surrounded by twenty-six series (in *H. decresiensis* by eighteen or twenty). Also the toes are more developed, the anterior as well as the posterior being conspicuously longer than the eye. Posterior frontals well developed. Seventy-two scales in a series between the axils of the fore and hind limbs.

South Australia. 4 inches long (Krefft, 48).

26. *Chelomeles quadrilineatus* (D. & B.).

Houtman's Abrolhos, Swan River.

27. *Soridia miopus*, sp. n.

Form of the head and arrangement of head-shields as in *S. lineata*, but with the snout somewhat less wedge-shaped. No free fore limbs, but there is a short longitudinal groove, in the upper end of which a minute tubercle (the first indication of an external limb) is visible; hind limb as long as the head, terminating in a single longish toe. Body surrounded by twenty series of scales. Coloration nearly uniform, pale olive; four very indistinct stripes of minute blackish dots along the dorsal series of scales.

Six inches long. Champion Bay.

28. *Œdura marmorata* (Gray).

Port Essington, New South Wales (Krefft, 52).

29. *Œdura rhombifera* (Gray).

?*Phyllodactylus Lesueurii*, D. & B.

New South Wales (Krefft).

30. *Strophura spinigera* (Gray).

Houtman's Abrolhos, Champion Bay, South Australia (Krefft, 42).

31. *Diplodactylus vittatus* (Gray).

Champion Bay, New South Wales.

32. *Diplodactylus ornatus* (Gray).

Houtman's Abrolhos, New South Wales, through Mr. Krefft (114, 518).

33. *Diplodactylus marmoratus* (Gray).

Houtman's Abrolhos, Freemantle, Champion Bay.

34. *Diplodactylus ocellatus* (Gray).

Diplodactylus bilineatus (Gray).

Houtman's Abrolhos, Champion Bay.

35. *Diplodactylus polyophthalmus*, sp. n.

Allied to *D. ocellatus* (Gray), but with much smaller scales, which in that species are particularly rough and tubercular. Tail rounded, rather swollen. Head scarcely depressed. Subdigital plates narrow. Scales minute, those on the belly scarcely larger than those on the back. Upper parts brownish or greyish, with round white spots, which, in young examples, are surrounded by a brown ring. Uniform white below.

Two specimens, 3 and 2 inches long.

Nicol Bay, Champion Bay.

36. *Gecko albo-fasciolatus*, sp. n.

Body covered with small flat granulations arranged in cross series, and with ten longitudinal series of mamilliform tubercles; scales of the belly in about twenty-six longitudinal series; præanal pores sixteen, in a slightly angular series. Nostril separated from the rostral by an intervening shield. Thirteen upper and eleven lower labials; the front pair of chin-shields are as long as the first lower labial. Head depressed, longer than broad. Tail rounded on the sides, with an irregular series of enlarged subcaudals. Reddish-olive, marbled with greyish; upperside of the head with a few small white spots; a narrow white horseshoe-shaped band across the neck, the convexity being directed backwards. Trunk with six rather irregular, narrow, transverse bands, composed of white spots. Lower parts uniform whitish.

Ten inches long; without tail 6½.

Polynesia?

37. *Gehyra australis* (Gray).

Swan River, Port Essington, Champion Bay, Norfolk Islands.

38. *Heteronota Binoei* (Gray).

Eublepharis derbianus (Gray).
Hoplodactylus australis, Steindachner, Reise d. Novara, p. 18, taf. 1. fig. 2.

Houtman's Abrolhos, Champion Bay, Port Essington, North Australia, Queensland.

39. *Hemidactylus vittatus* (Gray).

Borneo, Port Essington.

The Australian specimen differs from the types only in having a pair of additional rows of very small tubercles along the median line of the back.

40. *Phyllurus Milliusii* (Bory).

Sydney, Houtman's Abrolhos, Champion Bay.

RHYNCHOEDURA (g. n., Geckot.).

All the toes are compressed, rather slender, not dilated in any part, granular below, with feeble claws. Head and body with very small granule-like scales, without any tubercles; tail rounded, slightly swollen, covered with rings of small square plates. Snout pointed, peculiarly compressed; labial shields minute, front of upper jaw covered with a prominent, nail-like shield. Tongue narrow, rather pointed in front, not notched. Eye very large. Some larger shields, without pores, before and behind the vent.

41. *Rhynchoedura ornata*, sp. n.

Greyish, each side with confluent black half-rings, a black band across the occiput. Head and body with round, faint, whitish spots. Lower parts white.

Nicol Bay. 2½ inches long.

42. *Physignathus Lesueurii* (Gray).

Istiurus Lesueurii (D. & B.).
Amphibolurus heterurus (Ptrs.).

Clarence River (Krefft).

43. *Chlamydosaurus Kingii* (Gray).

Port Essington, Cape York, Nicol Bay.

44. *Lophognathus Gilberti* (Gray).

Redtenbacheria fasciata, Steindachner, Reise d. Novara, Rept. p. 31.

Port Essington, Swan River, Champion Bay, Nicol Bay.

45. *Grammatophora reticulata* (Gray).

Nicol Bay.

46. *Grammatophora maculata* (D. & B.).

Nicol Bay, Champion Bay.

47. *Grammatophora macrolepis*, sp. n.

No larger scales scattered between the others; all the scales comparatively large, those on the back larger than the labial shields; body surrounded by fifty-four series of scales, of which fourteen belong to the back. Scarcely a trace of a dorsal crest is visible on the back. Hind limbs long, extending to the ear, if laid forwards. Snout short, nostril midway between the end of the snout and the angle of the ocular slit. A few small prominent scales above and behind the tympanum. Yellowish-olive, with some darker markings on the side of the body and tail. Snout deep brown, interorbital space yellowish; lateral fold of the neck black.

Adult female, 8 inches long, tail 7½ inches.

48. *Grammatophora lævis,* sp. n.

Back with a median series and several irregular transverse series of larger scales. None of the dorsal scales with a distinct keel or spine; scales of the limbs and tail distinctly, those of the belly very faintly keeled. Head broad, high; snout very short, the nostril being midway between the end of the snout and the angle of the ocular slit. Limbs of moderate length, hind limb extending nearly to the gular fold. Sides of the head and neck with conical tubercle-like scales. Yellowish brown, with a series of irregular large blackish-brown blotches along each side of the back; sometimes the whole back reticulated with brown.

Champion Bay. 7 inches long, tail 4 inches.

49. *Grammatophora temporalis,* sp. n.

No larger scales scattered between the others, those on the back small, shorter than the labial shields; a slight dorsal crest runs from the nape to the end of the trunk. Hind limbs very long, extending beyond the eye, if laid forwards. Nostril much nearer to the end of the snout than to the angle of the ocular slit. A few prominent scales in the middle between the tympanum and the lateral fold of the neck. A white band along the lips, below the tympanum to the lateral fold of the neck; a black band above it from the eye to the tympanum; a white streak above the black band, more or less distinctly continued along the side of the anterior part of the trunk. Back with more or less complete black cross bars, the anterior only being distinct in adult examples. Tail more or less distinctly annulated.

Port Essington, Nicol Bay. The largest example is 13 inches long, the tail being 9 inches.

50. *Grammatophora calotella.*

Calotella australis, Steindachner, Reise d. Novara, p. 28.

Cape York.

51. *Tympanocryptis cephalus,* sp. n.

Body very stout; head very short, high, and broad; snout extremely short, the nostril being midway between the angle of the ocular slit and the end of the snout; hind limb extending somewhat beyond the gular fold, if laid forwards. Head above with keeled scales, larger than those on the back, those on the occiput being particularly large. Back with numerous enlarged spinous scales intermixed with the others; upper parts of the limbs with large spinous imbricate scales. Body reddish olive, with a brown collar; blackish-brown bands across the limbs and tail.

Nicol Bay. Adult female $5\frac{1}{2}$ inches long, tail 3 inches.

SNAKES.

52. *Tropidonotus picturatus* (Schleg.).

This snake varies in coloration. We have received a nearly entirely black example from Cape York.

Port Essington, Cape York, Rockhampton.

53. *Dendrophis punctulata* (Gray).

Attains to a length of 66 inches.

Port Essington, Moreton Bay, Cape York, Sydney.

54. *Dendrophis calligastra*, sp. n.

Scales in thirteen rows. Loreal none. Eight upper labials, the fourth and fifth entering the orbit; one præ- and two postorbitals; temporals $1+2+2$. Abdominal shields 179, strongly keeled. Some of the scales with a single terminal pore. Greenish brown above, sides of the head and neck yellow; a black band across the rostral shield through the eye to the side of the neck. Belly purplish yellow, powdered with purplish brown.

Cape York. 36 inches long, tail 12 inches.

55. *Brachysoma diadema* (Schleg.).

Elaps ornata (Gray).
Glyphodon ornatus (Gthr.).

Extends over the whole of Australia.

56. *Diemenia superciliosa* (Fisch.).

= *Pseudoelaps Sordelli* (Jan) = *Ps. Kubingii* (Jan) = *Cacophis Güntheri* (Steindachner).

New South Wales, Adelaide, Norfolk Islands?

Of this snake we possess now a series of nine examples, varying in length from 16 to 60 inches.

57. *Hoplocephalus nigriceps* (Gthr.).

Swan River, Champion Bay.

58. *Hoplocephalus maculatus* (Steindachner).

The young has the upperside of the head and neck uniform black.

Rockhampton.

FROGS.

1. *Pterophryne Georgiana* (Bibr.).

Port Essington, Sydney, King George's Sound (Krefft, 4).

2. *Pterophryne fasciata* (Steindachner).

Houtman's Abrolhos, Sydney. (*Cystignathus sydneyensis*, Krefft, 16.)

3. *Limnodynastes Krefftii* (Gthr.).

Limnodynastes Salmini, Steindachner, Reise d. Novara, p. 27, taf. 4. figs. 12–15.

Specimens from Rockhampton, collected by Hr. Dämel, have the hinder surface of the thighs black, dotted with white.

Sydney, Brisbane, Rockhampton, Clarence River (Krefft, 59), Port Denison.

4. *Limnodynastes ornatus* (Gray).

Opisthodon Frauenfeldi, Steindachner, Reise d. Novara, p. 9, taf. 1. figs. 1–3 (representing the usual coloration).

Extremely variable in coloration.

Port Denison, Cape York.

5. *Limnodynastes* (*Platypectron*) *Dumerilii* (Ptrs.).

Heliorana Grayi, Steindachner, Reise d. Novara, p. 32, taf. 2. figs. 11–14.

Adelaide.

6. *Limnodynastes platycephalus*, sp. n.

Closely allied to *L. tasmaniensis*, but with the head much broader and depressed. Snout very short, not longer than the eye. Hind leg without large gland. Two small metatarsal tubercles. Hind toes slightly fringed. Choanæ very small. Olive, with large dark-brown blotches, sometimes a white vertebral line. A broad dark band along the canthus rostralis, another from the eye to behind the angle of the mouth; an oblique band-like spot below the eye descending forwards.

Adelaide (Krefft, 39).

7. *Chiroleptes australis* (Gray).

Cyclorana Novæ Hollandiæ, Steindachner, Reise d. Novara, p. 29, taf. 2. figs. 7–10.

?*Phractops alutaceus* (Ptrs.) = old example?

Clarence River, Rockhampton, Port Denison, Nicol Bay.

8. *Chiroleptes alboguttatus*, sp. n.?

? *Chiroleptes inermis*, Ptrs.

Head as long as broad; snout depressed, with very indistinct canthus rostralis, somewhat pointed; the distance between the nostrils is less than that from a nostril to the eye. Tympanum at least one-third smaller than the eye. Vomerine teeth between the choanæ, in two transverse series, separated by an interspace, but extending to the edge of the choanæ. The inner metatarsal disciform tubercle well developed; no outer metatarsal tubercle. Smooth above; hinder lower parts very finely granulated. Toes half webbed. Blackish ashy above, indistinctly marbled with black. A white vertebral line. Sides of the body and hind part of the thighs black, with numerous round white spots. A black band along the canthus rostralis and above the tympanum. Lower parts white; throat reticulated with greyish.

Port Denison, Cape York. Body $2\frac{1}{3}$ inches long, hind limb $3\frac{1}{2}$ inches.

9. *Heleioporus albopunctatus* (Gray).

Swan River, Port Essington, River Murray, New South Wales.

10. *Uperolia marmorata* (Gray).

West Australia, Cape York, Sydney.

11. *Pseudophryne Bibronii* (Gthr.).

Van Diemen's Land, Sydney, Clarence River (Krefft, 60).

12. *Eucnemis bicolor* (Gray).

Port Essington, Cape York, Brisbane, Blue Mountains, Port Denison.

13. *Litoria Wilcoxii* (Gthr.).

?*Litoria Copei*, Steindachner, Reise d. Novara, p. 56, taf. 3. figs. 14–17.

Clarence River, Rockhampton, Port Curtis, Brisbane (Krefft, 62, 55), Richmond (Krefft, 12).

14. *Litoria nasuta* (Gray).

Port Essington, Clarence River (Krefft, 56), Brisbane (Krefft, 57), Sydney (Krefft, 54).

15. *Litoria latopalmata*, sp. n.

Snout of moderate length, somewhat pointed in front, the distance between the front angles of the orbit being equal to that between the eye and the extremity of the snout. Canthus rostralis rather obtuse; nostril much nearer to the end of the snout than to the eye. Tympanum very distinct, not much smaller than the eye. Back with a few indistinct, short, glandular folds or tubercles. Vomerine teeth in two oblique short series between the choanæ. Tongue with scarcely a trace of a notch behind. Openings of the Eustachian tubes at least as wide as the choanæ. Limbs rather slender, the third finger much longer than the fourth. The length of the body is less than the distance between vent and heel. Tarsus with a lateral fold of the skin. Metatarsus with two small tubercles, the inner being minute. Toes broadly webbed, the web extending to the disks of the third and fifth toes. The length of the fourth toe is one-half that of the body. Disks small.

Upper parts reddish-olive, with numerous small irregular brown spots. An irregular brown cross band between the eyes. A brown streak along the canthus rostralis; tympanum in front and behind with a narrow deep-brown margin. Hinder surface of thighs marbled with brown, as the upperside.

Length of the body	18 lines.
Width of cleft of the mouth	$5\frac{1}{2}$ „
Length of fore limb	12 „
„ third finger	3 „
„ hind limb	33 „
„ entire foot	14 „
„ fourth toe	9 „

Two specimens from Port Denison (Krefft, 11).

16. *Hylorana erythræa* (Schleg.).

East-Indian archipelago, San Christoval, Cape York.

17. *Hyla Ewingii* (D. & B.).

Hobart Town, North-east Australia, Melbourne, King George's Sound (Krefft, 2).

18. *Hyla adelaidensis* (Gray).

Port Essington, King George's Sound (Krefft, 23).

19. *Hyla rubella* (Gray).

Port Essington, Houtman's Abrolhos, Port Denison (Krefft, 36).

20. *Hyla Peronii* (D. & B.).

Port Essington, New South Wales, Clarence River, Rockhampton.

21. *Hyla infrafrenata*, sp. n.

Snout short, rounded, with obtuse canthus rostralis. Vomerine teeth in two transverse series on a level with the hind part of the choanæ, which are wide. Skin minutely granular. Fingers one-third webbed. Uniform green above (bluish in spirits). A pure white band round the margin of the *lower* jaw, and continued in a straight line to below and behind the tympanum. Lower parts whitish.

Cape York.

Body $1\frac{3}{4}$ inch long, hind limb 3 inches, foot $\frac{3}{4}$ inch.

22. *Hyla nigrofrenata*, sp. n.

Allied to *H. adelaidensis*, but with longer hind limbs, wider choanæ, and different coloration.

Snout long and pointed. Vomerine teeth in two transverse groups on a level with the front part of the choanæ. Choanæ about one-fourth the size of the tympanum. Fingers not webbed. Skin perfectly smooth above. Light olive-coloured; a broad black band runs from the extremity of the snout through the eye and tympanum, to the side of the abdomen, being *interrupted a short distance behind the tympanum.* A blackish band across the back of the wrist. Hind limbs marbled with blackish along the fore and hinder surfaces.

Cape York.

Body $1\frac{3}{4}$ inch long, hind limb $3\frac{1}{4}$ inches, foot 10 lines.

23. *Pelodryas cæruleus* (White).

Port Essington, Moreton Bay, Nicol Bay, Sydney.

FISHES.

1. *Serranus fuscoguttatus* (Rüpp.).

East Africa, Hope Island, Port Essington, Port Denison, Cape York.

2. *Serranus undulato-striatus* (Ptrs.).

New South Wales.

3. *Plectropoma maculatum* (Bl.).

Cape York.

4. *Priacanthus Benmebari* (Schleg.).

Japan, Sydney.

5. *Ambassis agrammus*, sp. n.

D. $7 \mid \frac{1}{8}$. A. $\frac{3}{8}$. L. lat. 26–27.

The height of the body is two-fifths of the total length (without caudal). Lateral line visible on the foremost scale only. The second dorsal spine is longer than the third, much longer than the second and third anal spines (which are equal in length), not much shorter than the head, and two-sevenths of the total length (without caudal). Uniform greenish olive, with a narrow bluish-silvery band along the middle of the tail.

Cape York.

6. *Ambassis Agassizii* (Steindachner).

D. $6 \mid \frac{1}{7}$. A. $\frac{3}{8}$. L. lat. 25.

The height of the body is contained twice and one-third in the total length (without caudal). Lateral line none. The second dorsal spine is scarcely longer than the third, much longer than the anal spines, shorter than the head without snout, and less than one-fourth of the total length (without caudal). Body immaculate, with a narrow bluish-silvery lateral band.

Clarence River (Krefft, 65).

7. *Apogon aterrimus*, sp. n.

D. 7 | $\frac{1}{9}$. A. $\frac{2}{8}$. L. lat. 25.

The height of the body is one-third of the total length (without caudal). Entirely uniform deep black.

Cape York.

8. *Apogon Novæ Hollandiæ* (Val.).

New South Wales.

9. *Arripis georgianus* (C. & V.).

Port Jackson, Hobson's Bay, Holdfast Bay, Houtman's Abrolhos.

10. *Therapon percoides* (Gthr.).

Fitzroy River, Nicol Bay.

The cross bands become less distinct in large examples, of 7 inches in length.

11. *Therapon unicolor* (Gthr.).

New South Wales, Fitzroy River, Rockhampton.

12. *Therapon caudovittatus* (Rich.).

Victoria, Harvey River, Cape York.

13. *Diagramma reticulatum* (Gthr.).

China, Cape York.

14. *Scatophagus argus* (L.).

= *Sc. ornatus* (C. & V.).

In young specimens the markings are frequently like those represented in *Sc. ornatus* by Cuvier and Valenciennes; but these specimens do not constitute a distinct species, being in other respects entirely similar to young *Sc. argus* without light bands on the head. The length of the dorsal spines is subject to much variation. Young specimens from Australia exhibit the coloration of *Sc. ornatus*; adult do not differ from East-Indian *Sc. argus*.

Cape York, Sydney (Krefft, 102).

15. *Atypichthys strigatus* (Gthr.).

Young with a black ocellus on the soft dorsal fin.

Swan River, Holdfast Bay, Champion Bay, Raoul Island, Sydney.

16. *Scorpis æquipinnis* (Rich.).

Scorpis lineolatus (Kner).
—— *Richardsonii* (Steindachner).

This species varies a little in the shape of the body, and in the proportions of parts of the head; but from an examination of eight examples in the British Museum, I cannot convince myself that these variations represent distinct species.

Swan River, King George's Sound, New South Wales (Krefft, 5), Sydney (Schütte).

17. *Upeneus porosus* (C. & V.).

D. 8 | $\frac{1}{8}$. A. 7. L. lat. 30.

Distinguished by the elevated anterior part of the body, the greatest depth of which is not more than one-third of the total length (without caudal). Upper profile of the head and neck describing a fourth of a nearly regular circle. Snout elevated, not quite twice as long as the eye. Barbels extending to the vertical from the hind margin of the opercle. The dorsal fin commences above the root of the pectoral; its spines are flexible, the longest being two-thirds the height of the body. Tubes of the lateral line with a cluster of short branchlets. Parts above the lateral line clouded with darker. Spinous dorsal blackish.

Sydney (Krefft), Melbourne, Van Diemen's Land, New Zealand.

18. *Upeneus signatus,* sp. n.

Allied to *U. barberinus,* but with the head much deeper, the snout much shorter, and larger caudal spot.

D. 8 | $\frac{1}{8}$. A. $\frac{1}{6}$. L. lat. 30–31.

The height of the body is contained thrice or thrice and one-third in the total length (without caudal). Head not much longer than deep; snout only twice as long as the diameter of the eye. Barbels extending to the hind margin of the præoperculum. Dorsal spines slightly flexible at the top. Tubes of the lateral line with rather long lateral branchlets in small number. Coloration as in *U. barberinus,* but with the black caudal spot large, square, extending over the back of the tail; a whitish blotch in front of it.

Port Jackson (Krefft, 12). $0^{m}\cdot18$ long.

19. *Lethrinus Richardsonii* (Gthr.).

China, Cape York.

20. *Girella tricuspidata* (Q. & G.).

New South Wales.

21. *Chilodactylus nigricans* (Rich.).

D. $\frac{15\text{–}16}{26}$. A. $\frac{3}{9\text{–}10}$. L. lat. 48–53.

King George's Sound, Victoria.

22. *Chilodactylus gibbosus* (Rich.).

The tuberosities on the snout and the long dorsal spines are probably sexual characters developed with age.

Sydney (Krefft).

23. *Scorpæna bynoensis* (Rich.).

Scorpæna bynoensis, Richards. Ereb. & Terr. Fish. pl. 14. figs. 3–5 (young).
—— *jacksoniensis,* Steindachner, Wien. Sitzgsber. xiii. taf. 3. fig. 2 (adult; tentacles and membrane between dorsal spines badly figured).

North-west coast of Australia, Port Jackson (Krefft, 6).

24. *Centropogon australis* (White).

Sydney, Port Jackson.

25. *Centropogon robustus* (Gthr.).

Centropogon Troschelii (Steindachner).

Sydney, Port Jackson, Cape York.

26. *Centropogon marmoratus* (Gthr.).

Moreton Bay.

27. *Polynemus macrochir,* sp. n.

D. 8 | $\frac{1}{12}$. A. $\frac{2}{12}$. L. lat. 70.

Five pectoral appendages, three of which extend to the anal fin; pectoral fin nearly as long as the head, the length of which is contained thrice and two-thirds in the total (without caudal), and equal to the distance between the root of the ventral and the anal. A distinct spine above the angle of the præoperculum. Coloration uniform.

New South Wales (Krefft, 103). $0^{m}{\cdot}22$ long.

28. *Otolithus atelodus.*

D. 10 | $\frac{1}{31}$. A. $\frac{2}{9}$.

Scales small; canine teeth none. Body elongate. The height of the body is contained five times in the total length (without caudal), the length of the head thrice and two-thirds. The maxillary does not quite extend to the vertical from the hind margin of the orbit. Præoperculum rounded, with small, slender, distant, spinous teeth. Dorsal spines moderately feeble. Caudal fin slightly emarginate. Silvery; indistinct, oblique, dark lines along the series of scales. Axil black behind.

Australia. $0^{m}{\cdot}31$ long.

29. *Acanthurus matoides* (C. & V.).

Indian Ocean, Pacific, Nicol Bay.

30. *Trachynotus Baillonii* (Lac.).

Indian Ocean, Pacific, New South Wales (Krefft, 101).

31. *Psettus argenteus* (L.).

New South Wales.

32. *Aphritis Urvillii* (C. & V.).

D. 7 | 17–19. A. 23. L. lat. 61.

(Van Diemen's Land.) Sydney (Krefft, 506).

33. *Batrachus diemensis* (Les.).

Port Essington, Cape York.

34. *Batrachus dubius* (White).

New South Wales (Krefft).

35. *Antennarius pinniceps* (C. & V.).

Sydney.

36. *Antennarius Commersonii* (C. & V.).

Sydney (Krefft).
Entirely uniform deep black.

37. *Lepidotrigla phalæna* (C. & V.).

Melbourne.

38. *Gobius crassilabris* (Gthr.).

Oualan, Aneiteum, Australia (63. 7, 29, 20, Krefft).

39. *Gobius bynoensis* (Richards.).

Port Essington, Cape York.

40. *Gobius ornatus* (Rüpp.).

Indian Ocean, Pacific, Nicol Bay.

41. *Gobius Voigtii* (Blkr.).

Port Essington, Cape York.

42. *Gobiodon quinquestrigatus* (C. & V.).

Tubercles on the forehead minute.
East-Indian archipelago, Cape York.

43. *Eleotris australis* (Krefft).

Eastern Creek.

44. *Eleotris gymnocephalus* (Steindachner).

Hawkesbury River (Krefft, 52).

45. *Eleotris Coxii* (Krefft).

Hawkesbury River, Mulgoa Bay (Krefft).

46. *Eleotris grandiceps* (Krefft).

Bronte (Krefft).

47. *Eleotris fusca* (Bl., Schn.).

Indian and Pacific Oceans, Australia.

48. *Eleotris compressus* (Krefft).

This species varies much in the form of the body, according to age and season, being rather elongate when young and before spawning-time. Also the coloration varies, old males having, in the spawning-season, a bright orange anal fin with a broad black and white margin.

Clarence River (Krefft), River Dunn (Port Denison).

49. *Eleotris aporos* (Blkr.).

Islands of the East-Indian archipelago and Pacific, Port Denison, Cape York.

50. *Eleotris muralis* (Q. & G.).

East-Indian archipelago, Philippine Islands, Cape York.

51. *Periophthalmus Koelreuteri* (Pall.).

Port Essington, Nicol Bay.

52. *Salarias meleagris* (C. & V.).

Van Diemen's Land, Cape York.

53. *Petroscirtes anolis* (C. & V.).

Port Jackson.

54. *Lepidoblennius haplodactylus* (Steindachner).

Rockhampton (Krefft).

55. *Cristiceps robustus*, sp. n.

$$\text{D. } 3 \mid \tfrac{32}{7}. \quad \text{A. } \tfrac{2}{25}.$$

The anterior dorsal fin commences over the hinder margin of the præoperculum, and is not higher than the posterior. A fringed tentacle above the orbit, a small one at the nostril.

Back with seven dark cross bands, the first below the anterior dorsal, suboccllated.

Melbourne. 5 inches long.

STICHARIUM, gen. nov. (Blenn.).

Body elongate, compressed, naked, or with scarcely a trace of rudimentary scales hidden in the skin. Anterior part of the lateral line distinct, near the dorsal profile. Snout short; small teeth in the jaws, without canines; palate apparently toothless. Dorsal fin long, formed by pungent spines only. Ventrals jugular, with two rays; caudal distinct. Gill-openings rather wide, the gill-membranes being broadly united below the throat and quite free from the isthmus.

56. *Sticharium dorsale*, sp. n.

D. 41. A. $\frac{2}{36}$.

The height of the body is two-thirds of the length of the head, which is contained six times and a half in the total length (without caudal). Cleft of the mouth extending to below the middle of the eye; lower jaw slightly prominent. Length of the trunk not much exceeding that of the head. Dorsal and anal fins very low, terminating in a low fold of the skin, which is continued to the caudal. Ventrals much longer than pectorals. A broad white band runs along the upper surface of the head and back. Sides finely marbled with brown, the markings radiating from the eye on the head.

Two examples, $0^{m}\cdot066$ long, formed part of a collection from Australia, containing several species known from Port Jackson.

NOTOGRAPTUS, gen. nov. (Blenn.).

Body elongate, compressed, covered with minute scales. Lateral line complete, running along the base of the dorsal fin. Head longish and rather depressed; snout of moderate extent, somewhat pointed; cleft of the mouth wide; a short flat barbel at the symphysis of the lower jaw. Bands of villiform teeth in the jaws and palatine bones, none on the vomer; tongue narrow, long, free. Vertical fins confluent; dorsal and anal with numerous spines, the posterior becoming gradually stiffer and more pungent than the anterior. Ventrals jugular, close together, reduced to a single bifid ray. The gill-membrane is attached to the isthmus before the ventrals. Pseudobranchiæ well developed. Intestinal tract short, simple, without pyloric appendages. Air-bladder none.

57. *Notograptus guttatus*, sp. n.

D. 69. C. 11. A. 43.

The height of the body is one-twelfth of the total length (without caudal), length of the head two-fifteenths. Eye small. Barbel shorter than the ventrals, which are about twice as long as the eye. Reddish or brown; dorsal fin, upper, and lateral parts with numerous blue dots, those on the head largest. Young with the spots on the body indistinct, and of a brown colour.

Cape York. $0^{m}\cdot17$ long.

58. *Mugil subviridis* (C. & V.).

India, Cape York.

59. *Mugil cephalotus* (C. & V.).

China, Hawkesbury River.

60. *Mugil breviceps* (Steindachner).

Hawkesbury River (L. lat. 48–50).

61. *Atherina stercus muscarum*, sp. n.

D. $7 \mid \frac{1}{8}$. A. $\frac{1}{9}$. L. lat. 33. L. transv. 8 or 9.

Origin of the spinous dorsal behind the root of the ventrals. The height of the body is contained four times and two-thirds in the total length (without caudal), length of the head thrice and two-thirds. Snout not much shorter than the eye. Dorsal spines feeble. Pectoral short, extending to the root of the ventral. A black band from the snout through the eye to the root of the pectoral. A silvery band along the fourth series of scales. Each scale with a black dot at the base.

Cape York. 2 inches long.

62. *Atherina signata*, sp. n.

D. $3 \mid \frac{1}{6}$. A. $\frac{1}{10}$. L. lat. 28. L. transv. 7.

Origin of the spinous dorsal behind the root of the ventrals. The height of the body is contained thrice and three-fourths in the total length (without caudal), length of the head four times. Snout obtuse, shorter than the eye. The three dorsal spines are united into a narrow lobe, terminating in a long filament. Anterior dorsal and anal rays, lobes of the caudal, and the ventrals prolonged into long filaments. The middle of the sides silvery; the prolonged parts of the fins deep black; ventrals white.

Cape York.

This is the smallest species of *Atherina* known at present, the single specimen, an adult male, being only $1\frac{1}{2}$ inch long. Probably the female and young are without the prolongations of the fins.

63. *Nematocentris nigra.*

Atherina nigrans, Richards.
Atherinichthys nigrans, Gthr.
Nematocentris splendida, Peters, Monatsber. Ak. Wiss. Berlin, 1866, July 23, p. 516 (published in 1866).
Strabo nigrofasciatus, Kner und Steindachner, Sitzgsber. Ak. Wiss. Wien, 1866, Oct. 4, p. 372. fig. 10 (immature example) (published in 1867).

Of this species, which was formerly represented in the British Museum by some skins in a more or less bad state of preservation, we possess now a fine and complete series, viz.:—

a. A skin, 3 inches long, from King's River, near Victoria, which is the type of the species. (Not from Port Essington as stated by Sir J. Richardson.)

b. A skin, 3 inches long, from Port Essington.

c–e. Three skins, 21 lines long, from Severn River, New South Wales.

f–l. Six examples, in spirits, 3–5 inches long, from Rockhampton (Krefft). [*Nematocentris splendida*, Ptrs.]

m–n. Two examples in spirits, 18–24 lines long, from Clarence River (Krefft, 67).

o. One example in spirits, 20 lines long, from Brisbane. [Godeffroy Coll., *Strabo nigrofasciatus.*]

p. One example, in spirits, 4 inches long, from Port Denison (Krefft).

q–t. Four examples in spirits, 3 inches long, from Cape York (Dämel).

I have convinced myself, from an examination of these specimens, that the names lately proposed and mentioned above refer to the same species, which appears to be spread over the whole of Australia. The black band, so distinct in the typical example, is paler in specimens from Port Denison and Rockhampton, replaced by a bluish band in other examples from Rockhampton and other parts of Queensland and New South Wales, and disappears sometimes entirely in apparently very old examples. The form of the body varies, of course, according to age and season. The pungent dorsal spines become stouter with age, and some of the rays become produced. The number of longitudinal series of scales varies from ten to thirteen, the lowest being more or less developed. D. $5 \mid \frac{1}{10-12}$. A. $\frac{3}{18-21}$.

64. *Parma microlepis* (Gthr.).

Port Jackson.

65. *Parma squamipinnis* (Gthr.).

Port Jackson (Krefft, 2).

66. *Heliastes hypsilepis*, sp. n.

$D. \frac{13}{14}. \quad A. \frac{2}{13-14}. \quad L. lat. 29.$

This species is allied to *H. notatus*; but each scale on the middle of the side of the body is twice as deep as long, whilst it is only somewhat deeper than long in that Japanese species. The height of the body is a little less than one-half of the total length (without caudal). A whitish spot below the end of the soft dorsal. Upper half of the base of the pectoral black.

New South Wales (Krefft). $0^{m}\cdot18$ long.

67. *Labrichthys gymnogenys* (Gthr.).

Port Jackson (Krefft, 2).

The specimens from Port Jackson are 8 and 9 inches long, and agree perfectly with the typical examples, which are of the same length. However, Mr. Krefft has sent us two other examples, 11 inches long, which differ in a remarkable manner in their coloration, but appear to be merely a variety. They are uniform dark brown, only the tail being somewhat lighter, the middle ventral rays black. In other respects they are perfectly identical with the younger examples.

68. *Labrichthys laticlavius* (Rich.).

Tasmania, King George's Sound, Port Jackson (Krefft).

Young with the lateral bands very indistinct or entirely absent.

69. *Odax Richardsonii* (Gthr.).

Odax Hyrtlii (Steindachner).

New South Wales (Krefft, 61), Hobson's Bay, Victoria.

70. *Gerres philippinus* (Gthr.).

Philippine Islands, Cape York, Nicol Bay.

71. *Dinematichthys mizolepis*, sp. n.

Very similar to *D. iluocœteoides* and *marginatus*, but with conspicuously larger scales, there being about ninety transverse series. Head naked. Palatine teeth in a long stripe.

Cape York. 2 inches long.

72. *Copidoglanis brevidorsalis*, sp. n.

This species differs in a singular manner from its congeners in having the anterior half of the second dorsal fin replaced by a pad of fat, from which the rays gradually emerge behind; the anterior portion does not contain any rays. It is therefore impossible to give an exact number of dorsal rays. The anal fin is composed of about eighty-five rays. The nasal barbel extends to the origin of the dorsal fin; none of the others reach beyond the extremity of the pectoral. The eye is one-seventh of the length of the head. Entirely black.

Cape York, Nicol Bay. 6 inches long.

Neosilurus Hyrtlii (Steindachner), from Rockhampton, is evidently closely allied to this species.

73. *Exocœtus atrodorsalis*, sp. n.

D. 8–9. A. 10. L. lat. 35.

Closely allied to *E. hillianus.* The pectoral extends to the end of the dorsal. The ventral fin is scarcely nearer to the root of the caudal than to the end of the snout, extending to the origin of the anal. Dorsal fin elevated, its longest anterior rays being as long as the head; it commences in front of the anal. Upper pectoral rays blackish, lower whitish; dorsal fin entirely black.

Cape York. 5 inches long.

74. *Hemiscyllium trispeculare* (Rich.).

Turtle Island, Cape York.

75. *Crossorhinus tentaculatus* (Ptrs.).

Adelaide, Cape York.

76. *Triænodon obesus* (M. & H.).

Red Sea, Aneiteum.

77. *Trygonorhina fasciata* (M. & H.).

? New South Wales (Krefft).

Addendum.

Holacanthus Duboulayi, sp. n.

D. $\frac{11}{23}$. A. $\frac{3}{20}$.

Allied to *H. mesoleucus.* Scales small. Præopercular spine with a scarcely perceptible groove, reaching to the vertical from the hind margin of the operculum. Dorsal and anal fins rounded posteriorly. Head with the anterior part of the trunk yellowish, which colour is sharply defined from the remaining brown portion. A very broad brown ocular band, broader than the eye, descends from the neck to the ventral fins. The brown portion of the body coarsely reticulated with yellowish, the lines descending from the back to the belly. Caudal fin and a cuneiform band along the hinder half of the base of the dorsal yellow.

North-west coast of Australia (Duboulay).

IX.—*On the Shell-structure of* Spirifer cuspidatus, *and of certain allied* Spiriferidæ. By William B. Carpenter, M.D., F.R.S.

To the Editors of the Annals of Natural History.

Gentlemen,

Being now in a condition to give a complete and explicit reply to the question raised by Mr. Meek, on which I addressed you six months ago (Ann. Nat. Hist. Jan. 1867, p. 29), I take the earliest opportunity of communicating to you the results of my researches, which will be found, if I mistake not, of singular interest to such palæontologists as pay special attention to the *Brachiopoda*.

I think it due both to Mr. Meek and to myself to point out that the note in the 'Annals' for August,' 1866 (p. 144), in which he is represented as calling in question the accuracy of my original observations on the imperforate structure of the shell of *Spirifer cuspidatus*, did not correctly express his views. In a letter with which he favoured me immediately on reading my previous communication he says:—

"I am sorry you had not seen my little paper before you read the notice of it to which you allude. If you had done so, I am sure you would have at once seen that I made no attempt whatever to cast doubts upon the accuracy of your investigations. I never for a moment questioned the fact that the shells examined by you are not punctate. The only question with me, after seeing, as I believed, very minute and very scattering punctures in the shells I had examined, was, whether there might not be in Ireland, and possibly in England, another rare type, not seen by you, indistinguishable by form and other external characters from *S. cuspidatus*, and yet widely separated by having a punctate structure. Believing that this might be the case, and knowing that, if so, it would be a matter of some interest to know which was the true *cuspidatus*, I published my remarks mainly in order to cause further investigations.

"As you have doubtless ere this seen my little paper, you must have observed that the words 'contrary to the opinion of Dr. Carpenter,' quoted by you, do not occur in it, nor any others of the same meaning. Indeed the question never once suggested itself to my mind whether you might not have been mistaken in regard to the shells you had examined; for I assure you there is no one living in whose opinion on such a question I have more confidence than in yours"*.

The results I have now to communicate, whilst fully confirmatory of my original determination, also afford a complete verification of the sagacious guess thus put forward by Mr. Meek.

Through the kindness of Mr. Worthen and Mr. Meek, I have been furnished with the following materials for examination:—

1. Chips of the type species of the genus *Syringothyris*, established by Prof. Winchell on the basis of a very peculiar feature of internal structure, which differentiates it from ordinary *Spirifers*, viz. the connexion of the vertical dental plates (fig. 1 *l, l*) by a transverse lamina (fig. 2, *tr*) which gives off a pair

Fig. 1.

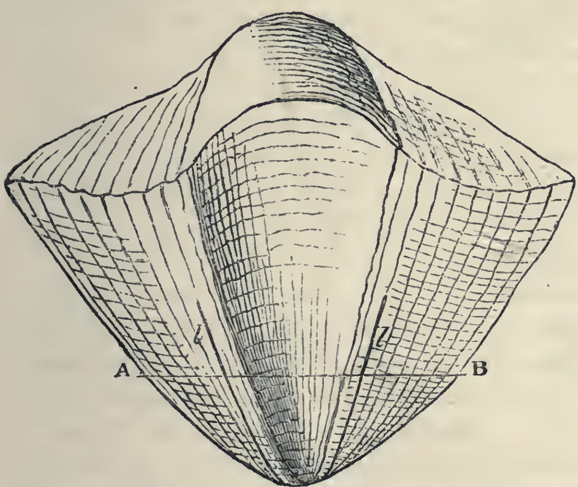


Fig. 2.

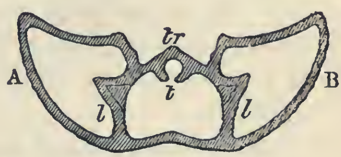


Fig. 1. *Syringothyris typa*, from a drawing by Prof. Winchell: *l, l*, dental plates; A B, plane of section.

Fig. 2. Section of *Syringothyris typa* across the plane A B, after Winchell: *l, l*, dental plates; *tr*, transverse lamina; *t*, incomplete tube.

of parallel lamellæ that curve towards each other so as nearly to meet on the median line, and thus form an incomplete tube (*t*)

* I cannot but contrast the courteous tone in which Mr. Meek (an entire stranger to me) has expressed his full reliance on my scientific accuracy in this matter with the treatment I continue to receive from Prof. King, who, in spite of my reiterated warnings against the fallacy of such superficial observations, has again (in the last number of the Geological Magazine) called in question the correctness of my statements, on no better evidence than that afforded by the examination of the *surface* of a specimen of *Spirifer cuspidatus* with a hand magnifier!

projecting into the interior of the shell. This peculiarity not being indicated by any corresponding peculiarity of external conformation, shells which are now found to present it have been ranked among Spirifers by our very highest authorities*.

2. Chips of the shells which have been ranked by American palæontologists as *Spirifer cuspidatus* and *Sp. subcuspidatus*.

3. Chips of the shell referred to by Mr. Meek as having been sent to Mr. Worthen by Mr. Davidson as a typical specimen of *Spirifer cuspidatus* from Millecent in Ireland.

In all the foregoing specimens the shell-structure was extremely well preserved.

Through the kindness of Mr. Jukes, who sent a collector to Millecent on purpose to obtain for me specimens of the last-mentioned type, I have also been enabled to examine—

4. Two entire specimens of reputed *Spirifer cuspidatus* from Millecent. Although there was but little shell on these specimens, that little was well preserved, and proved quite sufficient for my requirements.

Finally, the readiness of Mr. Davidson to make any needful sacrifice for the sake of arriving at the whole truth on this point has led him to place at my disposal—

5. The entire specimen of *Spirifer cuspidatus* from Millecent, figured by him in his 'Carboniferous Brachiopoda' (plate 8. fig. 19) as a typical representative of the species. The shell of this specimen is so well preserved that lamellæ scaled off from it could scarcely be distinguished from those of a recent *Rhynchonella*.

All the foregoing specimens have been examined under magnifying-powers of from 50 to 100 diameters, (1) by mounting in Canada balsam such lamellæ as were already thin enough to be transparent, and (2) by grinding down such chips as were originally opaque until they became thin enough to be seen through, and then mounting them in Canada balsam. This is the method which I have uniformly practised, when able to do so, in the examination of the shells of fossil Brachiopoda; and I consider it the only one by which satisfactory results can be obtained. A natural lamella gives the structure of that particular layer of which it formed part, whilst a thin section procured by grinding will generally traverse all the layers of the shell. The following are the facts thus revealed as to the structure of the specimens just enumerated:—

1. The type-specimen of Prof. Winchell's *Syringothyris* exhibits distinct perforations of about 1-3000th of an inch in diameter, set at an average distance of about 1-300th of an

* A fully illustrated description of this genus, by Mr. Davidson, will be found in the ensuing (July) Number of the Geological Magazine.

inch from each other. They are not distributed, however, with the uniformity which usually prevails in the shells of the perforated Brachiopoda; for patches of imperforate shell intervene between portions that are pretty regularly perforated, and sometimes a fragment large enough to fill a great part of the field of view is entirely imperforate. This, I feel certain, is not the result of any alteration produced by fossilization, the shell-structure being equally well preserved in the perforated and in the imperforate parts. Prof. Winchell speaks of this shell as "impunctate in all conditions and under high powers,"—a statement for which I can only account on the supposition that he happened to examine only minute fragments which chanced to be imperforate, as occurred to myself in my first examination of No. 4.

2. The *Spirifer cuspidatus* and *Sp. subcuspidatus* of the United States palæontologists are unquestionably perforated; and precisely resemble the preceding not only in the size of the perforations and in their distance from each other, but also in the *patchiness* of their distribution.

3. The Millecent (Irish) shell in Mr. Worthen's possession exhibits exactly the same combination of imperforate with perforated structure; and I have no doubt that it was the uncertainty produced by this peculiarity which led Mr. Meek, in transmitting me chips for examination, to express a doubt whether he had been originally correct in asserting the presence of perforations in this shell.

4. The two Millecent specimens obtained for me by Mr. Jukes also unquestionably exhibit the same character of *patchy* perforation; but I might not have ascertained the existence of perforations if I had not carefully scrutinized every lamella of shell that I could scale off, all the fragments first examined having chanced to be imperforate.

5. Mr. Davidson's typical specimen of *Spirifer cuspidatus*, also from Millecent, exhibits *not the smallest trace of perforations*, though I have scaled off from it flakes of such size, and from so many different parts (including also both its outer and its inner layers), that I feel justified in confidently asserting that this shell is essentially *imperforate*.

Thus, then, whilst my previous determination of the *imperforate* structure of *Spirifer cuspidatus* is fully borne out by the examination of a remarkably well-preserved specimen of that type (No. 5), this result is in apparent contradiction to the fact that shells (Nos. 2, 3, 4) not externally distinguishable from it are indubitably *perforated*. The difficulty has been entirely removed, however, by an examination of the internal structure of these shells, the results of which are in complete harmony with the singular correspondence between the *patchy* distribution of the perforations in Nos. 2, 3, 4 and that which is characteristic of *Syringothyris* (No. 1)—a correspondence which is the more significant as I have not elsewhere encountered this peculiarity.

On slicing across my *perforated* Millecent specimens (No. 4) in the direction indicated by Prof. Winchell's figure, the internal structure of one of them proved to be sufficiently well preserved to show most distinctly the transverse lamina (fig. 3, *tr.*) con-

Fig. 3.

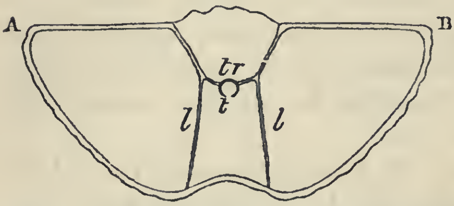


Fig. 4.

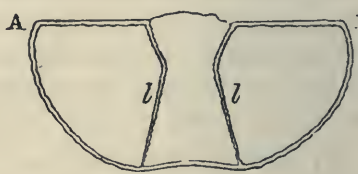


Fig. 3. Transverse section of *Syringothyris* from Millecent, from a drawing by Mr. Davidson: *l, l,* dental plates; *tr,* transverse lamina; *t,* incomplete tube.

Fig. 4. Transverse section of true *Spirifer cuspidatus* from Millecent, from a drawing by Mr. Davidson: *l, l,* dental plates.

necting the dental plates (*l, l*), with its projecting pair of lamellæ forming the nearly complete tube (*t*) characteristic of the typical *Syringothyris* (figs. 1, 2), to which genus, therefore, these shells are obviously to be transferred.

Nothing, then, remained save to subject the *imperforate* shell of the true *Spirifer cuspidatus* (No. 5) to the same crucial test; and on carrying a section through this specimen in precisely the same direction (A B), it proved that its dental laminæ (*l, l,* fig. 4) are unconnected by any transverse plate, and that there is no vestige whatever of the characteristic tube of *Syringothyris.*

Thus, then, the remarkable fact is incontestably established that there is an exact *isomorph* of *Spirifer cuspidatus,* not distinguishable from it by external conformation, but generically differentiated by a very marked peculiarity of internal structure, of which peculiarity the perforated structure of the shell seems (so to speak) to be the exponent.

It would be difficult, I think, to find a more significant proof of the value of the microscopic test than this result has afforded; and I venture to hope that, as I have spared neither time nor trouble in the investigation, and am prepared to stake my scientific character upon the accuracy of the observations now detailed, they may not be lightly called in question.

I should add, in conclusion, that, in addition to the foregoing, I have examined chips of the shells of the following species of reputed Spirifers sent to me from America by Mr. Meek:—*Sp. Hannibalensis* (Swallow), *Sp. capax* (Hall), *Sp.* ? *hemiplicatus* (the type of a new genus *Syntrilasma*), all of which are unquestionably perforated. On the other hand, a chip sent to me by Mr. Meek of a little shell which he states to be the type of Prof. Hall's genus *Ambocoilia* (= *Orthis umbonata*, Con.) is as certainly imperforate. But, after the experience above described, I should hesitate to pronounce on the absence of perforations in a shell allied to this group, except after the examination of *several* such fragments.

I remain, Gentlemen,
Your obedient Servant,
William B. Carpenter.

University of London, June 17, 1867.

P.S. I have to add that, having learned from Mr. Davidson that the typical structure of *Syringothyris* is exhibited by a Belgian shell hitherto known as *Spirifer distans*, I have reexamined the only example of this type at present accessible to me, the one contained in the Museum of the Royal School of Mines. So far as I can judge from the minute fragments of shell, not very well preserved, which this specimen has afforded, I should still say that it is imperforate. But the experience I have now acquired from the Millecent shells leads me strongly to desire a more complete investigation of this type; and I should be greatly obliged to any of your readers who may be able to supply me with well-preserved specimens of it. It does not seem improbable that the reputed *Spirifer distans* of Belgium, which proves to be truly a *Syringothyris* (see Davidson, *loc. cit.*), may be, like the Millecent shell, an isomorph of a true *Spirifer*.

BIBLIOGRAPHICAL NOTICE.

1. *A List of the Flowering Plants, Ferns, and Mosses collected in the immediate neighbourhood of Andover.* By C. B. Clarke. Calcutta, 1866.
2. *Flora of Devon and Cornwall.* By J. W. N. Keys. (Ranunculaceæ—Geraniaceæ.) Plymouth, 1866.
3. *The Bath Flora. A Lecture delivered to the Members of the Bath Natural-History and Antiquarian Field Club.* By the Rev. L. Jenyns. Bath, 1867.
4. *Flora of Norfolk: a Catalogue of Plants found in the County of Norfolk.* By the Rev. K. Trimmer. London, 1866.

These four tracts on the flora of Britain have recently reached us. They differ considerably in intention and character, but are well deserving of notice. The first has the peculiarity of being a partial flora of a district in England, printed and published at Calcutta.

The cause of this is mentioned in the introductory remarks—namely, that the author has become a resident in Bengal. We may add that he is a fellow of Queen's College at Cambridge, and has now charge of a large educational institution in India. He had occupied himself for several years before leaving England in the examination of the flora of Andover during such parts of the summer as he could be there, and has done well to print the results of his researches. He justly remarks that "a list of this kind can never be complete," and he therefore less regrets the incompleteness of the present. It is a valuable contribution to a knowledge of the distribution of our native plants. The author is a man of great ability and much originality: he has therefore occasionally made remarks which may not be quite palatable to some other botanists. They always well deserve attention, although we are sometimes far from altogether agreeing with the author. We would especially direct attention to the observations upon "geographical distribution," on pages 10–14. They deserve the notice of all who occupy themselves with that interesting study.

Under *Rubus* is the remark:—"I admit that universal botanists are not bound to get up the *Rubi*; but if they only describe *R. fruticosus* and *R. cæsius*, they should define those 'species' so as to collect the allied forms as well as possible; and they must not suppose that by making two species only they avoid all difficulty. So far is that from being the case, that it is as difficult at the least to separate the *Cæsii* and *Fruticosi* as it is to separate *R. leucostachys* from *R. discolor*. For instance, Dr. Bromfield, a skilful rubologist, considered *R. corylifolius* to belong to the *Fruticosi*, laying stress on its fruit; whilst most other rubologists consider it to be one of the *Cæsii*. If, therefore, rubologists are not always able to separate absolutely their 'species,' they are not therefore to be taunted as triflers by those who define their two species *R. fruticosus* and *R. cæsius* in such a way that, in the case of great masses of *Rubi*, nobody can decide under which section they are to be placed."

But we must proceed, after simply adding that the List records the localities and frequency of 667 species of flowering plants and ferns—not a bad catalogue for a small district of less than ten miles' radius.

The 'Flora of Devon and Cornwall' is the first instalment of a complete flora of these interesting counties. Such a flora is very much wanted, as we possess no satisfactory account of the plants of the south-west of England. Mr. Keys is well qualified for the work that he has undertaken; and we hope that he will be able to proceed successfully and quickly with it.

He makes only two "districts," namely the counties of Devon and Cornwall. We think that it would have been well, considering how much the different parts of these counties differ from each other, if he had followed the example of most of the modern local floras, and divided each of the counties into several local districts. The work which he has undertaken seems to be performed well and carefully.

Mr. Jenyns's Lecture is intended to show what has been done in the elucidation and completion of the flora of Bath since the publication (in 1839) of the 'Supplement to the Flora Bathoniensis.' He points out the errors to be found in that book, and corrects them, and adds a considerable number of species to the list.

Unfortunately, we cannot greatly praise Mr. Trimmer's 'Flora of Norfolk.' As a list of plants *found in the county*, it is doubtless very correct; but as a flora of the county it is very imperfect. There is no attempt to show the distribution of the plants by local divisions. It is an old-fashioned flora, such as might have been published fifty years since, except that its nomenclature and the view taken of species are those of the present day. Whole districts of the county seem not to have been examined, or only in a very superficial manner. If the author had made known his intention of publishing a flora of the county, we know that he might have obtained lists of plants for some of these neglected tracts. Let us hope that a new edition will supply the wants of this one.

MISCELLANEOUS.

On the actual state of our Information relative to the 'Leporide,' or Hybrid between Hare and Rabbit. By Dr. Pigeaux.

Are there any sexual relations between the hare and rabbit in a state of nature to which it would be possible to attribute the creation of a mixed or intermediate species, to be named, on account of external configuration, *Leporide*? The ancients, and indeed some of the moderns, deceived by the colours and special forms of certain varieties of rabbits common in the south of Europe and very abundant in Asia Minor, have believed this to be the case. Such varieties are found in some departments of the east of France and along the banks of the Rhône. These are, after all, merely rabbits which burrow, and are born without fur and with the eyes closed. Such are the *Léporides* of M. Roux, and those also which have been and are perhaps still called 'Leporides' at the Jardin d'Acclimatation in Paris. These rabbits pair voluntarily, and are productive either amongst themselves or in conjunction with the ordinary domestic rabbit. I have had in my possession some of them which, from their appearance, might almost have been mistaken for hares, having the tip of the ears black and the inferior surface of the belly and of the thighs tawny; nevertheless, by all characters distinctive of the species, they were never anything but rabbits. Thus I am able to negative the pretentions of M. Roux to having created a race of fertile hybrids begotten through a male hare and several female rabbits.

It is, however, by no means difficult to bring about a connexion between the hare and rabbit in a state of domestication; but for success we must not persist in uniting adult individuals unaccustomed to living together previously. In such a case the female nearly always kills the male, bleeding him at the jugular, or, unless the hutch be very securely fastened, succeeds in dislodging him.

This will occur indeed sometimes when a young male leveret has been brought up with young female rabbits, as soon as they become adult, if the cage be too constrained in its dimensions. In order that the experiment may succeed, it is necessary to provide a cage of a certain extent, say of some metres, barred in some portions and pannelled in others, so that the animals may escape observation at pleasure. It is well also to leave several females with the young male, in order that he may have some range for choice. Such measures were adopted by M. ——, of Nanterre, near Paris, whose success has been as complete as it is perfectly attested and indubitable. Several female rabbits were rendered pregnant by the agency of a single male hare existing in his menagerie; he has further been able to rear to the adult state a number of the *mongrels* or, rather, *mules* so obtained between the two species. There were both males and females, apparently strong and well developed; and these paired, but have not been productive, as far as I know, hitherto. I would not deny to these mongrels a fecundity similar in degree to that which is sometimes found in the cross between ass and mare; but such a case is only exceptional, and we can neither fear nor indeed hope to create a new race: so that from this point of view the *Leporides* do not exist.

The instance cited by M. Albert Geoffroy Saint-Hilaire, in which a female hare covered by a male rabbit gave birth to a young already covered with fur, and having the eyes open, is a most remarkable one; it could, however, be merely a case of a cross retaining the form of the mother, and no more fertile than in the case of those hybrids between the Ass and the horse in which the latter animal (the male) gives the predominant character to the offspring.

These experiments may be repeated and varied, proceeding with very young animals brought up together and enjoying a certain liberty, although confined in the hutch. It is of especial importance, in breeding with the male hare, to provide several females, whether of rabbit or of hare, always, however, isolating them as soon as they are ready to bring forth (in twenty-eight or thirty days). That the hare, when in good condition, will produce several times a year admits of no doubt; but as she does not burrow, it is necessary to furnish her with a sufficient quantity of twigs, and to keep them extremely fresh and clean. Although in captivity the hare usually produces only one or two young, she has been known to bring forth three, and to rear them with great tenderness; it is, however, necessary to remove them early from the male, and even from the female, who will often strangle them as soon as they are capable of living independently, especially if they are about pairing again.

The rearing of hares in captivity is but a thankless task, as they do not live long, wanting a sufficient space for running; their flesh, also, is insipid, unless, indeed, they are let loose some months previously in an area perfectly free from rabbits; for between these two species there rages a most inveterate war; and a single rabbit would with ease strangle fifty hares in one night. The female, also, is not very productive, and ceases to bear after the third year.

To sum up, therefore, we would affirm that *Leporides* exist undoubtedly under both forms, with predominance of the hare or of the rabbit; but as a species, or even a variety, we cannot admit them, since, like all other crosses, they have merely an accidental productiveness. Their utility moreover is but slender, the flesh having neither the whiteness of the rabbit nor the fine flavour of the hare. Pretty much the same thing may be said of hares reared in hutches; their flesh lacks flavour, and their multiplication is too limited to render them a profitable object of industry.—*Bulletin mensuel de la Société Impériale zool. d'Acclimatation*, 2^{me} série, tome iii. No. 7, July 1866.

Megaceros hibernicus *in the Cambridgeshire Fens.* By NORMAN MOORE, Esq.

Early this year some diggings for phosphatic nodules were opened near Upware, a village on the Cam, about twelve miles below Cambridge. I have several times visited the workings in company with Mr. J. F. Walker, B.A., F.G.S., Examiner in Natural Science at Sidney Sussex College; and whilst he was occupied with the Lower-Greensand fossils, I paid more particular attention to the surface soil. Some fragments of roebuck horns and teeth, one horn of a red deer, and various other bones have been the result. One of the roebuck horns is notched on each side, as if to afford a fastening-place for string, and the points are rubbed smooth; hence one might suppose that the horn was used, centuries ago, as a net-peg. While at Upware, on my last visit to the bed, a few days ago, I heard that a man in the neighbouring village of Wicken had an elephant's bone, which he had dug out of the surface soil while working at the coprolite-diggings in Burwell Fen. I luckily fell in with the man and the bone, which, to my delight, I saw belonged to an Irish elk. It was an almost perfect and well-marked ulna, evidently of a full-grown animal. The man informed me that several bones of like appearance were found with this one. They were sold for a small sum to a bone-dealer; this was kept as a curiosity because of its curious shape, "like a pistol." It is of a dark peat-colour. As far as I can judge by a comparison of the relation which the length of the ulna bears to the height of the shoulder from the ground in the Irish elk in the Woodwardian Museum, I suppose that the animal to which this ulna belonged cannot have been less than eighteen hands high.

St. Catharine's College, Cambridge.

Note on Assiminea Francesiæ. By Dr. J. E. GRAY, F.R.S. &c.

In the 'Annals and Magazine of Natural History' for June last, at p. 381, Mr. Blanford makes some observations on the various terminations which have been given to the name of the shell called *Assiminea Francesiæ.* I may state that I originally described the shell as above, naming it after my sister, Frances Ince, who made a very extensive collection of the freshwater shells of India—the first, I believe, that was sent to this country.

It is figured by Mr. W. Wood, however, in the Supplement to the Catalogue of Shells as *Turbo Francesi,* from specimens sent home by Mrs. Ince: so the confusion began early. Mr. Wood (unfortunately for science, as it added some confusion to the nomenclature) submitted the proofs of the text of the Supplement to Dr. Goodall, who, I suppose, not knowing that the names which I had supplied to Mr. Wood had already been published (though it is mentioned in the preface that they are the names used in the British Museum collection), altered some of the names capriciously. I suppose that the Provost of Eton College did not think it right that a shell should be named after a woman; for in the same way he altered *Nerita Smithiæ* and *Turbo Maugeræ* to *Nerita Smithii* and *Turbo Maugeri.* No one who knew him can believe that it arose from want of politeness or gallantry; but conchologists are more liberal now. I may observe that all the shells figured from specimens in the Supplement were engraved (not etched) on the copper at once, from the shells selected by myself either from the British Museum, Mrs. Mawe's, or Mrs. Gray's collection; and I furnished him with the names of the species (which in some cases were so oddly changed) and also with the Lamarckian Index to the Catalogue and Supplement.

On the Species of the Genera Latiaxis, Faunus, *and* Melanatria. By Dr. J. E. Gray, F.R.S. &c.

The examination of the original specimens on which the various species of the genus have been described and figured has convinced me that there are not more than two distinct species of *Latiaxis.* The first, *L. Mairæ,* is nearly smooth, with a flat depressed spire and a very large umbilicus: *L. purpurata,* Chenu (Mollusques Mar.), appears to be only a variety of this species, which is sometimes of a purplish colour. The second, *L. pagoda,* Johnson, has a conical spire and a small umbilicus. *L. pagoda,* Johnson, *L. textilis,* A. & H. Adams, *L. Eugeniæ,* Beraud, and *L. nodosa,* A. Adams, are all varieties of the same species, varying in the presence or absence of a keel on the last whorl, and in the whorls being slightly nodose. They are all inhabitants of the China Seas.

The specimens of the genus *Faunus,* Montfort, in Mr. Cuming's cabinet show most conclusively that the shells named *Faunus ater, F. terebralis,* Lamk., *F. Cantori,* Benson, and *F. pagoda,* Reeves, are only slight varieties of a single species. *F. Cantori* is a dwarf decollated state, and *F. pagoda* is described and figured from an accidentally distorted adult shell. They are found in Ceylon, Penang, the Philippines, and New Caledonia.

The species of *Melanatria,* Bowdich, have been also needlessly divided. There can be no doubt that *M. fluminea* and *M. plicata,* Reeve, are only varieties of *M. spinosa,* Lamk. It is found in Madagascar and West Africa. They vary not only in the strength of the plaits and spines (some are even quite smooth), but also in the depth of the notch of the hinder part of the outer lip.

The named species of *Latiaxis, Faunus*, and *Melanatria* are not even local varieties. A series of specimens from the same locality show the variations in the surface on which these *dealers'* species are professed to be distinguished, which should be treated as the names given to flowers by nurserymen and florists are by the botanist, as they are scarcely worthy the attention of the scientific conchologist. The effect of this useless multiplication of names has been to almost entirely prevent conchology being studied as a science.

Descriptions of new Fishes. By F. Steindachner.

1. *Plecostomus Wertheimeri.*—Marginal scutes of the sides of the head closely beset with long bristle-like spines; a row of broad transverse plates on each side of the belly between the pectoral and ventral; head adorned with black spots, body with yellow spots. From the river Mucuri in Brazil.

2. *Cottus Brandtii.*—Head parabolic; skin of body scaleless; præoperculum with three spines, of which the uppermost is the longest; mouth-cleft oval, longer than broad; vomer with teeth; upper surface of head closely set with round warts. D. 9/13; A. 11; V. 3; P. 17. From the mouth of the Amur.

3. *Amblyopus Sieboldi.*—Length of head contained 9 times in the total length, or $7\frac{1}{2}$ times in the length of the body; greatest depth $\frac{1}{16}$ of the total length; caudal pointed, long, $\frac{1}{6}$ of the total length. D. 6/48–49; A. 44; C. 17. Mouth of the Amur.

4. *Pseudorhombus adspersus.*—Length of head contained $3\frac{5}{6}$ times, depth of body $2\frac{2}{3}$ in the total length; diameter of eye $\frac{1}{6}$ of the length of the head; numerous black points, spots, and rings on the whole body. D. 72; A. 58; P. 12; V. 5; L. lat. 104. From the Chinchas Islands.

5. *Scopelus spinosus.*—Scales of body toothed; a long spine on the lower extremity of each scale of the last longitudinal series but one above the anal, which is longer than the dorsal; diameter of the eye $\frac{1}{2}$ the length of the head. D. 14; A. 20; V. 9; L. lat. 40; L. transv. $\frac{3\frac{1}{2}}{\frac{1}{5\frac{1}{2}\,(4\frac{1}{2})}}$. From China.

6. Genus *Tæniolabrus.*—Body rather compressed, much elongated, of very small depth, covered with cycloid scales; head scaleless; ventral fins articulated a little before the pectorals *; teeth in intermaxillaries and lower jaw uniserial, pointed, the foremost the longest; vomer and palatal bone with teeth; dorsal and anal fins very long; lateral line not interrupted.

7. *Tæniolabrus filamentosus.*—Head pointed, $\frac{1}{6}$ of the total length; lower jaw protruding; eyes approximated; depth of body $\frac{1}{17}$ of the

* In the original the author contrasts "Bauchflossen" with "Ventralen," which are identical; the above is probably his meaning.

total length; middle ray of ventral very much elongated; caudal very long, pointed; black rings on the scales of the lateral line. D. 6/41; A. 1/38; V. 1/5; L. lat. 58–59.

8. *Gobius pavo.*—Length of head contained $3\frac{6}{7}$, breadth of head $6\frac{1}{6}$, depth of body $8\frac{1}{3}$, and caudal fin $4\frac{1}{3}$ times in the total length; length of eye $\frac{1}{6}$ of length of head; dark golden brown, with four large indistinctly limited black spots along the lateral line, and two deep-black obliquely placed spots, separated by a light-yellow spot of nearly the same size behind the fifth spine of the first dorsal. 1 D. 6; 2 D. 1/8; P. 20; A. 1/8; L. lat. 31. From the Philippines.—*Anzeiger der Akad. der Wiss. in Wien,* May 16, 1867, p. 119.

Supplement to 'English Botany.'

Mr. J. W. Salter, the proprietor of this work, wishes to continue the publication of the fifth volume, which was commenced in 1863, and of which six numbers have appeared, but, owing to the very small support which the work receives from botanists, to whom apparently its great value is unknown, he is unable to do so. There ought to be ample support for this Supplement to the original 'English Botany,' since there are at least 2000 copies of that work in the hands of the public, and none of them can be considered complete without these supplementary volumes.

Some friends of this work are desirous of obtaining the help of from forty to fifty subscribers of £5 each, in order to raise a fund for completing this publication. They propose that these subscriptions should be placed in the hands of Prof. C. C. Babington, of Cambridge, and expended by him *solely in the payment of the artists' and printers' bills* for each number when it is issued to the subscribers. They will of course receive their copies in part repayment of the money advanced by them, the remainder being repaid by the sale of the work.

There are between 100 and 150 flowering plants as yet unpublished, of which about 20 have been already drawn by Mr. J. D. C. Sowerby or Mr. J. W. Salter for this Supplement: most of the remainder can readily be obtained; and it is intended to proceed with their publication as rapidly as circumstances will allow.

The plates and text will be superintended by Prof. C. C. Babington, who will be supported by some of the most active English botanists.

But nothing can be done until the fund for paying the necessary expenses has been raised; for the proprietor is not able to bear the heavy cost himself—although if once published it is nearly certain that the work will in due time be remunerative. The proprietor will hand over the booksellers' balance annually to Prof. Babington until the entire sum subscribed has been repaid.

Botanists or others who will kindly aid in this way are requested to communicate with, and pay their subscription to, Prof. C. C. Babington, of Cambridge, as soon as possible.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 116. AUGUST 1867.

X.—*On* Waldheimia venosa, *Solander*, sp.

By Thomas Davidson, F.R.S., F.G.S., &c.

To the Editors of the Annals of Natural History.

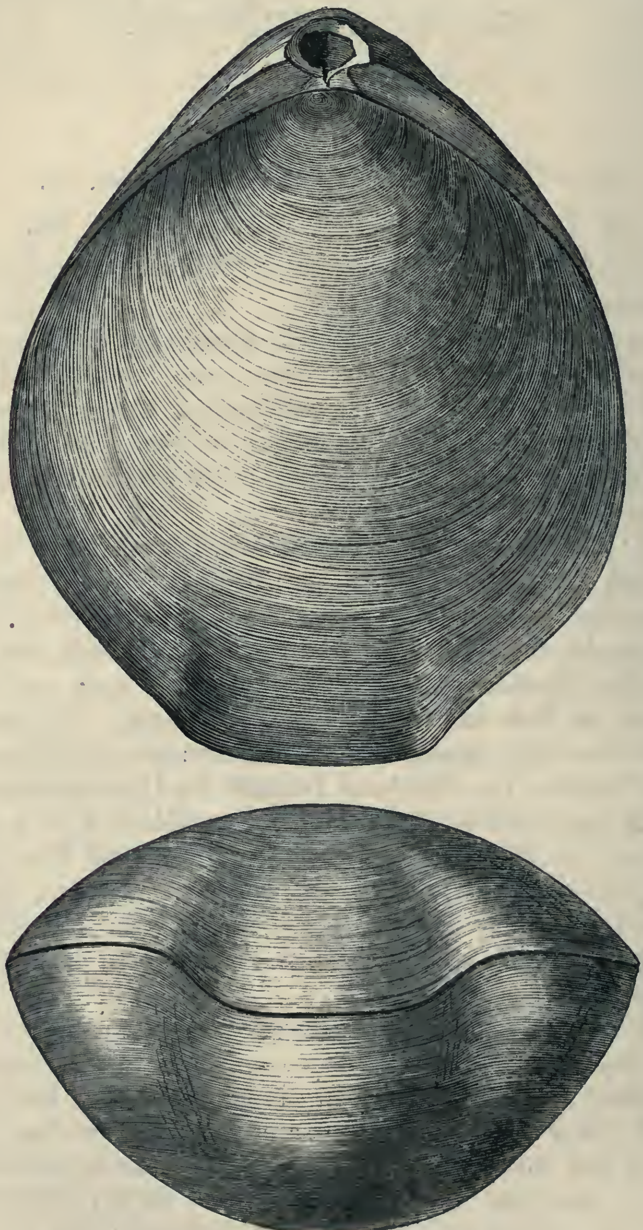
Gentlemen,

A great deal of valuable matter in connexion with the Recent Brachiopoda has from time to time been contributed to the 'Annals,' and consequently I would solicit space for a few remarks with reference to the largest recent specimen, and species, of Brachiopoda hitherto discovered, and of which we are now in possession of the correct habitat.

In the 'Annals' for June 1861, Mr. Lovell Reeve mentions that I had communicated to him the discovery that either *Waldheimia globosa* or *W. dilatata* had been collected nearly a century ago by the illustrious navigator Capt. Cook, and named by Solander *Anomia venosa*, that the name only appeared in manuscript at first in the Portland Catalogue, but that a few years later another specimen had been brought to England from the same locality (the Falkland Islands) by Capt. George Dixon, and in the narrative of his expedition, published in London in 1789, a very excellent figure and description had been given of it. The designation *Waldheimia venosa*, Solander, was consequently adopted by Mr. L. Reeve and myself, as it was the earliest name given to the largest recent form of Terebratula hitherto discovered.

On the 3rd of April of the present year, Rear-Admiral B. J. Sulivan kindly forwarded for my inspection and determination a Terebratula much exceeding in dimensions any I had hitherto seen; and I was informed at the same time that he had dredged it alive in the outer harbour of Port William, at the Falkland Islands, in the year 1843 or 1844. The depth at which the animal lived was from six to seven fathoms; the bottom on which the shell lay was a compact quartzose sand only, as no mud ever comes up with the dredge, although a stiff muddy clay underlies the sand, in which anchors hold very firmly. Many small *Serpulæ* are attached to its surface; and a long piece of sea-weed, two feet in length, was found growing from near its hinge.

On opening the box containing this interesting specimen (of which two correct drawings are here appended), I at once perceived that the shell was no other than an extremely large ex-



Waldheimia venosa, Solander, sp.
(Falkland Islands, and Collection of Rear-Admiral B. J. Sulivan.)

ample of Solander's species. In shape it is almost regularly oval, and longer than wide; the valves almost equally convex and deep, while in the dorsal valve there exists a shallow median depression or sinus close to the front, and which corresponds with a broad, slightly elevated mesial fold in the ventral valve. The beak of the ventral valve is moderately produced, incurved and truncated by a large circular foramen, partly margined by a deltidium in two pieces. In the interior of the dorsal valve the loop is elongated and reflected, while a sharp raised septum extends from under the cardinal process to about half the length of the valve. This fine specimen measured 3 inches 2 lines in length by 2 inches 8 lines in breadth, and 2 inches in depth.

Now the largest Tertiary Terebratula with which I am at present acquainted measures 4 inches 2 lines in length by 3 inches 1 line in breadth, and 2 inches 1 line in depth; but although the Crag *Terebratula grandis,* to which we would refer, does very much resemble in general form the recent *W. venosa,* the Tertiary shell was possessed of a short loop, and consequently is a true *Terebratula,* while *T. venosa* has an elongated one characteristic of the subgenus *Waldheimia.*

Admiral Sulivan informs me that *W. venosa* may perhaps occur also near Tierra del Fuego, where he supposes Solander's shell might have been found, as he is doubtful whether that naturalist ever was at the Falklands; and he thinks it surprising that during his own long service in that region, while in command of the 'Beagle,' the shell was never found by Darwin or any other of the officers on board, although the dredge was frequently at work.

In conclusion, I may here add that both the Cretaceous and Jurassic periods possessed one or two very large species of Terebratula; but none that I am aware of attained the proportions of the largest example of *T. grandis* with which we are acquainted. In the Triassic and Palæozoic periods the species of the genus are fewer in number and of much smaller proportions.

I remain, Gentlemen, yours, &c.,

THOMAS DAVIDSON.

XI.—*List of Coleoptera received from Old Calabar, on the West Coast of Africa.* By ANDREW MURRAY, F.L.S.

[Continued from p. 23.]

Bostrichidæ.

APATE, Fab.

This genus is in a state of considerable confusion. The few species described are for the most part of old date, being chiefly from the pen of Olivier and Fabricius and other authors of their date; and although tolerable figures are sometimes given by Olivier, it is not surprising, considering the strong family resemblance which prevails in all, that their short descriptions should have left entomologists very much in the dark and almost entirely dependent on tradition for a knowledge of the species intended by them.

Before entering on the description of the species from Old Calabar, I must ask leave to add to the entomological terminology an expression to enable me to deal without periphrasis with the anterior and posterior extremities of the Bostrichidæ. Every one who reads this knows that this group is composed of cylindrical insects which have the thorax terminating in an overhanging straight or excavated or more or less vertical front, and the elytra terminating either in a rapid, steep rounding off, an abrupt, oblique, or even vertical slope, or an actual excavation. These abrupt terminations at each end of the body I propose to call truncatures,—viz. the thoracic truncature and the apical truncature of the elytra. The word does not much matter; as Prof. Owen says, it is a mere tool to do the work. What I want is something to express in a word the declining abrupt termination at either end of the Bostrichidæ. Where it does not occur, of course it will not be used.

1. *Apate terebrans*, Pallas, Spicilegia Zool. Ins. p. 7; Oliv. Ent. iv. No. 77, pl. 1. fig. 4.

(*A. barbifrons*, Dupont, Dej. Cat.)

Found both in Brazil and Africa, and distinguished from other species by its size and a large tuft of yellow hair and two small projecting triangular teeth on the forehead. The elytra are marked with punctures running into each other, and making a series of rather fine rugosities or slight reticulations.

I have no doubt tradition is correct in assigning this insect to Olivier's *terebrans*, although his figure represents an insect considerably shorter. This we may assume to be an error in the drawing, because we know no other species which is so like the drawing as this, and the description in the text corresponds with that of the species.

I have wasted a good deal of time in carefully comparing the African and Brazilian specimens, with the expectation or desire of finding some difference between them; but have been unable to find anything that is constant or could be called specific. As a rule, the African specimens are more distinctly and deeply marked, and have a deeper fovea round the scutellum; but sometimes there is no such difference, or even the reverse occurs.

If a number of Brazilian and African specimens were mixed together, I think it would be impossible to assign them all correctly to their different countries, although probably the majority might be successfully guessed at.

Not rare in Old Calabar.

The same species also extends to Natal.

2. *Apate muricata*, Fab. Syst. El.

Nigra; capite plano, epistomate parum fulvo piloso antice; thorace utrinque antice dentibus parum uncinatis instructo; elytris profunde reticulatis, nitidissimis.

Long. 14 lin., lat. $4\frac{1}{3}$ lin.

This is a large, handsome insect (the finest of the family), cylindrical, black, with the elytra strongly impressed with deep coarse reticulations, and the raised parts glittering and shining. Head punctate posteriorly, almost impunctate in front, leaving smooth shining spaces about the middle and on each side, with a longitudinal line down the middle, somewhat more deeply impressed at a point in the centre, free from hair or pubescence, but covered on the sides and partially on the front with round, small tubercles. Epistome with a projecting point in the middle and a fringe of yellow pile. Labrum emarginate, almost bilobed, the margin of the lobes fringed with yellow pile; palpi and club of the antennæ piceous. Thorax widest in front, opaque, except behind, divided as it were transversely into two parts; the anterior part broad and large, and covered with denticulations, which at the anterior angles become developed into hooks, the denticulations being triangular projecting teeth near the anterior angles, on the sides and front flattened triangular spaces slightly elevated; the posterior half finely aciculate or subtuberculate, the tubercles here being a modification of the same triangular denticulations, only much finer and more closely adpressed and flattened, in the centre towards the base almost smooth; a slight central longitudinal line runs forward from the middle of the base; there is an indentation on each side of the middle of the base, making the centre into a lobe; the posterior angles are rounded eminences, with two somewhat transverse impressions on the sides. Scutellum rounded, opaque, lying in a hollow. Elytra parallel, cylindrical, deeply and broadly reticulated, with the elevated spaces very bright; there is a longitudinal hollow for about a line and a half behind the scutellum; the base is straight, the shoulders rather prominent and nearly smooth; the apical truncature is hollowed out, and the excavated space shining and nearly impunctate; the elytra above the truncature terminating in three projecting teeth (the two outermost projecting furthest, and the outermost the smallest); there are faint traces of three raised lines or costæ, of which these teeth are the terminations; the raised reticulations have in some specimens one more developed than usual, like a varicose vein, running transversely from the suture at about one-third of the length of the elytra from the apex. The outer margin has a row of punctures marked off by a slightly raised straight line, within which at the anterior part are two rows of punctures enclosed by an oblique line. Underside piceous. Metathorax fulvo-pilose. Tibiæ finely externally toothed, especially near the apex.

This I believe to be the *A. muricata* of Fabricius. Some entomologists on the continent still apply that name to it, doubtless from tradition. There is also a specimen in the Fabrician collection, now in the British Museum, bearing this name.

The continental entomologists generally, however, consider it synonymous with *A. terebrans,* Oliv.; and Lacordaire (Gen. Col. iv. p. 538) so records it; but I am convinced that this is an error, and a strong proof that it is so is that *A. terebrans* is found both in Brazil and Africa, while *muricata* is confined to Africa. Its appearance, too, is so different that one can only account for its ever being considered the same by the difficulty of putting the differences into words, and the ease with which a little exaggeration of the characters of *terebrans* would turn it into *muricata.*

It is of the same size as *terebrans,* only broader and not quite so long, giving the effect of a more bulky insect. The thorax is decidedly broader in front, instead of being narrower as in *A. terebrans.* It is deep black, with much deeper reticulations on the elytra, leaving more open raised spaces, which are more shining and glittering. The apical truncature is more vertical.

The descriptions do not help us in the least, that of Olivier's *terebrans* and Fabricius's *muricata* being *totidem verbis* the same for both. Lacordaire makes the suggestion that the tuft of hair on the forehead may be a sexual difference, in which case the present species might be a sex of *terebrans*: it has not the tuft, nor the projecting teeth, and it has an additional and a curved development of the small most advanced teeth on the thorax—both corresponding to a sexual difference which, I think, occurs in another (smaller) species, *A. monacha*; but in it the reticulations are the same in both, which is not the case here; and, besides, as already said, all idea of this being a sex of *terebrans* is excluded by the fact of the one, and not the other, being found in South America.

Not common in Old Calabar. It extends to Natal.

3. *Apate degenera.*

A. muricatæ valde affinis, fere tertia parte minor; elytris minus rugosis et minus reticulatis, apice haud leviter punctato sed leviter et evanescenter rugoso.

Long. 9 lin., lat. 3 lin.

Very close to *A. muricata,* of which it has the form, but nearly a third smaller, and the reticulations on the elytra not nearly so marked; they are not much deeper or more decided than in *A. terebrans,* but they have the character of those of *A. muricata.* It is exceedingly difficult to find any definite character to distinguish it from the latter; but the difference in its appearance, coupled with the above-mentioned distinctions, seem to warrant its being treated as a distinct species. A minor difference is that the apical truncature of the elytra, instead of being sparsely dotted with small shallow round punctures, is smooth, but marked with faint, evanescent, chiefly longitudinal corrugations.

Only one specimen received.

4. *Apate monacha,* Oliv. Ent. iv. pl. 2. fig. 9.

(*A. reticulata,* Dej. Cat. 333; *A. Leprieurii,* Dej. Cat. 333.)

A. terebranti similis, sed tertia parte minor. *Mas*? Capite cum fronte sine tuberculis sed fasciculo fulvo piloso instructo; thorace cylindrico, haud latiore antice, lateribus anticis vix tuberculatis; elytris subreticulatis, bi- vel tricostatis et apice aciculatim papillosis. *Femina*? Capite lævi, haud fulvo piloso; thorace parum latiore antice, lateribus anticis tuberculatis vel minute dentatis, dentibus anticis uncinatis; elytris vix costatis, potius fortiter punctatis quam reticulatis et apice fere lævibus.

Long. $8\frac{1}{2}$ lin., lat. $2\frac{1}{2}$ lin.

The above two forms are, in my opinion, the different sexes of the same species, the specimens which I possess of the allied species, *A. Francisca,* Fab., from Algiers, being of two forms, which are distinguished by similar differences, and which are also probably male and female. In *A. monacha* the general outline of the one is like that of *A. terebrans,* and that of the other is like *A. muricata,* but each about a third less than them in size. What, in accordance with Lacordaire's suggestion, I assume to be the male has a tuft on the forehead, and the elytra are subreticulate and bi- or tricostate; the hollowed apical truncature is acicularly papillose: in the other sex the tuft is absent and the forehead smooth and bare; the thorax is broader, too, and the tubercles or teeth on each side of the front of the thorax are more numerous and extend to its anterior margin, and the foremost of these is hooked. The small tubercles on the disk are still tubercles, although very small and flat-topped, while in the supposed female they appear as if rolled flat and even with the surface, and the elytra have the costæ less distinct, and are rather deeply punctate than reticulate; the hollow space at the apex of the elytra, too, is nearly smooth.

Var. *indistincta.*—There are some slightly larger and more coarsely reticulate specimens, which look somewhat different; but I can find no tangible character; however, I note it as a variety, because I have received specimens from Natal belonging to it, and not of the normal type.

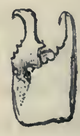
I have no certain knowledge that this is the *A. monacha* of Olivier; but it corresponds with his description and figure; and as his species is said to have come from Senegal, I think we may assume it to be it, especially as there is nothing else from Africa (so far as I know) to compete with it, except *A. Francisca*, Fab., from Algeria, which, although very close to it, is still distinct. *A. Francisca* can be readily distinguished from the present species, however, by the narrower thorax, the more rounded and decided punctures of the elytra, and more especially by the hollowed apical truncature of the elytra, which in the male of *A. Francisca* is strongly marked with deep, scattered, round punctures; while in this species, on close examination, it will be seen that the truncature, although apparently punctate, is in reality not so, but derives the appearance from raised papillæ or minute tubercles instead of sunk holes. The female of *A. Francisca*, Fab., is *A. Carmelita* of Fabricius, according to Lacordaire.

Common at Old Calabar.

Bostrichus, Geoffr., Lacordaire.

§ 1. Thorax with anterior angles prominently projecting.

1. *Bostrichus protrudens.*



Niger, nitidus; thorace tuberculato, angulis anticis recte projicientibus, apice haud acutis, subtus unituberculatis; elytris striato-punctatis, apice rotundatis, sine truncatura, margine solum parum explanato.

Long. 8–$8\frac{3}{4}$ lin., lat. $2\frac{2}{3}$ lin.

Black, moderately shining. Head invisible from above, in consequence of the projection of the thorax, covered with small round tubercles, which are finest behind; deeply hollowed out behind in a transverse rounded groove reaching to the posterior part of the eye on each side; in front of this furrow is a higher shelf running from the anterior part of the eye on each side; there is a longitudinal line in the middle of this, which has a slight emargination behind, on each side of which there is a faint elevation : in front of this shelf is a raised rounded ridge divided longitudinally, reminding one of the swollen upper lip of an otter or seal, slightly and shortly bristly, chiefly at the sides; this raised part projects a very little at each side both to the sides and in front, forming a semicircular epistome. Labrum transverse, entire, rather large, fringed with a moustache of fulvous pile. Thorax cylindrical, nearly as broad in front as behind, roughly tuberculate, except on the disk, where the tubercles are flattened down into flat scale-like markings; there is an irregular, not very strongly marked, longitudinal dorsal stria. The anterior angles are produced for a space about a third or fourth of the length of the thorax. Seen from above, the projections are nearly straight forward; seen from the sides, twice as broad as from above, and slightly turned up at the end; on their underside towards the base there is a tubercle; along the upper margin and the hollowed front of the thorax lying between the two projections are a number of small teeth or tubercles of different sizes; this anterior margin slopes obliquely to a channel in the middle, on each side of which is one of the more prominent tubercles; it is lined on its upper part with a sparing fulvous pile, and immediately above the head it is hollowed out into two smooth shallow foveæ; there is no marginal edging along the front; the posterior angles, seen from above, are rectangular. Scutellum slightly raised, somewhat rugosely punctate, and longitudinally impressed. Elytra very deeply and coarsely punctate-striate, the striæ, slightly oblique, being more numerous at the base than at the apex; suture depressed, most so near the scutellum; there are three slightly raised costæ running obliquely inwards from the base to the apex, the inner one starting at the base between the third and fourth or fourth and fifth striæ; and the three or four striæ lying between it and the suture have diminished to two before it reaches the apex; the second costa is separated from the first by a similar number of striæ similarly diminishing in number as they approach the apex; the outer costa is scarcely observable except posteriorly; none of the costæ reach the apex, but stop where the elytra begin to decline to the apex, where, in the species which have apical teeth, they would have terminated in teeth; the inner costa, as usual, stops first; the striation and punctuation continues equally marked to the apex; there is no excavation or smooth space, but the extreme apical margin is slightly explanate, and the edge thickened. Underside clothed with a somewhat loose woolly fulvous pile.

Olivier describes and figures a species from Madagascar under the name of *B. cornutus*, with the angles of the thorax projecting;

but it cannot be this or any of the following cornute species, for his species has the apex of the elytra hollowed out and with the teeth projecting. I have received another species, under the mistaken name of *Apate cornuta,* from Abyssinia, which comes much nearer this, and which I shall call *B. Abyssinicus,* as from the indications of its characters, which I am about to mention, I may be entitled to give it a name. It is distinguished from *B. cornutus* by many characters. The thorax is much shorter and less massy. The projecting angles of the thorax are not of the same shape: in *B. Abyssinicus* they are not flat, nor broader at the side than above; in it there is no tubercle on their underside. They are turned in in front, and the hollow between them is more rounded, open, and less sloped to the centre; that hollow in it is much more pilose. The whole surface of the thorax (except a longitudinal dorsal space) is covered with well-marked distinct small tubercles, instead of the disk being smooth: its elytra have traces of punctate striæ; but, instead of being remarkably distinct, they are almost merged in a tendency to transverse indiscriminate corrugation. The costæ are also much more prominent.

2. *Bostrichus productus,* Imhoff in Bericht über die Verhandlungen der Naturforschenden Gesellschaft in Basel, vol. v. p. 176.

Mas. Niger, punctatus; thorace cornibus intus haud tuberculatis et elytris haud apice prolongatis. *Femina.* Niger, punctatus; thorace cornibus intus bituberculatis; elytris singulis apice obtuse prolongatis.

Long. 8½ lin., lat. 2½ lin.

Like *B. protrudens,* but easily distinguished from it by the projecting angles of the thorax being curved instead of straight; and the female is equally easily distinguished both from it and the male, as well as the other species with curved thoracic projections, by the apex of each elytron being produced into a projecting knob.

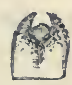
Male. The head is nearly the same as in *B. protrudens,* except that the intermediate shelf between the hollow furrow at its back part and the ridge forming an apparent swollen upper lip is absent; that ridge is consequently broader, and is not marked by any longitudinal line or division. The thorax is also nearly the same, with the following exceptions:—it is narrower in front, and the posterior angles are rather more rounded; the anterior angles of the thorax are incurved instead of being nearly straight, and have a slight turn outwards again at the very tip; viewed sideways, they are scarcely broader than when viewed from above, and terminate in a point curved upwards; there is no tubercle beneath them, nor on the upperside are there two on each side of the inner lower margin, as is the case with the female of this species. On the upper margin of the curve of the horns the teeth or tubercles are more numerous and larger than in *B. protrudens.* The scutellum does not differ from that of *protrudens.* The elytra differ in the costæ being almost absent, the striation straighter and less oblique, and in the apex of each being prolonged into a rather obtuse triangular end. I see no difference in the underside.

Female. Very nearly the same as the male, but it is distinguished by the elytra each terminating in a prolonged knob. The head is the same. The thorax is scarcely so coarsely tuberculate, and the disk is smooth and only shows a sculpture of the form of adpressed tubercles, instead of having flat-topped smaller tubercles present; and the dorsal longitudinal line is not so deep as in the male: the horns of the projecting angles are longer and less incurved; they have not a tubercle on the underside as in *B. protrudens,* but two on the inner margin of the upperside, one a little behind the point, and the other on the front margin, just before where the curve of the horn begins, with a marginal edging uniting the inner two; the hollow between the horns is greater than in the male. The elytra are, if anything, more deeply punctate, and at the apex, instead of a simple obtuse end, each elytron is prolonged into a rather large conical knob, smooth and shining, a little turned upwards and outwards. In other respects the same description will apply to both.

I state the distinction of the sexes on the authority of Imhoff. Until I saw his description I had regarded the male and female as distinct species.

I have only seen three specimens.

3. *Bostrichus brevicornutus.*



B. producto similis; elytris apice rotundatis dignoscitur.

Long. 6–8 lin., lat. $1\frac{2}{3}$–2 lin.

Very like *B. productus* (male), but has the elytra without any prolongation. The head and thorax are almost identical with those of that species, while the punctuation is more like that of *B. protrudens,* the striation being, as in it, more oblique than in *B. productus.* The elytra are rounded at the apex, and have the apical marginal edging of the former species; but it is rough and rugose, instead of being shining and more or less smooth.

Apparently more numerous than the preceding species of this section, but still received only in very small numbers.

§ 2. Thorax with anterior angles not prominently projecting.

The species in this section have not the same facies as the preceding species. *They* are large, coarse, black insects, with much more real affinity to the genus *Apate* than to the species of the present section, which contains the smaller *Bostrichi*, such as *B. varius*, Illig. (*Dufourii*, Latr.), &c. Indeed the distinction between *Apate* and *Bostrichus* (as that genus is now defined by Lacordaire) would better rest (according to my judgment) on the facies of the insects than on whether the antennæ have the club compact and close or open and loose. There are all degrees of difference in this character to be found in the species forming the two genera; and I should have preferred that *Apate* had been reserved for all the large, coarse, black species, while *Bostrichus* was kept for the smaller ones. But few genera can be so well defined as to escape criticism, at least when they contain more than one species; and to attempt to disturb Lacordaire's arrangement now would be a much worse evil than to preserve some incongruous or ill-characterized genera. A fixed arrangement that we all know and can refer to as a standard is what we have wanted for thirty years past, what Lacordaire's 'Genera' was started to supply, and what that wonderful work has most successfully accomplished.

4. *Bostrichus brunneus.*

Angustus, brunneus; thorace duobus parvis dentibus uncinatis, antice projicientibus, et post hos quatuor vel quinque lineis transversis dentium minorum; elytris lineatim punctatis, lineis irregularibus vix strias formantibus, apice rotundato sat abrupte declivo.

Long. $3\frac{1}{4}$ lin., lat. 1 lin.

The species in question is narrow, dull, and brown. The head is finely papillose or granulated, with a shallow transverse furrow across the front between the eyes, wider and tumid behind this depression; in the middle of the depression there is a short, transverse, slightly raised, smooth line; there is a little fulvous pile on the front of the epistome; the margin of the labrum is also fringed with fulvous pile. The thorax is as broad as long, widest in the middle, sinuate before the posterior angles, which are slightly prominent; the anterior angles are rounded, and terminate in front in two short but rather prominent teeth, which are curved upwards; there is a hollow between these, and the margin is semicircular; behind the thoracic truncature there are about four rows of small teeth running across from side to side; the posterior part of the thorax is finely granulose or papillose. Scutellum small and triangular. Elytra twice and a half the length of the thorax. punctate in lines, many of which are irregular. There are the faint traces of three costæ; the apex declines rapidly, and is rounded at the margin; the sutural line and the margin are both raised at the apex, so that on each elytron they include a slightly depressed, coarsely punctate space, although scarcely so decided as to be called a truncature. The underside is not quite so dark as the upper.

A single specimen.

Sinoxylon, Guér.

1. *Sinoxylon pubescens.*

Piceo-fuscum, pubescens; elytris sexdentatis, sutura sine dente; subtus dilutius, pedibus piceo-testaceis.

Long. $3\frac{1}{2}$ lin., lat. $1\frac{1}{2}$ lin.

Of the type of *S. sexdentatum*, but nearly a third larger. Piceous brown, clothed with a short, pale griseous pubescence close and thickly applied on the sides and back part of the thorax and on the underside; fine and woolly hairs sparingly scattered over the elytra. Antennæ and parts of the mouth testaceous. Head black and finely granulose; there is a narrow ridge or edging along the part that lies next the thorax; a transverse slightly curved line runs from the anterior inner angle of each eye, separating the epistome from the rest of the head; the labrum is covered with fulvous pile. The thorax is widest at about a third from the base, the truncature of which is pear-shaped with the apex in front, and truncate with the anterior angles slightly produced, covered with tubercles, which are largest at the sides; the sides and back part nearly smooth, covered closely with pale griseous pubescence, among which appear a few scattered, very minute, but distinct papillæ. Scutellum small, subquadrate. Elytra with the apical truncature very slightly oblique, almost vertical and even, as if a part of the body had been cut off; irregularly punctate, faintly at the base, and gradually more deeply towards the apex, where the punctuation is very deep, coarse, and rugose; there are traces of the usual three costæ on each elytron, which respectively terminate at the apical truncature in well-developed teeth; the sutural margin and the external margin of the truncature are both a little raised. Underside piceo-ferruginous, pubescent. Legs piceo-testaceous.

One specimen only.

2. *Sinoxylon fumatum.*

Antice testaceo-ferrugineum, postice gradatim piceum, parum pubescens; thorace postice lævi; elytris irregulariter punctatis, fortius versus apicem, apice oblique declivo, singulis duobus minutis tuberculis instructis.

Long. $2\frac{3}{4}$–3 lin., lat. 1–$1\frac{1}{8}$ lin.

Testaceo-ferruginous until past the middle of the elytra, when the colour becomes gradually darker, until at the apex it is piceous. The head and thoracic truncature are rather darker than the rest of the thorax. Head finely granulose, with a transverse curved depression or line behind the epistome. Mandibles piceous. Thorax broader than long, with the truncature covered with dentiform tubercles pointing backwards; the posterior part of the thorax smooth, shining, slightly pubescent, and with traces of very fine tubercles next the tubercular anterior part. Scutellum subquadrate, raised. Elytra very cylindrical, irregularly punctate, faintly at the base, and gradually more coarsely towards the apex, thinly clothed with fine woolly hairs; the apical truncature very slightly oblique, being very nearly vertical, as if the body had been cut through; the truncature is well-defined, slightly sloping inwards to the suture, which is distinctly raised, as well as the margin of the truncature, all round, except at its top; a little within it, near the upper margin, are on each elytron two scarcely perceptible tubercles in the relative position which would have been occupied by the termination of the two inner costæ usually met with in other species. Underside finely pubescent.

There is an undescribed species from Port Philip which is very like this; but it is narrower and has no tubercles at all on the apical truncature. In it the elytra are more coarsely punctate, particularly toward the base; the thorax (except the truncature) is shining and very finely and sparingly punctured; the piceous termination to the elytra is less decided, and the reddish colour brighter. I would call it *S. rufescens.*

Two specimens received.

3. *Sinoxylon nitidipenne.*

Atrum, interdum plus minusve piceum vel piceo-ferrugineum; elytris nitidis, leviter punctatis, truncatura apicali superiore margine rotundato sex-dentata; subtus castaneo pubescens.

Long. $2\frac{1}{3}$ lin., lat. 1 lin.

Black, varying more or less, both in place and degree, to piceous or piceo-ferruginous; the base of the elytra sometimes ferruginous, and the rest black; the legs testaceous, piceo-testaceous, or piceo-ferruginous. Head finely granulose; the epistome separated from the rest by a very marked line of separation, and more depressed than the posterior part. Thorax broadest behind the middle; the truncature rounded, extending pretty far back; a series of larger teeth and tubercles extending along the sides, others, not so large, across the back part; the front merely granulose; the anterior margin nearly straight; the posterior half of the thorax granulose or finely tuberculate in the middle, smooth, shining, and impunctate on the sides; the basal margin with a transverse depression reaching to the posterior angles, marked with four longitudinal aciculations. Scutellum small. Elytra shining, sparsely and finely punctured, the punctures of different sizes and often indistinct, most deeply marked towards the sides and apex; the apical truncature nearly vertical, with the margin sloped with a gentle curve on the upperside, and with a sharp raised edge on the sides; the sutural line is also raised, and projects in the middle into two teeth; there are also two smaller teeth within the truncature near the upper margin, corresponding in position to the termination of the usual costæ, which are not here present, but within the truncated space; near the apical margin the truncature is slightly hollowed. The underside is covered with a pale chestnut pubescence.

Four or five specimens of this have been received.

[To be continued.]

XII.—*On the Occurrence of* Diplommatina Huttoni *in Trinidad.* By R. J. Lechmere Guppy, F.G.S., F.L.S.

By the kindness of my friend Mr. Thomas Bland, F.G.S., of New York, I was made aware of the discovery, by Mr. Theodore Gill, in Trinidad, of a minute land-shell, which was believed by Dr. Pfeiffer to be identical with the East-Indian *Diplommatina Huttoni*. On the receipt of this information I took the earliest opportunity of making an expedition with the view of discovering this little shell, which had previously escaped my search. I was fortunate beyond my anticipation in finding the *Diplommatina*; but upon the first search I only found two perfect examples. Subsequently, however, I had the good fortune, on revisiting the same locality, to obtain more than twenty living examples. I could not, however, induce the mollusks to show themselves out of their shells; and I was obliged to destroy several in order to obtain a sight of the operculum and the dental membrane. Owing to its minuteness and tenuity, the operculum is scarcely visible to the naked eye, even when isolated. It is horny, transparent, subcircular, and composed of a few indistinct whorls with raised edges, hardly resembling the figure I have seen of that of *D. folliculus.*

The species is remarkable as being the only sinistral one of the genus, which only includes, I believe, five or six known species. The lingual dentition, being very minute, is somewhat difficult of preparation; but I have been able to make out its characters, which are as follows :—The dental band is of moderate length; the teeth are 3 . 1 . 3, the median is broad, its edge narrowly reflexed and five-toothed, its base narrow, almost pointed. The first and second laterals are subclavate, their edges reflexed and three-toothed. The third lateral is somewhat hamate and obscurely tricuspid. The mandible is broad and flat, covered with very distinct, separate, lozenge-shaped plates. All this tends to induce one to retain this genus in the Cyclophoridæ, to which these characters attach it more closely than to the Cyclostomidæ. Its position, therefore, with respect to its congeners seems to have been pretty correctly given by Pfeiffer and Gray.

The occurrence in Trinidad of a second land-shell common to India naturally induces one to seek an explanation of so curious a circumstance. *Ennea bicolor* has for some years been known to be common to St. Thomas and Trinidad in the West Indies, and to the East Indies. But it would have been unsafe to ground any conclusion upon a single coincidence, which might have been due to accident, as Mr. Bland appears to have suggested. *Ennea bicolor* is rare in Trinidad. During my eight years' residence in Trinidad, I have closely searched every locality near Port-of-Spain; and until made aware by Mr. Bland of its existence here, I had not discovered *Diplommatina Huttoni.* It has not been found in any other place than near the Maracas Waterfall, a distance of nine or ten miles from Port-of-Spain, the nearest seaport. I think, therefore, it is highly unlikely that these two species can have been introduced, not to mention the improbability of their surviving a voyage from India. In fact I need scarcely say more on this point, considering that the only direct communication between Trinidad and India is confined to the ships which bring Asiatic labourers from the latter place. I would suggest for consideration the possibility of these species having migrated by means of the supposed tertiary Atlantis, of the former existence of which I have endeavoured to show the probability in my paper on the Tertiary formations of the West Indies, published in the twenty-second volume of the Quarterly Journal of the Geological Society. It is true that this hypothesis supposes a very great antiquity for these species. But this antiquity has its parallel in the *Helix labyrinthica* of North America, which is found in the Eocene deposits of the Isle of Wight; and there are many circumstances which tend to show a high antiquity for the species of terrestrial Mollusca.

Port-of-Spain, Trinidad, June 4, 1867.

XIII.—*Conchological Gleanings.* By Dr. E. von Martens.

[Continued from vol. xvii. p. 213.]

V. *On the different ages of* Trochus niloticus, *L., and* Tr. maximus, *Koch.*

Trochus niloticus is one of the commonest shells in our collections; nevertheless it seems not to have been fully understood as regards its several stages of growth and its differences from its nearest ally *Tr. maximus*, Koch, which, indeed, is figured in Reeve's 'Conchologia Iconica' instead of the true *niloticus*.

Chemnitz's 'Conchylien-Cabinet,' the most complete work on conchology of the last century, contains, in its fifth volume, published in 1781, four shells, said to be of different species, which are to be referred as follows:—

Figs. 1605 and 1614, the true *Tr. niloticus* of Linné, full-grown.

Figs. 1606 and 1607, registered by Gmelin as a variety of the former, by Lamarck and Philippi (in Küster's new edition of Chemnitz) as a distinct species, *Tr. marmoratus*, Lam.; by Dillwyn, Deshayes, and Anton, on the contrary, as the younger age of *Tr. niloticus*. This latter opinion seems to me to be correct.

Figs. 1608 and 1609, cited only by Philippi (*loc. cit.*) as a variety of *niloticus*, "which may be perhaps a distinct species," I think is a young state of *Tr. maximus*.

Fig. 1611, called by Gmelin *Tr. spinosus*, regarded by Pfeiffer, in his index to Chemnitz's figures, with some doubt, as a young *marmoratus*, and by Philippi as *marmoratus*, var. *β*. I suppose it to be a *Tr. niloticus* still younger than fig. 1606.

The full-grown *Tr. maximus*, Koch, was not introduced as a distinct species before the year 1844, when it was figured in Philippi's 'Abbildungen und Beschreibungen neuer Conchylien;' it appears again in the same author's treatise on the genus *Trochus*, which forms a part of the above-mentioned new edition of Chemnitz, in Kiener's 'Iconographie,' with the name *Tr. marmoratus*, and in Reeve's 'Conchologia Iconica' as an illustration of *niloticus*. H. & A. Adams, 'Genera of Molluscous Animals,' i. p. 413, admit three species—*Tr. maximus, niloticus,* and *spinosus*; under the last name they perhaps also comprehend Lamarck's *marmoratus*, on the authority of Philippi, who unites both into one species.

In the zoological museum of Berlin there are at present twenty-seven specimens which I have been able to examine for this purpose—five full-grown *Tr. niloticus*, four full-grown *Tr. maximus*, twelve which I presume to be young ages of *niloticus*, and six which I think to be the young of *Tr. maximus*.

The differences of the two species, when full-grown, prove to be very striking; they are the following:—

1. *Tr. maximus* is as high as broad, *niloticus* is broader than high.

2. In *Tr. maximus* the two whorls before the last exhibit a distinct sculpture of large oblique folds; in *Tr. niloticus* they are as smooth as the last itself.

3. In *Tr. maximus* the last whorl has its upper surface slightly curved, in the same manner as the preceding ones; in *Tr. niloticus* it is remarkably concave, the peripheral margin being very swollen and projecting, whereas the surface of the preceding whorls is even.

4. The base or under surface of *Tr. maximus* is concave, that of *niloticus* convex.

5. The same part exhibits in *Tr. maximus* about twelve spiral grooves, whilst in *Tr. niloticus* it is smooth.

6. The markings also are somewhat different: in *Tr. maximus* they consist of distinct large purple rays, which become somewhat more numerous on the last whorl; in *Tr. niloticus* the rays are much more numerous, narrower, and variously bent in the last whorl; on the preceding ones they are interrupted and intermingled one with the other so as to form a repeatedly rather marbled design. The base, on the contrary, exhibits in *Tr. maximus* small linear spots situated between the grooves, and therefore in the direction of the spiral—in *Tr. niloticus* narrow radiating lines, which are variously bent and interrupted.

In both the markings of the base are of a lighter red than those of the upper surface, and in both the purple colour of the latter is sometimes partially replaced by a rather dark green. I suppose the latter to be the original colour, which may be changed into red in the dead shell, or the dead portions of it, by the influence of light, just as the same change of colour happens in *Neritina fluviatilis* by long exposure to the light of the sun.

Both species are subject to individual variations within rather narrow limits. The dilatation of the last whorl of *Tr. niloticus* and the convexity of its base especially are different in degree in different specimens; and the rays of some specimens of *Tr.*

niloticus are almost as broad, regular, and few as those of *Tr. maximus*: such a specimen of *Tr. niloticus* is figured by Chemnitz. The measurements of the largest and of the smallest specimens, which may be supposed to be full-grown, among those exhibited in the Berlin Museum are as follows, the height being measured from the top to the undermost part of the pillar side of the aperture:—

Tr. maximus:	height 130,	breadth 130;	height 91,	breadth 91 millims.
Tr. niloticus:	„ 112,	„ 124;	„ 61,	„ 67 „

The last measurements are taken from an extraordinarily dwarf specimen, the thickened pillar-lip and convex basis of which prove it to be full-grown.

In almost every full-grown specimen of *Tr. niloticus* the uppermost whorls are much worn and often wholly destroyed; this circumstance has probably hitherto formed the chief difficulty in recognizing the very young specimens as belonging to the same species. I am compelled by it also to number the whorls in a retrograde manner, from the last upwards. The two whorls before the last in *Tr. niloticus* are, as above stated, even, smooth, and marbled; they agree in these respects, as well as in size, exactly with the last two whorls of *Tr. marmoratus* as figured by Chemnitz (figs. 1606, 1607); and on placing several specimens in the Berlin Museum agreeing with those figures side by side with the full-grown *niloticus*, I feel quite convinced that they are nothing but the same species in a younger state, wanting the last whorl. The base of one of these specimens is as smooth as that of the full-grown *niloticus*; the base of another exhibits distinct traces of spiral grooves; in all, however, it is neither convex nor concave, but as even as the spiral growth allows it to be. The second whorl before the last in *Tr. marmoratus* exhibits a sculpture of large plaits or tubercles near the lower edge, and two or three rows of small grains above them, sometimes uniting themselves into oblique plaits, vanishing gradually towards the upper whorls; therefore the third before the last in the full-grown *niloticus* must have the same sculpture; but this is just within reach of the apical destruction, so as to show only few and less distinct traces of the sculpture in question. Moreover there are in the Berlin Museum smaller specimens agreeing perfectly with Gmelin's *Trochus spinosus*, Chemnitz, fig. 1611, in size, shape, and sculpture, which, on comparison with those named *marmoratus*, prove evidently to be the young of the same—that is, the very young *niloticus*, requiring still three or four whorls for its full age, and therefore sculptured on all the whorls which have been as yet formed. In these specimens, also, the base is even and slightly grooved in a spiral direction.

This sculpture is the same as that of the upper whorls in *Trochus maximus*; the striking differences between the two species enumerated above in Nos. 3–5 are situated in the last whorl. The markings on the upper whorls of *marmoratus* are nearly the same as in *maximus*; therefore the only differences by which we are able to distinguish the very young *Tr. niloticus* from a *Tr. maximus* of the same age are the somewhat broader shape of the whole shell and the somewhat larger apical angle. But whenever the specimens have reached about 40 millimetres in diameter, or about the fifth or sixth whorl (the third before the last in full age), the persistence of the sculpture and the deepening spiral grooves of the base will undoubtedly distinguish the young *Tr. maximus* from the young *Tr. niloticus*. I have at present before me two young *maximus* of this description, and two which are somewhat older but retain the same character; they agree very satisfactorily with Chemnitz's figures 1608 and 1609: in these specimens also the base is neither convex nor concave, but even; the markings show the characteristic features of *T. maximus*.

Thus three periods may be distinguished in the course of life of the two species: in the first, which extends until the fifth or sixth whorl, both are very like each other; in the second, comprising the two whorls before the last, the sculpture both of the upper and underside vanishes in *Tr. niloticus*, whilst in *Tr. maximus* the upper one becomes only more feeble, and the under one even increases in strength; in the third period, finally, the differences between the two species prove to be quite contrary, the last whorl becoming in *Tr. niloticus* concave above, convex and smooth beneath—in *Tr. maximus* nearly straight above, concave and deeply furrowed beneath.

The synonymy of the two species may be resumed as follows:—

I. *Trochus niloticus*, L. *Turbo exoticus umbilicatus*, Columna, De Purpura, p. 21; Chemnitz, Conch.-Cab. v. pl. 167. fig. 1605, and pl. 168. fig. 1614; Encyclopédie Méth. pl. 444. fig. 1; Kiener, Iconogr. pl. 10; Adams, Genera, pl. 46. fig. 7.
Trochus juvenilis, Lister, 680. 6; Chemnitz, v. pl. 167. figs. 1606, 1607. *Tr. marmoratus*, An. s. Vert. no.
Trochus pullus, Chemn. v. pl. 167. fig. 1610. *Tr. spinosus*, Gmel. *Tr. marmoratus*, var. *β*, Philippi.

II. *Trochus maximus*, Koch. *Trochus pyramidalis maximus late radiatus ex rubro*, Lister, Hist. Conch. no. 617. fig. 3; Philippi, Abbildungen, i. pl. 4. fig. 3; Chemn. ed. nov. *Trochus*, pl. 19. fig. 4. *Tr. marmoratus*, Kiener, Iconogr. pl. 11. *Tr. niloticus*, Reeve, Conch. Icon. fig. 3.
Trochus pullus, Lister, 619. 5; Rumph. 21 B; Chemn. v. figs. 1608, 1609. *Tr. niloticus*, var. *β*, Philippi.

In Lister's figure 3 the base seems rather convex than concave; but, as the other characters agree with *Tr. maximus*, I feel inclined to think this may be a fault of the engraver; or may it be a form intermediate between the two?

The figures in the works of Rumph (pl. 3. fig. 21), Gualtieri (pl. 59. fig. c), and Argenville (pl. 8. fig. c) seem to represent rather *Tr. maximus* than *Tr. niloticus*.

Trochus niloticus is an inhabitant of the Indian seas. I found it myself alive on the coral beach of the little island Pulo-tikus, near Bencoolen, Sumatra. Quoy and Gaimard (Voyage of the Astrolabe) describe the living animal, found by themselves at New Ireland. Philippi mentions as a locality for *Tr. marmoratus* (*i. e.* the young *niloticus*) the Sooloo Islands, south of the Philippines. Other localities, which may be got out of various published lists of sea-shells found at Ceylon, Madagascar, &c., may be here omitted, as, where no description or figure is added, we cannot tell with certainty whether the true *Tr. niloticus* or *Tr. maximus* is meant. The name *Trochus niloticus* itself is consequently incorrect: it originated with old Aldrovandi (who gave it, equally incorrectly, to a large species of *Conus*), and was transferred to our *Trochus* by Linné; but as it is now generally adopted and so evidently untrue that no misunderstanding is to be feared from it, I would not propose to change it for a new one.

The habitat of *Tr. maximus* has not been stated by Koch and Philippi. I procured a young specimen at Singapore, and think therefore that the Indian Ocean is the common home of both *Tr. niloticus* and *Tr. maximus*. Nevertheless there are some traces of another habitat for *Tr. maximus*: in the Berlin Museum there is a very young specimen of the latter, stated by a label to have formed part of a collection made in Guinea by Mr. Halleur (the other shells of the same collection are true West-African species); and Chemnitz informs us that, in his copy of Lister's work, a manuscript note, "ex insula Principis," was added to the said figure 617. 3. If this is the island situated in the Gulf of Guinea, it would be in favour of the West-African habitat; or are we perhaps allowed to presume that the Prince of Wales Island, *i. e.* Pulo Pinang, on the coast of Malacca, was meant? It is very desirable that more reliable statements concerning the habitat of this form, *Trochus maximus*, should come to our knowledge.

I never saw a full-grown specimen which left any doubt whether it belonged to the one or the other species: the difficulty of distinguishing them increases the younger the individuals are which come under observation, and the more so as even the different stages of age in which the characteristic changes of feature make their appearance are subject to a certain amount of individual variability. Some young individuals of *Tr. maximus* are as broad as high, some even a little broader than high; and, on the contrary, in the younger age of *Tr. niloticus* (stage of *marmoratus*), its breadth exceeds its height by a relatively smaller amount than in the full-grown shell. I have before me two very young specimens (stage of *spinosus*), which I am induced to regard as *niloticus* by their relative breadth; the height of both is the same, millims.; the breadth of the one , of the other millims.*, which last proves to be a very excessive one when compared with those of other young individuals. The even and smooth surface of their last whorls is the most characteristic feature of the adolescent specimens of *niloticus* (*marmoratus*); it is the consequence of the disappearance of the sculpture long before the change of shape peculiar to the full-grown age makes its appearance at the same time as the last whorl; whilst in *Tr. maximus* both changes, which are of less intensity, coincide with regard to the age of the individual. But even this vanishing of the sculpture in *Tr. niloticus* takes place in some individuals a little sooner or later than in others: the amount of this variation may be a whole whorl; and external causes seem to have some influence upon it: in fact one of the specimens in the stage of *marmoratus* shows the traces of having been fractured just in the whorl, where the change generally takes place very gradually; but here the sculpture is preserved in its full strength up to the fracture, and immediately after it the newly formed continuation is smooth. There is no evidence that a rather large portion of shell has been destroyed and taken away by the fracture; on the contrary, the perfect regularity of the following portion of the whorl shows that there is no marked restoration, but simply progress of growth; nevertheless the change of sculpture is sudden, as if the interruption and new beginning had given the animal an impulse to construct the following parts of the shell at once according to the new fashion, instead of gliding gradually from one into the other. Another instance of individual variation is presented by a specimen of *niloticus* which shows on its last whorl the dilatation and swelling of the lower edge which is so very characteristic of the last whorl of the full-grown shell, whilst its dimensions (height 56, breadth 66 millims.), the still even base, the broad purple rays above, and the small spots beneath rather clearly indicate that another whorl is still required for the full growth of the shell. Such specimens, in which a property normally peculiar to the adult makes its appearance in a previous stage of growth, may be called *premature* individuals.

* [These measurements, which have been accidentally omitted by our correspondent, will be given in a note in our next.—Ed.]

It is an almost general rule throughout the animal kingdom that members of different species, genera, families, or orders agree more with each other in the first stage of their life than when full-grown; but very often this general resemblance is due rather to the special characters being indistinct, or not yet developed, not to the special similarity of them—as, for instance, the embryo of all the Vertebrata in its first period is similar, but not a fish or a bird, the distinctive characters of these making their appearance afterwards. In the present instance the sculpture, which is a rather special character, neither similar in all species of *Trochus* nor already formed within the egg, is specifically similar in the young state of both species; and the difference in the sculpture between the two full-grown shells arises not from any new character coming up, but from the disappearance, earlier or later, perfectly or partially, of that which has been common. If we may take for granted that the single species, such as they live at present, have not been created independently of each other, but that they are the descendants of others of other times, that they bear the traces of their genealogy in themselves, and that the characters transmitted by a longer series of ancestors are also more constant and manifest themselves earlier in the youth of the individual, whereas the modifications acquired for the species in later times make their appearance less early in the course of individual development—if this be granted, then we may be entitled to pronounce that *Trochus niloticus* and *Trochus maximus* descend from similar, therefore probably common ancestors, which must have been sculptured throughout, with an even, spirally grooved base, such as is presented, for instance, among the now living allied species by *Tr. acutangulus*,—that *Tr. niloticus* has deviated in the same space of time more from the common ancestors than *Tr. maximus*, the characters of the last whorl in *Tr. niloticus* being quite new,—and that the above-mentioned premature specimen of the same may give a hint as to the direction in which the species will change itself in future times.

VI. *On the Species of* Argonauta.

Linné comprises all the *Argonautæ* known to him in one species, *A. Argo*; his second species, *A. Cymbium*, is a foraminiferous shell (*Peneroplis planatus*, Montfort), as is proved by his own words, "testa vix minimæ arenulæ magnitudine," and by the quotation of Gualtieri.

Lamarck, who laid the foundations of the modern generic and specific distinction of sea-shells, distinguishes *three* species of *Argonauta—Argo, tuberculosa,* and *nitida* (= *hians,* Solander).

D'Orbigny limits himself to the same three species, admitting *A. gondola* and *haustrum*, Dill., as varieties of *A. tuberculata* and *Argo*. Reeve, in the 'Conchologia Iconica,' vol. xii. 1861, admits five species; H. and A. Adams, in the 'Genera of Molluscous Animals,' 1858, and Sowerby, in the 'Thesaurus Conchyliorum,' six species.

On reviewing the twenty-nine specimens exposed in the Berlin Museum, I was impressed with the conviction that they all are referable to three constant types:—

1. Type of *A. Argo*: ribs smooth and numerous; keel narrow; colour white.

2. Type of *A. tuberculata*, Shaw (*nodosa*, Solander, *tuberculosa*, Lam., *oryzata*, Meuschen): ribs tuberculated, numerous; keel rather narrow; colour white or pale yellow.

3. Type of *A. hians*, Solander (*nitida*, Lam.): ribs smooth, distant, and therefore few; keel broad; colour yellowish or light brown.

In all three the hinder part of the keel is very often tinged with dark brown; this dark-brown colour is wanting in a few specimens of *A. Argo* and *tuberculata*, and in many of *A. hians*.

Within each of these types there are specimens in which the lateral edge of the aperture is nearly straight, the aperture therefore narrow (forma *mutica*), and others in which this edge forms near its inner end an angle which is more or less blunt (forma *obtusangula*), or extends itself into a prolongation called the ear (forma *aurita*).

Type of *Argonauta Argo*:—

a. Forma *mutica*: *A. Gruneri* (Dunker), Reeve, fig. 6 *b*, Marquesas Islands; Sow. fig. 9.

b. Forma *obtusangula*: *A. Argo* of most authors. Lister, Hist. Conch. pl. 555. fig. 7; Martini, Conchylien-Cabinet, vol. i. pl. 17. fig. 157; D'Orbigny, Céphalopodes, pl. 2. figs. 1, 2; Reeve, fig. 2[c], from Venezuela; Sow. Thes. fig. 2.

c. Forma *aurita*: obtained at Ceram, Moluccas, by myself; Rumph, Amb. Rariteitkamer, pl. 18. fig. A, from Amboyna; Gualtieri, pl. 12. fig. A; Argenville, Conchyliologie, pl. 5. fig. A; D'Orb. Céph. 2, 3–5. *A. haustrum*, Dillwyn; Reeve, fig. 2, from Tahiti; Sow. Thes. fig. 1.

Type of *Argonauta tuberculata*:—

a. Forma *mutica*: one specimen from the coast of Brazil, in the Berlin Museum; Reeve, fig. 1.

b. Forma *obtusangula*: some specimens in the Berlin Zoological Museum.

c. Forma *aurita*: Gualtieri, pl. 12. fig. B; Argenville, 5 C; Martini, figs. 156 & 160; D'Orb. Céph. pl. 4; Reeve, fig. 2; Sow. fig. 3. *A. navicula*, Solander. *A. gondola*, Dillwyn, on the authority of D'Orbigny.

Type of *Argonauta hians*:—

a. Forma *mutica*: Lister, 553. 5?

b. Forma *obtusangula*: Gualtieri, pl. 12. fig. C; Argenville, 5 B. *A. hians*, Solander, and *A. Owenii*, Adams and Reeve, Zool. Voy. Samarang, Reeve, figs. 4 & 5, pl. 3, South Atlantic. Obtained by myself at Ceram, Moluccas.

c. Forma *aurita*: Lister, 554. 6; Rumph, pl. 18. fig. B, from Amboyna; D'Orb. Céph. pl. 5. *A. gondola* (Dillwyn), Adams and Reeve, Zool. Voy. Samarang, pl. 2, from the South Atlantic. *A gondola*, Reeve, figs. 3^a & 3_b; Sow. fig. 4, from the Philippines. Obtained by myself at Batjan, Moluccas, from the natives.

Concerning *tuberculata*, I have no doubt that the three forms are merely variations of the same species, as some specimens remain intermediate between them. For *A. hians* I incline rather to think the same, although very respectable authorities range themselves on the opposite side; in this the first form seems to be very rare, as it is the only one out of the nine which is wanting in the Berlin Zoological Museum. The presence or absence of the ears, however, is not a character of age, as both are to be seen in very young and in full-grown specimens, nor does it seem to be a difference of geographical value, the forms *b* & *c* of *hians* having been found both in the South Atlantic and in the Indian Ocean. For *A. tuberculata*, I cannot find anywhere the geographical habitat of the eared variety separately stated, so as to compare it with that of the earless form.

Concerning *A. Argo* I feel much more doubtful—first because the want of the ears in *A. Gruneri* is combined with a more elongated shape of the whole shell, and secondly because it seems to me that the eared form, *A. haustrum*, is proper to the Indian seas, the obtuse-angulated, on the contrary, to the Mediterranean; but I am acquainted with the exact habitat of too few specimens of either form to advance anything positively in this respect. However, it seems to me not quite absurd to admit that some species may be rather constant and others very variable in the shape of the upper margin. It may be remarked that the ears of *A. haustrum* are prolonged in the same plane with the sides of the shell, whereas they are bent outwards in the eared forms of *A. tuberculata* and *A. hians*.

Finally, there is in the Berlin Museum a specimen, belonging to the type of *A. Argo*, in which the angles are present but little developed, and not free but firmly joined to the spire, in consequence of which, at first sight, one might suppose them to be entirely absent; the shell is more compressed and more elongated than that of *A. Argo* generally; its coloration is typical of that species. This seems to be a very well-characterized species; but I cannot help suggesting whether it may not be regarded rather as a fourth variation of *A. Argo*, especially as *A. Kochianus,* Dunker (*loc. cit.* figs. 7, 8) appears to be the analogous variation of *A. hians.* If this view should prove to be right, we shall have a fourth form (forma *agglutinans*), the rarest of all, being as yet exemplified only in two of the three species.

XIV.—*Notulæ Lichenologicæ.* No. XVI. By the Rev. W. A. Leighton, B.A., F.L.S.

Prof. Santo Garovaglio has favoured us with a copy of a further portion of his 'Tentamen Dispositionis Methodicæ Lichenum,' comprising the *Verrucariæ quadriloculares,* and illustrated with three plates.

Sectio III.

Verrucariæ quadriloculares.

Saxicolæ vel corticolæ; hermaphroditæ, monoicæ vel dioicæ; epithecium breve, dimidiatum, subintegrum, carbonaceum (in una alterave specie coloratum; paraphyses nullæ, obsoletæ vel distinctæ, simplices aut ramosæ, continuæ vel in frustula solutæ, capillares vel articulatæ; asci lineares vel clavato-elongati obovative, interdum circa medium ventricosi, interdum supra basim saccato-gibbi, octospori; sporæ in duplicem triplamve seriem, rarius (Cohors IV.) uno ordine altera super alteram dispositæ, figura et magnitudine variæ, s. ovoideæ, obovatæ, in formam cocci, bombycis, vel fusi, in cohorte III. gracillimæ, aciculares, in reliquis sat crassæ, rectæ vel curvatæ, normaliter quadriloculares, loculis amplis vel angustis, quorum duo interpositi vix non semper rectangulari-tetragoni, extimi duo subconici. In quibusdam speciebus loculi omnes ocellulati apparent, ocellis rhombeis, subrotundis vel ellipticis, in singulis loculis ut plurimum singulis. Thallus varius, in corticolis hypophlœodes. Hypothallus modo obsoletus, modo distinctus, ater.

Cohors I.

Epithecio brevi vel dimidiato; paraphysibus nullis vel obsoletis; ascis elongato-clavatis, ventricosis, inflatis, octosporis; sporis in duplicem triplamve seriem intra ascos distributis, tumidulis, ellipsoideis obovatisve, eximie bombyciformibus, grandiusculis, quadrilocularibus, loculis binis intermediis rectangulari-tetragonis, extimis duobus ad formam coni, quorum infimus vix non semper minor. (Species omnes saxicolæ, hermaphroditæ.)

1. *V. pseudo-Dufourei,* Garov. = *V. pyrenophora,* Leight. Ang. Lich. p. 76; Exs. 139. *V. papillosa,* Leight. Ang. Lich. t. 24.

f. 1. *V. Sprucei,* Leight. Ang. Lich. t. 23. f. 4, 5, 6; Heppe, 97, 98.

Subspecies 1. *V. cryptarum,* Garov. = Anzi, Lich. rar. Ven. 143.

2. *V. Zwackhii,* Garov. = Heppe, 96, 437, 442, 443; Anzi, Lich. rar. Ven. 136, 171.

Cohors II.

Epithecio vario, carbonaceo vel colorato; paraphysibus liberis, distinctis, flexuosis, simplicibus vel subramosis, capillaribus vel articulatis, perdurantibus; ascis elongatis, linearibus, inferiora versus sensim attenuatis, passim clavato-obovatis, in medio ventricosis vel circa basim saccato-gibbis, octosporis; sporis duplici triplave (jam ordinata, jam confusa) serie spiraliter intra ascos dispositis, angustato-ellipticis s. fusiformibus, adultis quadrilocularibus, loculis ope septi tenuis crassive evidenter sejunctis, duobus interpositis cylindrico-truncatis vel rectangulari-tetragonis, extimis subconicis. (Species saxicolæ vel corticolæ, monoicæ vel dioicæ.)

A. *Saxicolæ.*

1. *V. umbonata,* Schær. = Schær. Exs. 285; Leight. Ang. Lich. t. 24. f. 6, Exs. 32; Heppe, 696; Rabenh. 650.

2. *V. Ricasolii,* Garov. = Leight. Ang. Lich. t. 22. f. 1, 2, t. 23. f. 1; Heppe, 694, 695.

Subspecies *V. macularis,* Wallr. = Zw. Exs. 152, 153; Schær. L. H. Exs. 523, 524; Leight. Ang. Lich. t. 25. f. 3, Exs. 138; Heppe, 693.

B. *Corticolæ.*

1. *V. punctiformis,* Fries, L. Europ. Ref. p. 447.

f. *carpinea,* Garov. = M. & N. 855; Schær. 525; Leight. Ang. Lich. t. 18. f. 2, Exs. 99; Heppe, 459; Anzi, Lich. rar. Ven. 139.

f. *callopisma,* Garov. = Mass. Lich. Ital. 350 A, B; Anzi, Lich. rar. Longob. 222; Zw. Exs. 46.

f. *rhyponta,* Garov. = M. & N. 557; Schær. 591; Anzi, Lich. rar. Ven. 121, 122; Mass. Ital. 255.

Subspecies *V. erumpens,* Garov.

2. *V. cerasi,* Schrad. = Schær. Exs. 664; Zw. Exs. 106; Leight. Ang. Lich. p. 41; Mass. Ital. 106; Anzi, Lich. rar. Ven. 130; Heppe, 457.

Cohors III.

Epithecio tenui, dimidiato, carbonaceo; paraphysibus raro distinctis, plerumque obsoletis, vel in massam granuloso-floccosam cito diffluxis; ascis clavato-elongatis sublinearibusve, octosporis; sporis duplici sat regulari serie intra ascos collectis, gracillimis, fusiformi-acicularibus, vel angustato-ellipticis, incurvis, primum unilocularibus, tribus vel quatuor ocellis rotundis minutis præditis, dein bilocularibus cum loculis elongato-cylindricis acuminatis, postremum quadrilocularibus cum vel absque ocellis. (Species unica, corticola.)

1. *V. oxyspora,* Nyl. = Zw. Exs. 107; Rabenh. 117; Heppe, 460; Mass. Ital. 352.

Cohors IV.

Epithecio carbonaceo, crasso, subintegro, cum tunica arcte laxeve conjuncto; paraphysibus creberrimis, gracilibus, filiformibus, flexuosis, interdum in frustula fatiscentia solutis; ascis elongatis, cylindricis, vel linearibus, circa basim attenuatis, octosporis; sporis plerumque in una rectilinea serie ad invicem verticaliter aut oblique sibi succedentibus, rarius duplici confuso ordine congregatis, ovoideo-ellipticis, obtusiusculis (s. cocciformibus), quandoque torulosis, cæterum coloratis s. fulvis vel fuliginosis, quadrilocularibus, passim bi- trilocularibus, loculis septo tenuissimo, sæpe obsoleto, divisis, duobus interpositis prismatico-tetragonis, binis extimis obtuse conicis, omnibus ocellulatis, ocellis in singulis vel pluribus, rhombeis, subrotundis vel ellipticis. (Species omnes corticolæ, monoicæ vel dioicæ.)

1. *V. nitida,* Schrad. = Borrer, E. Bot. Suppl. t. 2607. f. 1; Leight. Ang. Lich. t. 15. f. 3; M. & N. 365 A B.

f. *major* = Schær. Exs. 111; Heppe, 467.

f. *minor* = Leight. Exs. 28; Heppe, 468.

2. *V. glabrata,* Ach. = Schær. Exs. 110; M. & N. 950; Zw. Exs. 34, 35; Leight. Ang. Lich. t. 18. f. 4; Heppe, 227.

f. *coryli,* Nyl. = Rabenh. 85; Heppe, 455.

Appendix.

V. quercus, Garov. = Schær. Exs. 105; Zw. Exs. 33, 215.

The plates contain sections of the apothecia, asci, and sporidia:—

Verrucariæ uniloculares.

Tab. I. fig. 1. *V. aberrans,* Gar. 2. *V. hydrela,* Ach. 3. *V. æthiobola,* Ach. 4. * *V. submersa,* Schær. 5. *V. plumbea,* Ach.

6. *V. glaucina*, Fries. 7. **V. collematoides*, Gar. 8. *V. nigrescens*, Pers. 9. **V. nigrescens*, Pers., var. *stenospora*, Gar.

Tab. II. fig. 1. *V. macrostoma*, Duf. 2. *V. tristis*, Krmphbr. 3. *V. Dufourei*, DC. 4. *V. epipolæa*, Ach., var. *orbicularis*, Gar. 5. *V. epipolæa*, Ach., var. *muralis*, Gar. 6. *V. macrostoma*, Duf., var. *imbricum*, Gar. 7. *V. epipolæa*, Ach., var. *lurida*, Gar. 8. *V. epipolæa*, Ach., var. *murina*, Gar.

Tab. III. fig. 1. *V. decussata*, Gar. 2. *V. epipolæa*, Ach., var. *rupestris*, Gar. 3. *V. epipolæa*, Ach., var. *major*, Gar. 4. *V. papularis*, Fries, var. *neglecta*, Gar. 5. *V. papularis*, Fries, var. *platyspora*, Gar. 6. *V. papularis*, Fries, var. *subtestacea*, Gar. 7. *V. purpurascens*, Hoffm. 8. *V. calciseda*, DC.

Verrucariæ biloculares.

Tab. IV. fig. 1. *V. olivacea*, Fries. 2. *V. Ungeri*, Flot. 3. *V. heterospora*, Gar. 4. *V. pertusatii*, Gar. 5. *V. conoidea*, Fries, var. *vulgaris*. 6. *V. conoidea*, Fries, var. *subsquamacea*.

Tab. V. fig. 1. *V. gemmata*, Ach. 2. *V. biformis*, Borr. 3. *V. confusa*, Gar. 4. *V. epidermidis*, Gar., var. *analepta-spectabilis*. 5. *V. epidermidis*, Gar., var. *cinereo-pruinosa*. 6. *V. epidermidis*, Gar., var. *lauri*. 7. *V. epidermidis*, Gar., var. *fraxini*. 8. *V. epidermidis*, Gar., var. *analepta-vulgaris*. 9. *V. epidermidis*, Gar., var. *analepta-betulæ*. 10. *V. Heppii*, Naeg., var. *Juglandis*, Gar.

Verrucariæ quadriloculares.

Tab. VI. fig. 1. *V. pseudo-Dufourei*, Gar., var. *verrucosa*. 2. *V. pseudo-Dufourei*, Gar., var. *feracissima*. 2*. *V. pseudo-Dufourei*, Gar., var. *crassiseda*. 2**. *V. pseudo-Dufourei*, Gar., var. *conspurcata*. 3. *V. cryptarum*, Gar., var. *intumescens*. 4. *V. cryptarum*, Gar., var. *hiascens*. 5. *V. cryptarum*, Gar., var. *asperata*. 6. *V. cryptarum*, Gar., var. *detersa*. 7. *V. Zwackhii*, Gar. 8. *V. umbonata*, Schær. 9. *V. Ricasolii*, Gar. 10. *V. macularis*, Wallr.

Tab. VII. fig. 1. *V. nitida*, Schrad., var. *major*, Gar. 2, 2*. *V. nitida*, Schrad., var. *minor*, Gar. 3. *V. glabrata*, Ach. 4. *V. punctiformis*, Gar., var. *callopisma**. 5. *V. punctiformis*, Gar., var. *carpinea**. 6. *V. punctiformis*, Gar., var. *callopisma***. 7. *V. *erumpens*, Gar. 8. *V. Heppii*, Gar., forma. 9. *V. punctiformis*, Gar., var. *rhyponta*. 10. *V. punctiformis*, Gar., var. *carpinea***. 11. *V. cerasi*, Schrad.

Tab. Suppl. I. fig. 1. *V. Anziana*, Gar. (unilocular). 2. *V. cinereorufa*, Schrad. (unilocular). 3. *V. Hochstetteri*, Fr. (unilocular). 4. *V. scrobicularis*, Gar. (bilocular). 5. *V. micula*, Fltw. (bilocular). 6. *V. oxyspora*, Nyl. (quadrilocular). 7. *V. quercus*, Gar. (4–5–6-locular).

XV.—*New Fishes from the Gaboon and Gold Coast.* By A. Günther, M.A., M.D., Ph.D., F.R.S.

[Plates II. & III.]

A most valuable collection of Fishes made by Mr. R. B. N. Walker in the Gaboon country has been recently secured by the Trustees of the British Museum. Besides several species which were formerly desiderata in this collection, the following prove to be new and of great interest, partly because some of them are the types of distinct groups, and partly because others prove that the Fish-fauna of the Upper Nile is nothing but the most eastern branch of that of Tropical West Africa. Repeatedly on former occasions I have directed attention to the identity of these two faunas; and we may safely conclude that there is an uninterrupted continuity of the fish-fauna from west to east, and that the species known to be common to both extremities inhabit also the great reservoirs of water in the centre of the African continent.

Mr. Walker had sent other collections to the Free Public Museum of Liverpool; and Mr. Moore was kind enough to lend them to me for examination, adding another very valuable collection made by H. T. Ussher, Esq., Deputy Assistant Commissary-General, Lagos, on the Bossumprah River, Gold Coast. The latter gentleman had previously sent a small collection to the British Museum from the same locality.

The Cyprinoids are not mentioned in this paper, as their descriptions will be found in the forthcoming seventh volume of the 'Catalogue of Fishes.'

Ctenopoma Petherici (Gthr.).

Dorsal spines sixteen, seventeen, or eighteen, anal spines nine or ten. This species, first discovered by Mr. Petherick in the White Nile, occurs also in the Gaboon.

Ctenopoma multispine (Ptrs.).

This species was first described from East-African specimens with seventeen dorsal and ten anal spines. An example from the Gaboon, with twenty dorsal and eleven anal spines, agrees in every other respect with the East-African type, and must be regarded as a variety only.

Mastacembelus cryptacanthus (Gthr.).

The number of dorsal spines varies between twenty-four and thirty. A fine example, 16 inches long, has been sent to the Liverpool Museum, from the Bossumprah River, by Mr. Ussher.

Hemichromis fasciatus (Ptrs.).

Guinea, Lagos (Mr. Ussher), Gaboon (Mr. Walker).

Clarias Gabonensis, sp. n.

D. 76–78. A. 56–60.

Vomerine teeth villiform, forming a band which is about as broad as that of the intermaxillaries; it has not a process behind in the middle of its concavity. Head finely granulated above, its length being one-fourth of the total (without caudal). Barbels long; those of the nostril extend to the base of the occipital process, those of the maxillary beyond the origin of the dorsal. The pectoral fin extends to, or somewhat beyond, the vertical from the origin of the dorsal; its spine is at least three-fourths as long as the fin. The dorsal extends to the root of the caudal. Snout somewhat narrowed in front.

River Ogome (Mr. Walker). 7 inches long.

This species may prove to be identical with *Clarias angolensis* of Dr. Steindachner, who, however, has omitted to give the formula of the fin-rays, so that it is impossible to determine our specimens from his description.

Heterobranchus isopterus (Blkr.).

Bossumprah River (Mr. Ussher).

GYMNALLABES, g. n. (*Silur.*).

(Group CLARIINA.) Adipose fin none; dorsal and anal fins very long (confluent with the caudal *). Jaws with a band of villiform teeth; a crescent-shaped band of similar teeth across the vomer; cleft of the mouth transverse, anterior, of moderate width; eight barbels, as in *Clarias*. Eyes very small. Head covered entirely with soft skin, the lateral parts especially muscular and soft. The postbranchial cavity is present; but the accessory organ is reduced to a simple securiform process of the second and third arches. Pectoral and ventral fins very small, the former with a pungent spine, the latter five-rayed.

Gymnallabes typus, sp. n. Plate II. fig. A.

D. ca 98. A. ca 82. C. 12.

The height of the body is one-sixteenth or one-fifteenth of the total length (without caudal), the length of the head one-ninth or one-tenth. Head much depressed, flat, swollen on the temples, two-thirds as broad as long. Nasal and outer mandibulary barbels not quite as long as those of the maxillary; the latter are longer, and the inner of the mandible shorter, than the head. Uniform brownish black.

West Africa, probably Old Calabar. 7 inches long.

* This is perhaps merely a specific character, as in *Clarias*.

Eutropius mandibularis, sp. n.

D. 1/6. A. 59. P. 1/10.

The height of the body is contained thrice and three-fourths in the total length (without caudal), the length of the head five times. The greatest width of the head equals its length without snout. The upper jaw is slightly the longer; cleft of the mouth twice as broad as deep. Anterior mandibulary barbels short; maxillary, nasal, and posterior mandibulary barbels subequal in length, not extending to the base of the pectoral, but beyond the orbit. The diameter of the eye is two-ninths of the length of the head. The dorsal fin is situated entirely before the ventral, the width of its base being more than that of the latter; its height equals the length of the head; spine slender, serrated posteriorly. The anal fin terminates at some distance from the caudal. Caudal deeply forked, with the lobes pointed. Pectoral spine rather broad, serrated, terminating at some distance from the ventral.

A single specimen, 9 inches long, was sent by Mr. Ussher from the Bossumprah River to the Liverpool Museum.

Chrysichthys macrops (Gthr.).

Upper Nile, Gaboon, Bossumprah River (Gold Coast).

Synodontis guttatus (Gthr.).

Gaboon, Lake Aznigo.

Malapterurus affinis (Gthr.).

Old Calabar, Gaboon.

NANNOCHARAX, g. n. (*Characin.*).

Dorsal fin short, placed in the middle of the body, above the ventrals; anal short. Body elongate, covered with scales of moderate size; belly rounded. Cleft of the mouth very small, similar to that of a *Coregonus*; intermaxillary and mandible with a single series of notched incisors. Nostrils close together. Gill-openings rather narrow, the gill-membrane being grown to the isthmus.

This genus is the type of a separate group, NANNOCHARACINA, intermediate between *Anostomatina* and *Tetragonopterina*.

Nannocharax fasciatus, sp. n. Plate III. fig. A.

D. 12. A. 10. V. 10. L. lat. 46. L. transv. $4\frac{1}{2}/4\frac{1}{2}$.

The height of the body is contained six times in the total length (without caudal), the length of the head four times and one-third. Eye large, the length of its diameter being less than one-third of that of the head, and more than that of the snout or the width of the interorbital space. Head low, elongate, flat above; snout subconical, the upper jaw somewhat longer than the lower. Ventral fin below the anterior dorsal rays, long, pointed; the third ray is the longest, extending to the vent. The distance of the origin of the dorsal fin from the end of the snout is somewhat more than that from the adipose fin. Back with seven rhombic brown spots, lighter in the centre; sides with about ten brown cross bars broader than the interspaces between.

Gaboon. 2 inches long.

This discovery of Mr. Walker is of the greatest interest, not only because the fish is the type of a distinct group of the family of *Characinidæ*, but also because it throws light upon the fish from the Nile which was described by Joannis in Guérin's Mag. Zool. 1835 (Günth. Fish. v. p. 379) as *Coregonus niloticus*, and which has ever since been a riddle to ichthyologists. There cannot be the slightest doubt of the affinity of these two fishes, although Joannis (who had no experience whatever in the description of fishes) states that his fish is toothless. The affinity between the two fishes is so great that the differences which at present appear on comparing the descriptions may prove to be accidental, and the *Nannocharax niloticus* to be identical with the West-African species.

The figure is double the natural size.

Alestes macrophthalmus, sp. n.

D. 10. A. 21. L. lat. 39. L. transv. 11.

Closely allied to *A. sethente*, but with larger scales. The height of the body equals the length of the head, and is two-ninths of the total length (without caudal). Eye very large, scarcely less than one-third of the length of the head, with broad adipose eyelids. The origin of the dorsal fin is exactly opposite to that of the ventral. Pectoral not much shorter than the head. Silvery, a blackish stripe along each series of scales; pectoral blackish.

Gaboon. 11 inches long.

Alestes tæniurus, sp. n.

D. 10. A. 19. L. lat. 23. L. transv. $4\frac{1}{2}/3\frac{1}{2}$.

Closely allied to *A. acutidens*, but with the body more elevated, its depth being more than one-third of the total length (without caudal). The origin of the dorsal fin is a little behind the base of the ventral. A narrow deep-black band runs along the middle of the tail and caudal fin, commencing below the end of the dorsal fin.

Gaboon. 5 inches long.

I do not retain the genus *Brachyalestes*, as the last two species would be separated from those most nearly allied to them by the technical character on which that genus was founded.

Alestes leuciscus, sp. n.

D. 10. A. 17. L. lat. 26–27. L. transv. $5\frac{1}{2}/3\frac{1}{2}$.

The height of the body is contained thrice and one-fourth in the total length (without caudal), the length of the head thrice and two-thirds. The origin of the dorsal fin is exactly opposite that of the ventrals. The pectoral terminates close to the ventral. Bright silvery, with a very indistinct dark humeral spot and a second at the root of the caudal. Iris golden.

Two specimens, $2\frac{1}{2}$ inches long, from West Africa; purchased of a dealer.

Sarcodaces odoë (Bl.).

Bossumprah River (Mr. Ussher). This fish has fifty scales in the lateral line, and not sixty, as stated in 'Fish.' v. p. 352.

XENOCHARAX, g. n. (*Characin*).

(Group CRENUCHINA.) Dorsal fin rather long, placed in the middle of the length of the body, above the ventrals. Anal not elongate. Body compressed, rather elevated, covered with rather small scales; lateral line present; belly rounded. Cleft of the mouth rather wide. Intermaxillary and mandible with a double or treble series of small bicuspid teeth; a few teeth in the maxillary. Nostrils close together. Gill-openings wide; the gill-membranes not attached to the isthmus. Gill-rakers long, setiform.

Xenocharax spilurus, sp. n. Plate III. fig. B.

D. 18. A. 13. V. 11. L. lat. 73. L. transv. 10/15.

The height of the body is contained twice and two-thirds in the total length (without caudal), the length of the head thrice and one-fourth. Jaws equal in length; the maxillary extends to below the front margin of the large eye. Root of the ventral below the middle of the dorsal. Silvery; body with about fourteen narrow blackish transverse bands. A large round black spot on the root of the caudal.

Gaboon. 4 inches long.

Distichodus notospilus, sp. n.

D. 16–17. A. 15–16. L. lat. 39. L. transv. 7/9.

The height of the body is two-fifths of the total length (without caudal), the length of the head one-fourth; snout a little longer than broad, with the nose slightly protruding. Teeth in a double series, the lower jaw with sixteen teeth in the front series. Body silvery, caudal and lower fins red; a large, oblique, band-like black blotch on the dorsal; a small black spot on the root of the caudal.

Gaboon. From 3 to 5 inches long.

Mormyrus zanclirostris, sp. n. Pl. II. fig. B.

D. 19. A. 39. L. lat. 70.

Snout much prolonged, tubiform, straight. Lower jaw without appendage; eye rather nearer to the end of the snout than to that of the opercle, very small. Teeth small, compressed, incisor-like, $\frac{14}{16}$. Pectorals much longer than ventrals, but terminating at a great distance from the base of the ventrals. Caudal very small. Origin of the dorsal fin opposite to the thirteenth anal ray. The height of the body is one-seventh of the total length (without caudal), the length of the head rather more than one-fourth. Brown; an ill-defined band along the lateral line, and the tail of a darker colour.

Gaboon. 10 inches long.

The figure is two-thirds the natural size.

Mormyrus microcephalus, sp. n.

D. 15–16. A. 28–31. L. lat. 62.

Snout obtuse, very short, twice as long as the eye, the diameter of which is about one-seventh or one-eighth of the length of the head. Mouth subanterior. Teeth brown, emarginate, small, $\frac{6}{6}$. The height of the body is two-elevenths of the total length (without caudal), the length of the head one-sixth. Pectoral nearly as long as the head, extending beyond the root of the ventral. Caudal fin small. Brown; head and fins black.

Gaboon (River Ogome). 7 inches long. Evidently allied to *Marcusenius brachyistius* (Gill).

Mormyrus Henryi.

Isichthys Henryi (Gill).

This is not a *Mormyrops* as I formerly supposed; it has an elongate band of teeth on the palate and tongue. Our specimen has D. 48. A. 46, and is from West Africa, probably Old Calabar.

Mormyrus Moorii, sp. n.

D. 24. A. 29. L. lat. 45. L. transv. $\frac{\text{ca } 7}{\text{ca } 7}$ *.

Snout obtuse, with the jaws equal in length, the mouth being terminal. Eye small, its diameter being one-half of the length of the snout, and one-eighth of that of the head. Teeth small, deeply notched, $\frac{4}{6}$. Pectoral fin not much shorter than the head, extending somewhat beyond the middle of the ventral fin. The height of the body is contained thrice and four-fifths in the total length (without caudal), the length of the head nearly five times. Brown; head and a small spot on the root of the caudal fin black.

One specimen, 9 inches long, is in the Liverpool Museum; it was discovered by Mr. Walker in the River Ogome.

Mormyrus Ussheri, sp. n.

D. 27–28. A. 30. L. lat. 58. L. transv. $\frac{\text{ca } 10}{\text{ca } 10}$.

Snout not very obtuse, with the lower jaw somewhat prominent, and terminating in a very short skinny flap. Eye small, its diameter being two-fifths of the length of the snout, and two-thirteenths of that of the head. Teeth small, slightly notched, $\frac{4}{6}$. Pectoral fin at least as long as the head, extending beyond the middle of the ventral fin. The height of the body is contained thrice and a half in the total length (without caudal), the length of the head four times and two-thirds. Uniform brown.

Two specimens, from 7 to 9 inches long, were collected by H. T. Ussher Esq., in the Bossumprah River, Gold Coast.

Mormyrus catostoma (Gthr.).

This species was described from East-African specimens. An example with twenty-nine anal rays, from the Bossumprah River, has been sent by Mr. Ussher to the Liverpool Museum.

Mormyrus Walkeri, sp. n. Plate III. fig. C.

D. 21. A. 22–23. L. lat. 55.

Allied to *M. niger*.

Snout obtuse, convex, not projecting beyond the mouth, which is terminal. Eye small, its diameter being shorter than the length of the snout. Teeth deeply notched, $\frac{12}{12}$. Pectoral fin as long as the head without snout, not quite twice as long as, and extending beyond the root of, the ventral. The

* In an oblique line between the origins of the dorsal and anal fins.

height of the body is two-sevenths of the total length (without caudal), the length of the head one-fourth. Uniform brown.

River Ogome (Gaboon). 4 inches long.

Mormyrops longiceps, sp. n.

D. 26. A. 39. L. lat. 90.

Head very low and elongate, more than twice as long as high. Snout subcylindrical, of moderate length, rounded in front, with the upper jaw somewhat longer than the lower. Eye very small, situated in the anterior third of the head. Teeth not very small, truncated and notched at the apex, $\frac{24}{22}$. Dorsal fin more than half as long as the anal. The height of the body is one-seventh of the total length (without caudal), the length of the head a little less than one-fourth. Coloration uniform.

This species is more closely allied to *M. anguilloides* from the Nile than to *M. deliciosus* from West Africa; it differs from the former in the shape of its head. It was discovered by H. T. Ussher, Esq., in the Bossumprah River. One specimen, 11 inches long, is in the Liverpool Museum.

XVI.—*Description of a new Species of* Apocryptes. By Dr. Albert Günther.

Apocryptes polyophthalmus.

D. 5–6 | $\frac{1}{24}$. A. 25.

Scales minute anteriorly, becoming somewhat larger posteriorly. The height of the body is one-sixth or one-seventh of the total length (without caudal). Snout rather high, twice as long as the eye, with the upper jaw somewhat longer than the lower; gape extending to below the posterior margin of the eye. Eye retractile as in *Periophthalmus*. Teeth small, two anterior pairs enlarged in each jaw; mandibulary teeth nearly horizontal. Dorsal fins not continuous, the spines of the anterior prolonged into filaments. Caudal fin shorter than the head. Olive-coloured; head with some minute whitish dots. Anterior dorsal with numerous small (in spirits white) ocelli. Similar ocelli on the second dorsal, where they are elongate and arranged in four regular series; a few ocelli on the caudal fin.

China. 5 inches long.

XVII.—*A Reply to Mr. H. G. Seeley's Remarks on my Account of the Phosphatic Deposit at Potton, in Bedfordshire.* By J. F. Walker, B.A., F.C.P.S., F.C.S., F.G.S., Sidney Sussex College, Cambridge.

In April 1866 the Rev. P. B. Brodie wrote a paper on the phosphatic deposit near Potton, in Bedfordshire, and stated that the fossils were derived from preexisting formations*. Having obtained from this bed some additional fossils, especially remains of *Iguanodon,* I wrote a short paper, supplementary to Mr. Brodie's, which was published in the Number of this Magazine for July 1866. At this period the Woodwardian Museum contained no fossils from this deposit; but since then, through the exertions of Mr. Keeping, who has the care of the Museum, it has obtained a fine series of these fossils. In August of the same year Mr. Seeley published a letter criticising the results arrived at by Mr. Brodie and myself; but this fact does not appear from his reference to that paper in the last Number of the 'Annals,' in which he would seem to intend to represent himself as the person attacked, instead of the aggressor, in this matter. Mr. Seeley stated in his letter that all the fossils appeared to him to be "denizens of the old sea-bed where they abound;" and this is the chief point on which our views do not coincide. Mr. Seeley says that the only mistake in his paper is the statement that "the *Gryphæa dilatata* is perversely wanting." But I am not surprised that Mr. Seeley obtained no specimens of this fossil, as the work-people did not save the ferruginous shells until I told them to do so†. I will now consider Mr. Seeley's criticisms *seriatim.*

I. Mr. Seeley objects to this deposit being called the Lower Greensand, and says:—"The Shanklin (or Lower Green) Sand, as I understand it, is the series of beds between the Weald Clay and the Gault. But these sands at Potton are between the Gault and the Oxford Clay; and, so far as I remember, the only fossil previously recorded from the beds in this district is *Ammonites biplex,* mentioned in my paper on the Cretaceous beds at Ely,—neither of which facts offers any presumptive evidence of the deposit being Shanklin Sands." Here is his statement in the paper he refers to:—"The lower part of the Shanklin Sands is a conglomerate of small rounded pebbles, which in the best place in the section is hardly more than four feet thick; and above this are some brown sands alternating irregularly with thin courses of clay with phosphatic nodules;

* Geological Magazine, vol. iii. p. 153.

† This circumstance explains Mr. Brodie's apparently erroneous assertion that "every organism in this phosphatic bed is evidently extraneous," which was perfectly true with regard to the fossils obtainable when he wrote.

and in places these deposits almost stand on end, through false bedding. They are seven feet thick, and unfossiliferous, a good deal resembling the beds below; but I cannot say they should not be classed with the Gault. A rolled fragment or two of *Ammonites biplex* is the only fossil I have found in the rock; so that it might be Portland Sands but that it is traced to Hunstanton, where fossils are more numerous." Mr. Seeley then proceeds to trace the bed to near Potton and Sandy. He evidently at the time he published the above (December 1865) considered the bed to be of the same age as I do, but has since altered his opinion. I shall again have occasion to refer to the second paragraph quoted above. I am not aware that *Neithea quinquecostata* has ever been found in the Kimmeridge Clay at Weymouth or elsewhere.

II. Mr. Seeley says, "The term conglomerate applied to this bed is calculated to mislead," and gives a definition of what he thinks a conglomerate ought to be. In the paragraph already quoted Mr. Seeley applied this term to the same beds! I wished to involve the idea he objects to, viz. the denudation of older beds.

III. I stated that, if Mr. Seeley's views be correct, the term Carstone is inapplicable to the bed. On the idea that the Carstone at Hunstanton represents the Gault and Lower Greensand, he forms his remarkable hypothesis of the Significance of the Sequence of Rocks*. He now restricts the term to the sands of Yorkshire, Lincolnshire, and Norfolk, between the Hunstanton Limestone and the Kimmeridge Clay, and says, "But though I abandon the term, I do not abandon the idea," which idea he proceeds to illustrate by a diagram, but does not attempt to prove it; therefore I will not discuss the merits of it.

IV. I appear to have misunderstood Mr. Seeley's remarkable expression "the truth is, the 'Sandy nodule bed,' as this bed in the Carstone may be called, reproduces earlier in time the conditions of the Cambridge Greensand." I am very sorry; but it may be due to the ambiguity of the sentence tending to mislead. But I am still of opinion that two deposits so different in every respect as the Cambridge Greensand and the sandy conglomerate bed at Potton and elsewhere cannot have been accumulated under similar conditions. Mr. Seeley by no means explains the discrepancies between the two formations indicated in my former paper†, nor does he bring forward a particle of evidence in support of his assumption that both were formed upon a long low shore.

V. Mr. Seeley ascribes to me the "notable discovery that by soaking six or seven parts of alumina in decomposing animal

* Geological Magazine, vol. ii. pp. 262–265.

† Ann. Nat. Hist. ser. 3. vol. xviii. p. 383.

and vegetable matter till they increase to 100, you will produce a nodule of *phosphate of lime*." In return I may congratulate him on having made a still more "notable discovery," namely, that clay consists of pure alumina, which is evidently implied in his interpretation of my statements. Mr. Seeley ought to be aware that clay consists not of alumina, but of a silicate of alumina; and also that clays like the Oxford and Kimmeridge contain various other substances. Again, what Mr. Seeley denominates "rolled concretions of tolerably pure phosphate of lime" do not, in the best average samples, contain more than 22·39 per cent. of phosphoric acid = 48·51 per cent. of tricalcic phosphate, supposing it all combined with calcium (see analyses given in Mr. Brodie's paper). I hope at some future period to demonstrate the origin of these nodules by chemical analysis. The indication of the comparatively small amount of pure alumina contained in clays may serve to a certain extent to remove Mr. Seeley's difficulty as to what "becomes of the clay;" and I may also remind him that, on his part, he has not told us whence the alumina undoubtedly contained in the nodules is derived. To Mr. Seeley's objection to the word "soaked" I can only reply that I used it to indicate my belief that the clay derived from the sea-cliffs, formed of older beds, encloses and is saturated with animal and vegetable matter.

VI. Mr. Seeley repeats, "with diffidence, on account of the state of the specimens," that he gathered no extraneous fossils from the bed. It is "on account of the state of the specimens" that I regard them as derived from the denudation of older formations. The condition of the bones and teeth of reptiles and fishes shows that they have been rolled, and, moreover, rolled after fossilization.

VII. & VIII. Mr. Seeley complains that I did not take the trouble to get the phosphatic casts of the shells named; but he cautiously omits to give a list of those which he has determined to be Portland species; he also omits a list of the ferruginous shells. I gave a list of all I had obtained, when my paper was published, that were in a condition sufficiently perfect for determination.

IX. I am flattered by Mr. Seeley's remark that my list of Mollusca has "some approach to correctness." I am sorry that he does not add the "some few others" to his remarkable statement about the species of *Terebratulæ*. With regard to the fossil I have named *Ostrea macroptera*, he makes the following curious statement:—"Although this is the name used by me for this fossil, as a variety of the *O. frons* of Parkinson, it is a form limited, so far as I know, to the Portland Rock—very unlike Sowerby's typical *O. macroptera*." Why does Mr. Seeley call this fossil by a name which he knows to be the wrong one? On referring to Prof. Morris's catalogue, I find that *O. macroptera* occurs in the Gault of Oxfordshire, in the Lower Greensand of Atherfield, and in the Greensand of Farringdon, where I found specimens during a recent visit. Mr. Seeley next states that he has seen no such shells as *Exogyra conica* &c., adding, "though I have long had other species of those genera in the Woodwardian Museum." He ought to have given a list of the specimens, which I presume, from his statement, have been presented by him to the University Collection.

X. With regard to this paragraph I can only say that, in my paper read before the British Association, I distinctly mentioned that fishes from the Kimmeridge Clay at Ely, specifically identical with those from Potton, were exhibited in the Woodwardian Museum, and that I think the rolled condition of the Potton specimens is a sufficient "reason for thinking them other than tenants of the sea of the time." I must confess that I am at a loss to understand the purpose of Mr. Seeley's reference to the existence of named specimens of these fishes in the University Museum, unless he considers that no one has a right to consult a public museum without acknowledging each occasion on which he may have derived information from it. As regards the specimens referred to in my paper, I had many of them in my possession and had determined them before any fossils from Potton were exhibited or, so far as I know, contained in the Woodwardian Museum.

XI. I will not be behind Mr. Seeley in confessing what I dare not call the *only* mistake in my paper. There occur in this bed rolled fragments of a rock composed almost entirely of shells; the specimens found were very much decomposed, and presented precisely the aspect of fragments of the *Cyrena*-bed. Since then, more boulders of this rock have been found, in a better state of preservation. On breaking these, I also have found specimens of *Cardium*; therefore I will admit that the specimens I mentioned in my paper probably contain the same shells. But I think that there is sufficient evidence of the denudation of the Wealden in the occurrence of the rolled bones of *Iguanodon* &c., and in the rolled fruits and wood. The wood exists in two different states of mineralization, as I remarked in my paper. Mr. Seeley states that he has shown in his paper "that the material of the deposit came from the east." I suppose he refers to one of his unpublished papers.

XII. The species described by me as *Sphæra Sedgwickii*, if not a *Sphæra*, is probably the type of a new genus; if, however, it should hereafter be proved to be a *Cyprina*, I have no doubt that it will be found to differ considerably from *C. angulata*, Sow., of which species Mr. Seeley says it is only a variety. *Pholas Dallasii* (mihi) appears to me to be nearly allied to D'Orbigny's *P. Cornueliana*; and both will, of course, take their place in the subgenus *Pholadidea*, as indicated by Mr. Seeley.

Finally, Mr. Seeley says: "The age of the beds is a difficult problem, and not one that can be solved by an appeal to fossils, or mineral character, or superposition." Unfortunately, Mr. Seeley does not inform us how the problem is to be solved, unless he wishes us to receive his hypotheses without requiring any proof. If I am honoured by a reply to my remarks, I may remind Mr. Seeley that, although the opinion of an eminent geologist must have great weight, yet it is by no means weakened by an appeal to facts, and that it is hardly fair to adduce in support of his arguments results said to be detailed in a book still unpublished, or in papers which have not yet appeared in print *.

XVIII.—*Note on the Species of the Genus* Tribonyx. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Zoological Society of London.

In endeavouring to ascertain the correct scientific name of a fine specimen of a Ralloid bird of the genus *Tribonyx*, from Western Australia, which has lately been added to the Society's Collection, I have discovered that there seems to have been some little confusion between two of the species of this genus, which I take the opportunity of setting right.

Upon turning to Mr. Gould's 'Birds of Australia,' to which one naturally refers for the determination of an Australian bird, it is at once apparent that the Society's specimen is not the bird figured there as *Tribonyx Mortieri*, being distinguishable by its larger size and the distinct white stripes on the wings, although otherwise much resembling it. But, in his original description of *Tribonyx Mortieri*, Du Bus most clearly describes these

* Several examples of this citation of unpublished materials occur in Mr. Seeley's paper. I may refer more particularly to that which, as he says, was read on May 27th, 1867, before the Cambridge Philosophical Society, on a deposit near Upware. I was present on that occasion, and heard Mr. Seeley's remarks, with many of which, however, I could not concur, as I stated at the time. Mr. Seeley's so-called paper consisted apparently of an extempore exposition of his views. No list of fossils was given by him; and the whole paper was quite unworthy of an attempt to revolutionize the geological classification of the Upper Jurassic and Lower Cretaceous beds, in support of which it is cited in the last Number of the 'Annals.' I had already communicated (May 7th, 1867) a short paper on the Upware deposit to the Yorkshire Philosophical Society: this is printed in the 'Geological Magazine' for July.

spots*, although they are very faintly represented in the figure attached. It is the same in the case of Lafresnaye's description of his *Brachyptrallus ralloides*, which is to be referred to the stripe-winged species. It becomes evident, therefore, that Mr. Gould has been in error in referring the smaller Tasmanian bird to *Tribonyx Mortieri*; and I propose to call it *Tribonyx Gouldi*, after its discoverer. We may then distinguish the three species (two of which are now living in the Society's collection, where also the third was exhibited alive a few years since) as follows:—

1. *Tribonyx Mortieri.*

Tribonyx Mortieri, Du Bus, Bull. Ac. Brux. vii. p. 215 (cum fig.).
Brachyptrallus ralloides, Lafr. Rev. Zool. 1840, p. 232.

Diagn. Major; alis albo striatis; plaga magna hypochondriali alba.

Hab. Western Australia.

In vivario Soc. Zool. Londin. Specimen unicum!

2. *Tribonyx Gouldi.*

Tribonyx Mortieri, Gould, Birds of Austr. vi. pl. 71; ejusd. Handb. ii. p. 324.

Diagn. Medius; alis immaculatis; plaga magna hypochondriali alba.

Hab. Tasmania.

Nuper in vivario Soc. Zool. Londin.

3. *Tribonyx ventralis.*

Gallinula ventralis, Gould, Proc. Zool. Soc. 1836, p. 85.
Tribonyx ventralis, Gould, Birds of Austr. vi. pl. 72; Handb. to Birds of Austr. ii. p. 325.

Diagn. Minor; alis immaculatis; hypochondriis nigris, albo guttatis.

Hab. New South Wales, Southern Australia, Victoria and Western Australia (Gould).

In vivario Soc. Zool. Londin.

XIX.—*On* Hyalonema lusitanicum. By J. V. Barboza du Bocage.

Letters addressed to Dr. J. E. Gray.

My dear Sir, Lisbon, May 25, 1867.

On my return from a journey of a few weeks to our northern provinces I have just received three of your letters, the last of

* "Tectricibus alarum mediis et minoribus cinereo-olivaceis, albo terminatis, et longitrorsum in medio striatis."—*Du Bus.*

which informs me that the specimen of *Hyalonema* sent to M. Ehrenberg has already returned into your possession.

At the same time with your letter, I have received another from Professor Ehrenberg. He persists in believing me the victim of a mystification, and in regarding the Hyalonemas as artificial products manufactured by the Japanese. I will here transcribe for you a portion of his letter, in order that you may judge of the arguments upon which he supports his opinion. It is Professor Ehrenberg who speaks:—

"I am convinced that the officer of customs who procured you these specimens has been deceived by some dealer in objects of natural history, or by travellers coming from Japan, and who have invented the fishery of these bodies near Setubal. It has been possible to *place beyond doubt the presence of cotton threads for the attachment of the different pieces*; there are also on the surface fibres of wool coloured red and green, certainly belonging to some old sailor's garment. The resemblance of this specimen to one of Brandt's figures is so striking, that it is impossible for me to believe that bodies so alike in all their parts can occur both in the Sea of Japan and in that of Portugal, or that these forms could be constructed in a manner so identical in the midst of circumstances so widely separated."

Such are the arguments which lead Professor Ehrenberg to maintain:—1. That the Hyalonemas are artificial products. 2. That the specimens that I possess have been manufactured in and brought from Japan. 3. That they have been sold to my correspondents by natural-history dealers (who do not exist in Portugal), or by sailors returning from Japan to Setubal, which has never, in the memory of man, seen a ship from China or Japan enter its little port!

I have just replied to M. Ehrenberg:—1. That the seven specimens which I possess have been sent to me from Setubal by three persons, all belonging to the well-to-do classes of society, and all well known as perfectly honourable. 2. That these persons have received the Hyalonemas at different periods (1863, 1864, and 1865) from well-known fishermen, who brought them precisely in the season of the shark-fishery. 3. That these fishermen had no interest in deceiving, as they could not know the scientific interest of these captures. 4. That these fishermen were always contented with a very modest gratuity (two or three francs) as a remuneration for having brought them. 5. That if the fishermen had the intention of demanding a higher price, instead of announcing them as derived from our coasts, they would not have failed to say that they had bought them from strangers, that this had cost them very dear, &c. Here, as everywhere, exotic products generally pay much better.

This is pretty nearly what I have replied to Professor Ehrenberg; but I am sure that he will maintain his first notion. It is his *fixed idea.*

There is, however, in what Professor Ehrenberg has written to me a question of fact, which I beg you to verify and get verified. M. Ehrenberg asserts that he has been able to place beyond doubt the presence of cotton threads attaching the different pieces of the Hyalonema. Now I beg you to examine with the utmost care the specimens which you possess, and in which M. Ehrenberg asserts that he has found this proof of *artificial fabrication,* and be kind enough to communicate to me the result of your examination.

For my part I have examined with scrupulous attention the six specimens which I possess; and not one of them presents the least trace of cotton threads, or anything which would lead one to believe in their artificial fabrication. The power of a preconceived idea is such that it will make us see cotton threads and signs of human fabrication in perfectly natural products in which they do not exist!

The confidence with which M. Ehrenberg writes to me about this throws me into the deepest astonishment. On my side there is not the least question of self-love. I am disposed to change my opinion in the presence of good arguments; but I cannot accept as such perfectly absurd hypotheses. I have also just read, in the 'Annals and Magazine of Natural History' (March 1867), the article by M. Max Schultze. He still believes in his sponge; but, although agreeing on this point with Dr. Bowerbank, he does not admit that the polypes also belong to the sponge. *Quot capita, tot sententiæ.*

Excuse me for having written you such a long letter, and accept, &c.

J. V. BARBOZA DU BOCAGE.

MY DEAR AND HONOURED CONFRÈRE, Lisbon, June 15, 1867.

Professor Ehrenberg's incredulity with regard to the habitat of *Hyalonema lusitanicum* has driven me to undertake a journey to Setubal, in order to obtain all desirable particulars on the spot. The following is a summary of the rigorous inquiry which I have just carried out.

The Hyalonemas are well known not only to the shark-fishers and the proprietors of fishing-boats, but also to several people of good position in the town. They call them "*chicotes de mar,*" that is to say, "sea-whips." It is since 1863 that the shark-fishers have most frequently found Hyalonemas attached to their fishing-apparatus; nevertheless some persons remember having seen, long before that period and at long intervals, some specimens brought from the sea by an old padrone lately dead, called Christovao da Penha.

It is not difficult to explain why the Hyalonemas, having been extremely rare and almost unknown at Setubal until 1863, have become more abundant since that period. We must in the first place take into account the ignorance of the fishermen, who are in the habit of throwing overboard everything that they think useless; but there is another important circumstance that has strongly struck me. Formerly the sharks were more abundant in our seas, and to find them the fishermen of Setubal did not need to depart very far from the shore; but for some years they have had to be sought at greater distances and at greater depths; and it is precisely in these deeper seas and at this greater distance from the coast that the Hyalonemas are found. I must also add that, from information in which I have perfect confidence, the above-mentioned fisherman (Christovao da Penha) was, previous to 1863, perhaps the only one who was in the habit of fishing in the seas at a distance from the shore now frequented by all the fishermen; and this explains quite naturally why this same fisherman was the only one to meet with Hyalonemas in his tackle.

Since 1863 I have received from Setubal seven complete specimens of *Hyalonema* and a large packet of threads belonging to three or four individuals, which makes a total of ten or eleven individuals. Perhaps you would like to know the dates of these acquisitions, the names of the persons from whom I received them, and the names of the proprietors and padrones of boats who captured them.

The first specimen (that which was described and figured by me) was sent to me by M. Garnitto, superior officer of customs at Setubal; it was fished in June 1863 by the padrone Domingo Correia.

In May 1864 I received from M. Garnitto another individual, which was given to him by José Vagueiro, proprietor of a boat, the padrone of which is named Manuel de Souza.

In September of the same year, M. Brito, a landed proprietor at Setubal, presented me with a magnificent specimen and with a large packet of threads, which he had received from Manuel Pedro, proprietor of a boat, the padrone of which is named José Correia.

Lastly, in September 1866, M. Cunha Freire, officer of customs at Setubal and collector of the fishery dues, presented me with four specimens taken together by the padrone Domingo Correia, the same who brought to M. Garnitto the first specimen of which he made me a present, in 1863. It is one of these four specimens that is now in the British Museum.

I profited by my short residence in Setubal to inquire whether there were other specimens of *Hyalonema* in the possession of any inhabitant of that town, and I had the good fortune to find one in a good state of preservation, belonging to a proprietor of fishing-boats, Antonio Avelino, who generously gave it to me. This individual, which brings up to twelve the number of Hyalonemas observed by me, was fished in April of the present year, by the padrone Manuel de Souza the younger.

After this exposition of the facts, the correctness of which I guarantee, I hope there will no longer be any pretext for doubting the habitat which I have assigned to *Hyalonema lusitanicum*.

As to regarding the Hyalonemas as artificial products of the industry of the Japanese, this is an hypothesis so destitute of proof that it seems to me useless to discuss it here. I will only renew the declaration which I have already made to you with regard to the cotton thread which Professor Ehrenberg supposes to exist twisted round the filaments beneath the corium polypigerum. *I maintain that this supposed thread does not exist either in the specimen I have presented to the British Museum, or in any of those in the Museum at Lisbon.*

I authorize you to make what use you please of this letter, as also of my preceding one.

Accept, &c.,
J. V. Barboza du Bocage.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 2, 1867.—Lieut.-General Sabine, President, in the Chair.

"On the Genera *Heterophyllia, Battersbyia, Palæocyclus*, and *Asterosmilia*, and their Position in the Classification of the Sclerodermic Zoantharia." By Dr. P. M. Duncan, Sec. G.S.

Although the practical and natural classification of the Madreporaria (Sclerodermic Zoantharia) which has been submitted by MM. Milne-Edwards and Jules Haime is very generally admitted to be the best, still there are great gaps in the succession of the genera, and, moreover, some genera cannot be placed.

The "break" between the Turbinolides and the Astræides is so great as to render the classification rather artificial; but Dr. Duncan's discovery of a genus *Asterosmilia*, comprising several species, unites these great divisions. The new genus has the peculiarities of the *Trochocyathi*, but in addition it is furnished with an endotheca. The species are described.

The genera *Heterophyllia*, M'Coy, and *Battersbyia*, Milne-

Edwards and Jules Haime, are amongst those *incertæ sedis*. The discovery of several new species of *Heterophyllia* enables Dr. Duncan to determine the anatomy of the genus, to offer for consideration the most extraordinary coral form he has ever seen, and to ally the genus with *Battersbyia*, which he proves had no cœnenchyma. The species of both of the genera are described shortly, and the development and reproduction of *B. gemmans* also. The genera are placed amongst the Astræidæ.

The genus *Palæocyclus*, M.-E. & J. H., supposed to be one of the Fungidæ, is proved to be a vesiculo-tubulate coral genus, and to be one of the Cyathophyllidæ.

One Mesozoic family is therefore removed from the Palæozoic coral-fauna, and two genera of a Mesozoic division are introduced. They foreshadow the *Thecosmiliæ* of the Trias.

"Contribution to the Anatomy of *Hatteria* (*Rhynchocephalus*, Owen)." By Albert Günther, M.A., Ph.D., M.D.

The skull of *Hatteria* is distinguished by the following characters:—

1. Persistence of the sutures, especially of those between the lateral halves of the skull, combined with great development of its ossified parts—a development which appears in the expanse of the bones forming the upper surface of the facial portion, in the completeness of an orbital ring with a temporal and zygomatic bar (Crocodilia), in the much expanded columella, in the nearly completely osseous bottom of the orbit, and roof of the palate.

2. Sutural union of the tympanic with the skull; firm and solid union of the bones of the palate with the tympanic, as shown by the sutural connexion of tympanic and pterygoid, broad sutural connexion of the columella with tympanic and pterygoid, immoveable pterygo-sphenoid joint, firm and extensive attachment of pterygoid to ectopterygoid.

3. This restriction of the mobility of the bones named is compensated by an increased and modified mobility of the lower jaw, the mandibles being united by ligament, and provided with a much elongated articular surface.

4. Displacement of the palatine bones, which are separated by the pterygoids, and replace a palatal portion of the maxillaries.

5. Perforation of the tympanic; extremely short postarticular process of the mandible.

The *vertebral* column and the *remainder of the skeleton* show the following peculiarities:—

1. Vertebræ amphicœlian; caudal vertebræ vertically divided into two equal halves. Points of minor importance are the uniform development of strong neural spines, and the direction of the caudal pleurapophyses, which point forwards.

2. The costal hæmapophyses are modified, first, into a series of appendages identical in position with the uncinate processes of birds; and, secondly, into a double terminal series connecting the

ribs with the thoracic and abdominal sterna, the distal pieces being much dilated and forming the base of a system of muscles (retractors of the abdominal ribs).

3. The development of a system of abdominal ribs, standing in intimate and functional relation to the ventral integuments.

4. Continuity of the ossification of the coracoid; presence of an acromial tuberosity of the scapula; subvertical direction of the os ilium.

5. The arrangement of the bones of the limbs and their muscles does not show any deviation from the Lacertian type.

The *dentition* of *Hatteria* is unique. That of young examples differs scarcely from the dentition of other acrodont lizards. In adult examples the intermaxillaries are armed with a pair of large cutting-teeth; a part of the lateral teeth are lost; and the alveolar edges of the jaws are cutting and highly polished, performing the function of teeth. A series of palatine teeth is in close proximity and parallel to the maxillary series, both series receiving between them in a groove the similarly serrated edge of the mandible.

As regards the *organs of sense*, the absence of the pecten of the eye and of the tympanic cavity, the commencement of a spiral turn of the cochlea, and the attachment of the hyoid bone to the terminal cartilage of the stapes are to be noticed.

The structure of the *heart* and of the organs of *respiration* and *circulation* are of the Lacertian type.

The *absence of a copulatory organ* is a character by which *Hatteria* is distinguished from all other Saurians. Thus *Hatteria* presents a strange combination of elements of high and low organization, and must be regarded as the type of a distinct group. Its affinities and systematic position may be indicated in the following

Synopsis of Recent Reptilia.

I. Squamata.
- First order. *Ophidia.*
- Second order. *Lacertilia.*
  - Suborder A. *Amphisbænoidea.*
  - Suborder B. *Cionocrania.*
  - Suborder C. *Chamæleonoidea.*
  - Suborder D. *Nyctisaura.*
- Third order. *Rhynchocephalia.*

II. Loricata.
- Fourth order. *Crocodilia.*

III. Cataphracta.
- Fifth order. *Chelonia.*

May 9, 1867.—Lieut.-General Sabine, President, in the Chair.

"On the Development and Succession of the Teeth in the Marsupialia." By William Henry Flower, F.R.S., F.R.C.S.

Although the dentition of adult individuals of all the animals which constitute the remarkable Order or, rather, Subclass Marsupialia has been repeatedly subjected to examination, and described with exhaustive minuteness of detail, it is a singular circumstance that most of those peculiarities in the succession of their teeth which distinguish them from other mammals appear hitherto to have escaped observation. To supply this blank is the object of the present communication. Fortunately the materials at my disposal, although not quite so complete as might be desired, are yet amply sufficient to illustrate the main aspects of the question, and to supply a result as interesting as it was unexpected.

Descriptions are given in the paper, accompanied by drawings, of several stages of the dentition of members of each of the six natural families into which the order is divided.

1. *Macropodidæ*.—The dentition of the Kangaroo (genus *Macropus*), from the completely edentulous fœtus to adult age, is described in detail. Contrary to what has been specially stated with regard to this genus, there are no deciduous or milk-incisors, the teeth of this group which are first formed and calcified in both jaws being those which are retained throughout the life of the animal. The rudimentary canine and first premolar have also no deciduous predecessors. The second tooth of the molar series (a true molar in form) is vertically displaced by a premolar. The four true molars have, as has long been known, no deciduous predecessors. There is thus but one tooth on each side of each jaw in which the phenomenon of diphyodont succession occurs. The period at which this takes place varies in different species of the family. In some forms of *Hypsiprymnus* the successional premolar is not cut until after the last true molar is in place and use,—this probably having relation to the extraordinary size of the tooth, and the time consequently required for its development. A special characteristic of this family is the tendency to lose the canine and one or both premolars at a comparatively early period of life.

2. *Phalangistidæ*.—Several early stages of the dentition of *Phalangista vulpina* are described and figured. In a young specimen in which no teeth had cut the gum, the crowns of the permanent incisors, canine, and first two molars were found to be calcified, and the germ of the permanent premolar was already formed beneath the milk- or deciduous molar, which, as in *Macropus*, is the only tooth which is shed and replaced by a successor. The change takes place at an earlier period than in the last family.

3. *Peramelidæ*.—No very early stages of *Perameles* were examined; but adolescent specimens of this genus and of *Chœropus* show that a very minute, compressed, molariform tooth is replaced by the triangular, pointed, third or posterior premolar. No other signs of vertical displacement and succession were observed.

4. *Didelphidæ*.—In the American genus *Didelphys*, the observations are complete from the earliest stage, and show that, as in the Australian *Macropodidæ* and *Phalangistidæ*, none of the teeth of the permanent series have predecessors except the compressed pointed last premolar, which replaces a tooth having the broad multicuspidate crown of a true molar.

This change does not occur until the animal approaches the adult age.

5. *Dasyuridæ.*—In a fœtal *Thylacinus,* in which no teeth had cut the gum, the crowns of the permanent incisors, canines, premolars, and anterior true molars were partially calcified, and necessarily much crowded together in the jaw. A very minute rudimentary molar was situated just beneath the alveolar mucous membrane, superficially to the apex of the hindermost premolar, and was evidently its milk-predecessor.

6. *Phascolomyidæ.*—This family is placed last because the observations regarding it are less complete than in the case of any of the others. The youngest Wombat available presented no evidence of succession of any of the teeth; but it is probable that the single premolar is preceded by a milk-molar, at a still earlier period than any examined.

From the foregoing observations it may be concluded with tolerable safety that the animals of the Order Marsupialia present a peculiar condition of dental succession, uniform throughout the order, and distinct from that of all other mammals. This peculiarity may be thus briefly expressed. The teeth of Marsupials do not vertically displace and succeed other teeth, with the exception of a single tooth on each side of each jaw. The tooth in which a vertical succession takes place is always the corresponding or homologous tooth, being the hindermost of the premolar series*, which is preceded by a tooth having the characters, more or less strongly expressed, of a true molar.

It has been usual to divide the class Mammalia, in regard to the mode of formation and succession of their teeth, into two groups—the *Monophyodonts,* or those that generate a single set of teeth, and the *Diphyodonts,* or those that generate two sets of teeth; but even in the most typical diphyodonts the successional process does not extend to the whole of the teeth, always stopping short of those situated most posteriorly in each series. The Marsupials occupy an intermediate position, presenting as it were a rudimentary diphyodont condition, the successional process being confined to a single tooth on each side of each jaw. This position, however, is by no means without analogy among the mammals of the placental series. In the Dugong and the existing Elephants the successional process is limited to the incisor teeth. It is questionable whether the first premolar of those animals of this group which have four premolar teeth, as the Hog, Dog (mandible), &c., ever has a deciduous predecessor, at all events so far advanced as to have reached the calcified stage. But the closest analogy with the marsupial mode of succession is found among the Rodents. Here the incisors appear to have no deciduous predecessors; and in the Beaver, Porcupine, and others, which have but four teeth of the molar series, *i. e.* three true

* The convenient distinction between false molars or premolars and true molars, is always well marked in the form of the crown, especially in the upper jaw, in the Marsupials.

molars and one premolar, the latter is, exactly as in the Marsupials, the only tooth which succeeds a deciduous tooth. The analogy, however, does not hold in those Rodents which have more than one premolar, as the Hare; for in this case each of these teeth has its deciduous predecessor.

In the preceding account I have used the term "permanent" for those teeth which remain in use throughout the animal's life, or, if they fall out (as do the rudimentary canines and the premolars of the *Macropodidæ*), do not give place to successional teeth; and I have therefore assumed that the milk or temporary dentition of the typical diphyodont mammals is represented in the Marsupials only by the deciduous molars. It may be held, on the other hand, that the large majority of the teeth of the Marsupials are the homologues of the milk or first teeth of the diphyodonts, and that it is the permanent or second dentition which is so feebly represented by the four successional premolars. This view is supported by many general analogies in animal organization and development, such as the fact that the permanent state of organs of lower animals often represents the immature or transitional condition of the same parts in beings of higher organization.

Looking only to the period of development of the different teeth in some of the marsupial genera, we might certainly be disposed to place the successional premolar in a series by itself, although, indeed, all its morphological characters point out its congruity with the row of teeth among which it ultimately takes its place, the reverse being the case with its predecessor. It is, however, almost impossible, after examining the teeth of the young Thylacine described and figured in the paper, to resist the conclusion originally suggested. The unbroken series of incisors, canines, premolars, and anterior true molars of nearly the same phase of development, with posterior molars gradually added as age advances, form a striking contrast to the temporary molar, so rudimental in size, and transient in duration. I can scarcely doubt that the true molars of this animal would be identified by every one as homologous with the true molars of the diphyodonts, which are generally regarded as belonging to the permanent series, although they never have deciduous predecessors. Now, if the homology between the true molars of the Thylacine and those of a Dog, for instance, be granted, and if the anterior teeth (incisors, canines, and premolars) of the Thylacine be of the same series as its own true molars, they must also be homologous with the corresponding permanent teeth of the Dog.

It may be objected to this argument, that the true molars of the diphyodonts, not being successional teeth, ought to be regarded as members of the first or milk-series; but, in truth, the fact that they have themselves no predecessors does not make them serially homologous with the predecessors of the other teeth, while their morphological characters, as well as their habitual persistence throughout life, range them with the second or permanent series.

We have been so long accustomed to look upon the second set of teeth as an after-development or derivative from the first, that it appears almost paradoxical to suggest that the milk- or deciduous teeth may rather be a set superadded to supply the temporary needs of mammals of more complex dental organization. But it should be remembered that, instead of there being any such relation between the permanent and the milk-teeth as that expressed by the terms "progeny" and "parent" (sometimes applied to them), they are both (if all recent researches into their earlier development can be trusted) formed side by side from independent portions of the primitive dental groove, and may rather be compared to twin brothers, one of which, destined for early functional activity, proceeds rapidly in its development, while the other makes little progress until the time approaches when it is called upon to take the place of its more precocious *locum tenens.*

Many facts appear to point to the milk-teeth as being the less constant and important of the two sets developed in diphyodont dentition. Among these the most striking is the frequent occurrence of this set in a rudimentary and functionless or, as it were, partially developed state. The milk-premolars of some Rodents (as the Guinea-pig), shed while the animal is *in utero*, the simple structure and evanescent nature of the milk-teeth of the Bats, Insectivores, and Seals, the diminutive first incisors of the Dugongs and Elephants, all appear to be cases in point. On the other hand, examples of the commencing or sketching out, as it were, of the successors to a well-formed, regular, and functional first set of teeth, are rarely, if ever, met with. Occasional instances of the habitual early decadence, or, perhaps, absence of some of the second or so-called permanent teeth occur in certain animals ; but these are rather examples of the disappearance or suppression of organs of which there is no need in the economy, and chiefly occur in isolated and highly modified members of groups in the other members of which the same phenomenon does not occur, as in *Cheiromys* among the Lemurs, *Trichechus* among the Seals, and the recent Elephants (as regards the premolars) among the Proboscideans. They form no parallel to the cases mentioned above of the rudimentary formation of an entire series of teeth of the temporary or milk-set.

To return to the Marsupials :—If this view be correct, I should be quite prepared to find, in phases of development earlier than those yet examined, some traces either of the papillary, follicular, or saccular stages of milk-predecessors to other of the teeth besides those determinate four in which, for some reason at present unexplained, they arrive at a more mature growth*. Such proof as this would alone decide the truth of these speculations ; and I have not at present either the requisite leisure or materials for following out so delicate an investigation. I trust that the facts already elicited are sufficiently novel and important to justify my bringing them, as they now stand, before the Society.

* It may be remarked that the milk-tooth which alone is developed in the Marsupials corresponds homologically with that which, as a general rule, is most persistent in the typical diphyodonts, including Man, viz. the posterior milk-molar, replaced by the posterior permanent premolar.

May 16, 1867.—William Bowman, Esq., V.P., in the Chair.

"Further Observations on the Structure and Affinities of *Eozoon Canadense*." (In a Letter to the President.) By William B. Carpenter, M.D., F.R.S., F.L.S., F.G.S.

University of London, May 9th, 1867.

When, on the 14th of December 1864, I addressed you on the subject of the remarkable discovery which had been recently made in Canada, and submitted by Sir William Logan to myself for verification, of a fossil belonging to the Foraminiferal type, occurring in large masses in the Serpentine-limestones intercalated among Gneissic and other rocks in the Lower Laurentian formation, and therefore long anterior in Geological time to the earliest traces of life previously observed, no doubts had been expressed as to the *organic* nature of this body, which had received the designation *Eozoon Canadense.*

The announcement was soon afterwards made, that the Serpentine Marble of Connemara, employed as an ornamental marble by builders under the name of "Irish Green," presented structural characters sufficiently allied to those of the Laurentian Serpentines of Canada to justify its being referred to the same origin. An examination of numerous decalcified specimens of this rock led me to the conclusion that, although the evidences of its organic origin were by no means such as to justify, or even to suggest, such a doctrine, if the structure of the Canadian Eozoon had not been previously elucidated, yet the very exact correspondence in size and mode of aggregation between the Serpentine-granules of the Connemara Marble and those of the 'acervuline' portion of the Canadian was sufficient to justify in behalf of the one the claim which had been freely conceded in regard to the other.

In the following summer, however, it was announced in the 'Reader' (June 10, 1865) by Professors King and Rowney of Queen's College, Galway, that having applied themselves to the study of the Serpentine-Marble of Connemara with a full belief in its organic origin, they had been gradually led to the conviction that its structure was the result of chemical and physical agencies alone, and that the same explanation was applicable to the supposed *Eozoon Canadense* of the Laurentian Serpentines. This view was afterwards fully set forth in a Paper "On the so-called Eozoonal Rock," read at the Geological Society on the 10th of January 1866, and published (with additions) in the Quarterly Journal of the Geological Society for August 1866. The following is their own Summary of their conclusions (p. 215):—

"It has been seen (1) that the 'chamber-casts' or granules of serpentine are more or less simulated by chondrodite, coccolite, pargasite, &c., also by the botryoidal configurations common in Permian Magnesian Limestone; (2) that the 'intermediate skeleton' is closely represented, both in chemical composition and other conditions, by the matrix of the above and other minerals;

(3) that the 'proper wall' is structurally identical with the asbestiform layer which frequently invests the grains of chondrodite—that, instead of belonging to the skeleton, as must be the case on the eozoonal view, it is altogether independent of that part, and forms, on the contrary, an integral portion of the serpentine constituting the 'chamber-casts,' under the allomorphic form of chrysotile, and that perfectly genuine specimens of it, completely simulating *casts* of separated nummuline tubules, occur in true fissures of the serpentine-granules; (4) that the 'canal-system' is analogous to the imbedded crystallizations of native silver and other similarly conditioned minerals, also to the coralloids imbedded in Permian Magnesian Limestone; that its typical Grenville form occurs as metaxite, a chemically identical mineral imbedded in saccharoidal calcite; (5) that the type examples of 'casts of stolon-passages' are isolated crystals apparently of pyrosclerite. Furthermore, considering that there has been a complete failure to explain the characters of the so-called internal casts of the 'pseudopodial tubules' and other 'passages' on the hypothesis of ordinary mechanical or chemical infiltration, also bearing in mind the significant fact that the 'intermediate skeleton,' in Irish and other varieties of eozoonal rock, contains modified examples of the 'definite shapes' more or less resembling the crystalline aggregations and prismatic lumps in primary saccharoidal marbles—that eozoonal structure is only found in metamorphic rocks belonging to widely separated geological systems, never in their unaltered sedimentary deposits,—taking all these points into consideration, also the arguments and other evidences contained in the present memoir, we feel the conclusion to be fully established, that every one of the specialities which have been diagnosed for *Eozoon Canadense* is solely and purely of crystalline origin: in short, we hold, without the least reservation, that from every available standing point—foraminiferal, mineralogical, chemical, and geological—the opposite view has been shown to be utterly untenable."

Considering that the Foraminiferal characters of *Eozoon Canadense* had been unhesitatingly accepted by all those zoologists, Continental as well as British, whose special acquaintance with the group gave weight to their opinion, it might have been prudent, as well as becoming, on the part of the Galway Professors, to express themselves somewhat less confidently in regard to its purely mineral origin. The case they made out would not have lost any of its real strength if they had simply put forward their facts as affording valid grounds for *questioning* the received doctrine; and a way of escape would have been left for them, if the progress of research should happen to bring to light conclusive evidence on the other side.

Although such conclusive evidence is now producible, it may be well for me briefly to point out what I regard as the fundamental fallacies in the argument of Professors King and Rowney.

In the first place, the Serpentine-Marble of Connemara, on which their investigations had been chiefly conducted, is admitted by every one who has examined it to have undergone a considerable amount of metamorphic change. To myself, as well as to Professors King and Rowney, the evidence which it presents of the operation of chemical and physical agencies is most obvious and conclusive; whilst the evidence of its organic origin rests entirely on its partial analogy to the eozoonal rock of Canada. Hence an entire surrender might be made of the organic hypothesis as regards the Connemara marble, without in the least degree invalidating the claim of the eozoonal rock of Canada to an organic origin. But, on the other hand, if the latter claim can be sustained, it may be fairly extended to the "Irish Green," should the evidence of similarity be found sufficient to justify such an extension, since it must be admitted by every petrologist that no amount of purely mineral arrangement in a metamorphic rock can disprove its claim to organic origin, if that claim can be shown to be justified by distinct traces, in other parts of the same formation, of organisms adequate to its production. The Carboniferous Limestone, various members of the Oolitic and Cretaceous formations, and the Hippurite and Nummulitic Limestones, all exhibit in parts an entire absence of organic structure, which is yet so distinct elsewhere as to justify the generalization that their materials have been originally separated from the ocean-waters by animal agency. And it is well known to those who have studied the changes which recent Coral-formations have undergone when upraised above the sea-level, that a complete conversion of a mass of Coral into a subcrystalline Limestone not distinguishable from ordinary Carboniferous Limestone, may take place under circumstances in no way extraordinary.

It is, therefore, upon the character of the Serpentine-Limestone of *Canada*, not upon the nature of the Connemara Marble, that the question of organic origin entirely turns; and, as I have elsewhere shown in detail*, the hypothesis of Professors King and Rowney altogether fails to account for the *combination of phenomena* which the former presents, whilst the accordance of that combination with the idea of its Organic origin (a very moderate allowance being made for the effects of metamorphic change) is such as to establish the same kind of probability in its favour as that which we derive in the case of the Human origin of the "flint implements" from the cumulative evidence of their succession of fractured surfaces, or in the case of the chemical composition of the sun from the precise correspondence between certain dark lines in the solar spectrum and groups of bright lines produced in a dark spectrum by the combustion of certain known metals.

I may stop to point out, however, that Professors King and Rowney do not attempt to offer any feasible explanation of the fundamental fact of the regular alternation of lamellæ of Calca-

* Quarterly Journal of the Geological Society, August, 1866.

reous and Siliceous minerals, often amounting to fifty or more of each kind, extending through a great range of area, nor of the fact that not only is this arrangement the same, though the siliceous mineral may be Serpentine in one place, Pyroxene in another, or Loganite in another, whilst the calcareous may be Calcite in one part and Dolomite in another, but that these variations may occur in one and the same specimen, the structural arrangement being continuous throughout.

And in what they state of the peculiar lamella forming the proper wall of the chambers, which I have designated the "nummuline layer," they have fallen into errors of fact so remarkable, that I can only account for them by the belief that when their paper was written they knew this layer only by decalcified specimens, and had never seen it in thin transparent sections. For they describe it as composed of parallel fibres of chrysotile packed together without any intermediate substance; whereas I have distinctly proved that the siliceous fibres are imbedded in a calcareous matrix, which I therefore feel justified in regarding as a finely tubulated Nummuline shell, of which the tubuli that were originally occupied by pseudopodia have been permeated by siliceous infiltration.

So, again, while asserting that by no conceivable process could the animal substance originally occupying these tubuli have been replaced by siliceous minerals, they have entirely ignored the fact stated by me, that this very replacement has taken place in recent specimens in my possession—a fact on the basis of which the reconstruction of the animal of Eozoon proposed by Dr. Dawson and myself securely rests.

The question may now, I believe, be regarded as conclusively settled by the recent discovery, in a sedimentary limestone of the Lower Laurentian formation at Tudor in Canada, of a specimen of *Eozoon* presenting characters that cannot, in the opinion of the most experienced palæontologists and mineralogists, be accounted for on any other hypothesis than that of its organic origin. For, in the first place, the occurrence of a calcareous framework or skeleton in a matrix of sedimentary limestone, which also fills up its interspaces, altogether excludes the hypothesis that this framework might be the product of any kind of pseudomorphic arrangement produced by the separation of calcareous and siliceous minerals from a solution containing both. And, secondly, this specimen exhibits that which had not previously been distinctly seen in any other, viz. a distinctly limited contour, formed by the curving downwards and closing-in of the septa, in a manner as perfect and characteristic as the closing-in of the successive chambers of any polythalamous shell. I believe that no palæontologist familiar with Palæozoic fossils would have hesitated to pronounce this specimen a fossil Coral allied to *Stromatopora*, if it had occurred in a Silurian Limestone.

That this specimen, though differing greatly in appearance from the ordinary Serpentinous *Eozoon*, really represents that organism, is shown not merely by the general arrangement of the calcareous lamellæ, but by their minute structure. This, it is true, is far less characteristically seen in thin sections microscopically examined than it is in the specimens whose cavities have been filled up by Serpentine, the texture of which is often so marvellously little changed as to have all the appearance of recent shell-substance; but the alteration which the shelly layers have undergone in this specimen is precisely paralleled by that which I have been accustomed to find in the best-preserved specimens of other organic structures contained in the more ancient limestones. And there are still distinctly recognizable traces of the canal-system imperfectly injected with black substance, which correspond with those of the ordinary Serpentinous *Eozoon*.

For the imperfection of the specimen in this respect, however, full compensation is made in the perfect preservation of the canal-system in a small fragment of *Eozoon* long since observed by Dr. Dawson in a crystalline limestone at Madoc. This specimen having been placed in my hands by Sir William Logan, with permission to treat it in any way that should enable me to make a thorough examination of it, I have succeeded in finding in it most complete and beautiful examples of the canal-system, presenting varieties of size and distribution exactly parallel to those with which I am familiar in the Serpentine-specimens. Now, as there is not in the Madoc, any more than in the Tudor specimen, any such combination of different minerals as has been supposed by Professors King and Rowney to have given origin to the arborescent forms of the canal-system of Eozoon (which they have likened to moss-agate or crystallized silver), there can be no longer any reasonable ground for disputing the essential similarity of this canal-system to that first described by myself in *Calcarina*, with which it was originally compared by Dr. Dawson*.

The extension of the inquiry into the character of the Serpentine limestones intercalated among the Gneissic and other rocks of Laurentian age in various parts of Europe, has brought to light such numerous examples of eozoonal structure, more or less distinctly preserved, as to afford strong grounds for the conclusion that this organism was very generally diffused at that epoch, and performed much the same part, in raising up solid structures in the waters of the ocean, that the Coral-forming Zoophytes perform at the present time. I had myself examined before the close of 1865 specimens of Ophicalcite from Cesha Lipa in Bohemia and from the neighbourhood of Moldau, in which an eozoonal structure was distinctly traceable; and early in 1866 a more extended series was transmitted to me through Sir C. Lyell from Dr. Gümbel, the Government Geologist of Bavaria, in which I was able to

* A full description of these specimens by Dr. Dawson, with a notice of their stratigraphical position by Sir William Logan, has been read at the Geological Society, on the 8th of May, 1867.

trace a continuous gradation, from specimens in which the eozoonal structure was distinct, to others in which, if it ever existed, it had been completely obscured by subsequent metamorphism. The results of a very careful and complete examination of the Ophicalcites of Bavaria by Dr. Gümbel himself have been communicated to the Royal Academy of Munich*.

Appearances of the same character are presented by a series of specimens of the Serpentinous Limestones from the Primitive Gneiss of Scandinavia, kindly transmitted to me by Prof Lovén.

I venture to hope that the foregoing *résumé* of the present aspect of this subject will be of interest to the Fellows of the Royal Society. I say the *present* aspect, because I am strongly convinced that we are at present only at the beginning of our knowledge of this and other ancient types of Foraminiferal structure, and that careful search in promising localities will bring to light many wonders now lying unsuspected in the vast aggregate of pre-Silurian strata.

May 23, 1867.—Lieut.-General Sabine, President, in the Chair.

"*Ovibos moschatus* (Blainville)." By W. Boyd Dawkins, M.A., F.G.S.

Ovibos moschatus, more commonly known as the musk-ox, has been described under different names by naturalists as their opinions fluctuated concerning its affinities with the ox, buffalo, or sheep. It is called the musk-ox by all the arctic explorers, *Bos moschatus* by Schreber, Zimmermann, Pennant, and Cuvier, musk-buffalo allied to the *Bubalus caffir* of South Africa by Professor Owen, *Ovibos moschatus* by De Blainville, Desmarest, Richardson, and M. Lartet. That the latter four naturalists are right in the place they assign to it in the zoological scale, intermediate between *Ovis* and *Bos*, is proved both by the natural history and the osteology of the animal. The absence of a muffle and dewlap, the hairiness of the nostrils, the shortness of tail and smallness of ear, and the possession of two teats only, separate the animal from *Bos* and connect it with *Ovis*, while the large size and long gestation of nine months differentiate it from the latter animal. Precisely the same evidence is afforded by its skeleton. In the skull, the tapering of the anterior portion, the prominence of the orbit, the verticality of the facial plate of the maxillary, the presence of a larmier, the squareness of the basisphenoid, the presence of the occipito-parietal suture on the coronal surface—in the dentition the sharpness of the costæ 1, 2, and 3, and the absence of the accessory column from the inner interspace of the lobes of the upper teeth, are among the chief ovine characters; and throughout the skeleton the same ovine tendency is manifested.

* "Ueber das Vorkommen von Eozoon im ostbayerischen Urgebirge," aus d. Sitzungsber. d. k. Acad. d. W. in München, 1866, i. 1.

With the exception of the great development of the horns, there is no point in common between it and *Bubalus caffir*. The encroachment of the horn-cores on the parietals differentiates it from the sheep.

The animal ranges at the present day from Fort Churchill, lat. 60°, northwards as far as the arctic sea, and eastwards as far as Cape Bathurst, lat. 71°, living for the most part on the "barren grounds," and never penetrating far into the woods. In geological times, however, it had a far greater range eastwards and southwards. In the pleistocene river-gravels lying on the solid ice in Eschscholtz Bay, in Russian America, it is found associated with the elk, reindeer, bison, horse, and mammoth. Traces of the animal ranging further to the east are afforded by the skull found on the banks of the Yena, in lat. 70°, long. 135°. Dr. Pallas's discovery of two skulls on the banks of the Obi brings the animal still closer to the borders of Europe. All three skulls were found in the "Tundas," or treeless "barren grounds" of Siberia, in the same series of gravels which afford such vast stores of fossil ivory. In Germany it has been found in three localities; and in France, in the valley of the Oise, it is associated with flint implements of the St. Acheul type, and with the mammoth and *Elephas antiquus*. It has also been found in the reindeer-caves of Périgord, under circumstances that prove beyond doubt that the animal was eaten by the reindeer-folk. In England it has been found in three gravel-beds of late pleistocene age, near Maidenhead, at Freshford near Bath, and at Greenstreet-green near Bromley. In 1866 the author dug it out of the lower brick-earth of Crayford in Kent, where it was associated with *Rhinoceros megarhinus*, *R. leptorhinus* (Owen), and *Elephas antiquus*. The skull in this latter case belonged to a remarkably fine old male. Thus its present limited range in space contrasts most strongly with its wide range in pleistocene times through North Siberia and Central Europe north of a line passing through the Alps and Pyrenees. Its association with animals of a temperate or else southern zone is to be accounted for by its having been driven from its usual haunts by an unusually severe winter. The rarity of its remains proves that it was not so abundant as those animals which are associated with it in France, Germany, and Britain.

Professor Leidy figures and describes two fossil skulls most closely allied to *Ovibos moschatus*, from Arkansas and Ohio, under the name of *Bootherium cavifrons* and *B. bombifrons*; they are, however, most probably the male and female of the same species. They differ from *Ovibos moschatus* only in the direction of their horn-cores, and in their bases meeting and becoming fused on the coronal surface of the male skull. The horn-cores are supported both by the frontals and parietals. In other respects they present the same ovine affinities as *Ovibos*, and certainly belong to the same genus.

MISCELLANEOUS.

Cases of Monstrosities becoming the starting-point of New Races in Plants. By C. Naudin.

The discussion lately raised by MM. C. Dareste and A. Sanson upon the question whether monstrosities, in the animal kingdom, can become the origin of peculiar races, recalls to my memory some teratological facts which appear to me to show that this is the case in plants. Perhaps, however, in the first place, we ought to come to an understanding as to the sense to be attached to the word *monstrosity*; and to avoid all confusion I shall say that I employ it in the sense which is habitually given to it in botany, that of a notable deviation from typical or reputed typical forms. There is, in fact, a distinction to be made between cases of monstrosity incompatible with the faculty of reproduction by generation in the individuals affected by it, and those in which the alteration of form is not such as necessarily to imply the loss of this faculty. It is to the latter only that I wish to refer here, as they alone are in question.

Well attested facts place it beyond a doubt, in my opinion, that considerable anomalies which, by general consent, are classed among the teratological facts of the vegetable kingdom are faithfully transmitted from generation to generation, and become the salient characters of new races. Horticulture would furnish a great number of these if the trouble had been taken to collect them and subject them to the check of experiment; but I can cite only a few, because they alone, as far as I know, have been examined scientifically; and, moreover, they suffice to establish the principle of the transmission of anomalies by sexual reproduction through an indefinite series of generations.

The first fact of this kind will be borrowed from Professor Göppert of Breslau. This was a poppy (*Papaver officinale*) which presented the curious anomaly of the transformation of a part of its stamens into carpels, from which resulted as it were a crown of secondary capsules round the normal central capsule, the development of which was nevertheless complete. One thing to be noted is that many of these small additional capsules, as well as the normal capsule, contained perfect seeds capable of reproducing the plant. In 1849, M. Göppert, having learnt that a whole field of these monstrous poppies existed a few miles from Breslau, sowed in the following year a considerable quantity of seeds taken designedly from the normal capsules; and nearly all the plants which sprang from this sowing reproduced the monstrosity of the previous generation, although not all in the same degree. I do not dwell upon this first fact, because its observation was not, so far as I know, carried any further, and it may be thought that the number of generations is not sufficient to justify our concluding from it the stability of the anomaly indicated.

The same doubt does not exist with regard to the following facts. Cultivators of ferns know that these plants are very subject to vary, and that some of them, even in the wild state, present true monstrosities in the conformation of their fronds, which by that means acquire very singular figures. These monstrosities are sought for by the fanciers of these plants, because they consider them an improvement; and they were for a long time rare and bore a high price in horticultural commerce. Now-a-days they are produced in as great abundance as can be desired, by simply sowing the spores, on condition that these spores are taken from the altered parts of the fructifying frond. Where the frond remains in the normal state, the spores only give origin to normal plants; but those of the monstrous portions of the same fronds reproduce with certainty plants affected with the same kind of alteration. This mode of propagation has been in use for several years; and the fact of the transmission of monstrosities by sowing, in the Ferns, has never yet been invalidated by experiment.

Very considerable anomalies, which may be classed among teratological facts with as much reason as in the two preceding instances, may be observed in the three species of alimentary gourds—plants subjected to cultivation from time immemorial, and which have never been found in the wild state. These anomalies are peculiar in this respect, that they characterize very well-marked and persistent races, are preserved notwithstanding changes of place and climate, and even partially resist crossing with other races of the same species. The date of their origin is unknown, nor do we know under what influences they were formed; but the species being here entirely reduced to a state of domesticity, it is very probable that some of these races, if not all, were actually produced by cultivation. Such, among others, is a race of the common gourd (*Cucurbita pepo*), in which the tendrils are all converted into a kind of branches which give origin to leaves, flowers, and often to fruits; such are also, in the same species, those numerous races with deformed, warty, and oddly coloured fruits, which are preserved by sowings, always in a similar condition, so long as intercrossings do not step in to modify them. A still more remarkable example is that of a small race of pumpkin (*C. maxima*) which we have received from China and observed for several years at the Museum. Resembling the type of the species in the organs of vegetation, it differs therefrom singularly in the ovary and the fruit, which have become almost entirely free, the tube of the calyx being reduced into a sort of plateau serving to support the carpels. Nevertheless the complete adhesion of the ovary to the tube of the calyx, in which it is deeply immersed, is given by all authors as one of the essential characters of the family *Cucurbitaceæ*. From this example we see how great may be the extent of the variations and also what a degree of fixity these variations may acquire when once they are produced.

The fact of which I have still to speak is quite recent, and has already been brought under the notice of the Academy by Dr. Godron, Professor of Botany at Nancy (Comptes Rendus, 1866, i. p. 379). I refer to it here because my own observations confirm it in all points, and especially because it shows us very clearly how a new race may originate from an anomaly. In 1861, Dr. Godron found in a sowing of *Datura tatula*, a species with very spinous fruits, a single individual of which the capsule was perfectly smooth and unarmed. The seeds taken from this capsule furnished, in 1862, a lot of plants, all of which faithfully reproduced the individual from which they were derived. From these seeds sprang a third generation similarly unarmed; and I have myself observed at the Museum, in 1865 and 1866, the fourth and fifth generations of this new race, in all nearly one hundred individuals, none of which manifested the least tendency to resume the characters of the spinous type of the species. When crossed with the latter by M. Godron himself, the unarmed race furnished hybrids, which in the succeeding generation reverted to the spinous and unarmed forms; in other words, they behaved like true hybrids endowed with fertility. From this fact M. Godron proceeds to refer to a single specific type *Datura stramonium*, *D. lævis* (Bertoloni, not Linnæus), and *D. tatula*, three very constant forms which had previously been regarded as good species. By adding to these the *D. tatula inermis*, discovered by him, and to a certain extent originated under his eyes, we have four distinct forms, issuing by variation from a single type, and with regard to which we should not well know how to say what they wanted of being true species.

Here a point presents itself to which I call the particular attention of those who believe in the mutability of specific forms, and ascribe the origin of existing species to simple modifications of more ancient ones. They assume (at least most of them do so) that these modifications have been effected with excessive slowness, and by insensible transitions—for example, that it required several thousands of generations to transform one species into another congeneric species. We do not know what may have taken place in this long lapse of ages; but experiments and observation teach us that in the present day slight or profound anomalies, alterations of what we, perhaps arbitrarily, call *specific types*,—in a word, monstrosities, whether they be transitory and purely individual, or give rise to new durable races uniform in an unlimited number of individuals, are produced suddenly, and without there ever having been transition forms between them and the normal form. A new race originates perfectly formed, and the first individual which represents it is at once such as it will show in the succeeding generations if circumstances allow it to be preserved. New modifications may be added to the first and subdivide the primary race into secondary races, but they are produced with the same suddenness as the first. I do not here set myself up as the defender of the doctrine of evolution; I only say that the biological phenomena of the period in which we live by no means justify the hypothesis of an insensible degradation of ancient forms and the necessity of millions of years for changing the physiognomy of species. To judge from what we know, these transformations, if they have taken place, may have been effected in a lapse of time incomparably shorter than has been supposed. It may be, indeed, that there are these alternations in the life of nature—that periods of immobility, real or apparent, are succeeded by other periods of rapid transformation, during which what was previously only exceptional and abnormal becomes the regular state of matters. And, finally, we must not forget that to us time is only the succession of phenomena, and that, whether these phenomena appear to us to succeed one another slowly or precipitately, the result remains the same as regards the doctrine of evolution. In either case the principle of the continuity of things is in no degree affected.—*Comptes Rendus*, May 13, 1867, pp. 929–933.

The Theory of the Skeleton.

To the Editors of the Annals and Magazine of Natural History.

GENTLEMEN,—I do not imagine that readers of this Magazine will have forgotten Mr. Herbert Spencer's claim to date his views on the skeleton from 1858. I wrote to you not to dispute that, or to impugn Mr. Spencer's claim to be a great discoverer, but to vindicate my own claim to have honestly and independently thought out, from anatomical and physiological data, the theory of the skeleton which I had the honour to submit to your readers. I did not attempt to claim any credit, believing the pursuit of truth inconsistent with the pursuit of fame, and that fame is not honour when awarded at a man's measure of his deserts, but only when spontaneously conferred by his fellow thinkers. If the germ of the view published in my paper prove, as it may prove in its present or some other form, an addition to the philosophical groundwork of anatomy, Mr. Spencer may be sure that he will receive a full share of honour, if his claim is well founded; but till then, all haggling over priorities is waste of good time, which neither of us ought to be able or asked to spare from original work.

I have done myself the pleasure to read the review of Prof. Owen's theory of the skeleton, printed in the 'British and Foreign Medical and Chirurgical Review' (new ser. vol. xxii.), of which Mr. Spencer avows himself the author. And after much logical criticism, in which Prof. Owen's views are roughly handled, the review concludes with a page or two, much less logical, in which Mr. Spencer claims to have stated his discovery. So far as I can judge, the important passages in this statement are these:—

"The entire teaching of comparative osteology implies that differences in the conditions of the respective vertebræ necessitate differences in their structures."

*   *   *   *   *

"It is impossible to deny that if differences in the mechanical functions of the vertebræ involve differences in their forms, then community in their mechanical functions must involve community in their forms."

*   *   *   *   *

"...... *have* a community of function, it follows necessarily that they will have a certain general resemblance."

In my judgment, this is only another and more emphatic way of stating the coordination of structure and function which has been insisted on by Prof. Owen and other naturalists again and again. In the first passage that I have quoted all this dependence of structure on "conditions" is assumed to be true. In the second passage, assuming it to be true, it is generalized into a law. In the third passage, assuming the existence of the law, its results are assumed to be tolerably uniform.

Now I am not aware that any number of assumptions, vague ideas, or guesses will make a discovery; and if they had done so, are we not entitled to assume that the discoverer, instead of publishing it anonymously, in a few vague sentences at the end of a review in a specially professional periodical, would have avowed his great thought, and brought it prominently before naturalists who could judge of its value? especially as he is now anxious to have credit for it.

I have also had an opportunity of referring to the 'Principles of Biology;' and although Mr. Spencer insists with admirable clearness on the correlation of structure and function, and, as in the review, on the modification of structures by "incident forces," I did not notice that these "incident forces" were defined; while, so far as I could understand, Mr. Spencer confessed that he did not altogether see how their results were produced.

If this is a correct statement of Mr. Spencer's vague hypothesis, I submit that, but for the terms "pressure and tension," and "mechanical theory," our views have little in common. His appears to me to have been an idea evolved out of an intellectual consciousness of what ought to be. My view was arrived at inductively from a long investigation; and it was only when I was assured by mathematicians, chemists, physicists, and others of their willingness to cooperate in eventually demonstrating the view, that I consented to publish a sketch of my method of studying the theory of the skeleton. For it is a part of a larger system referring the phenomena of nature to their ultimate and actual physical causes, many of which in their applications to life are discussed in a book of mine shortly to be published, on "The Dynamical Geology of Great Britain."

I am, Gentlemen,

Very faithfully yours,

HARRY SEELEY.

Note on the Phenomena of Muscular Contraction in the Vorticellæ. By C. ROUGET.

Living muscles can alternately shorten and elongate themselves: this is their characteristic property. In purely elastic organs shortening only takes place after previous mechanical elongation; the muscles, on the contrary, can shorten themselves without appearing to have undergone any extension.

Whatever may be the causes of the elongation and shortening of the muscular fibres, whether these opposite states result from a mechanical extension followed by retraction, or whether they are produced apparently spontaneously, observation proves that in either case the alternate changes which the contractile organ undergoes are identical. In a muscular fibre which, after mechanical extension, returns upon itself in virtue of its elasticity, the transverse striæ change their aspect and approach each other, at the same time that the transverse diameter increases in proportion to the diminution of the length. It is exactly in the same way that the muscular fibre behaves in passing from the state of elongation corresponding with the repose of the muscle to the state of *active* shortening designated by the name of *muscular contraction*. If the essential phenomena by which muscular contraction is manifested are identical with those of the elastic contraction of muscles—if, on the other hand, the elementary structure of contractile organs appears specially adapted to the manifestations of elasticity, we may justly ask whether it is necessary to invoke, in order to explain the shortening of muscle in the state of contraction, a special property of contractility, distinct from the properties of inorganic matter.

Elasticity may become a cause of movement in two opposite conditions :—

Either the elastic body, the spiral spring, is subjected to a pressure which keeps the turns of the spiral in a forced approximation, when, on the pressure ceasing, the turns separate, the spring elongates and moves by the mere fact of its elasticity ; or the spring is subjected to a tension which elongates it by separating the turns of the spiral from each other ; on the tension ceasing, the turns approach each other, and the spring moves by shortening, without anything but elasticity coming into play.

The alternations of elongation and shortening of the elastic elements (*spiral fibrillæ*) of the muscles might therefore be explained by elasticity alone, if we demonstrated the existence either of an agent of pressure exercising its action during the period of shortening, or of an agent of extension acting during the period of elongation—the muscle elongating in the former case and shortening in the latter by the free play of elasticity the moment the action of an antagonistic force ceases to equilibrate it.

The physiological problem of muscular movement is thus brought to its most simple terms—to determine the natural form (the state of repose) of the muscular spring, the conditions which can remove it therefrom, and those to which elasticity recalls it.

There are at present two hypotheses as to the cause of muscular movement : one attributes this movement to a special property of muscular fibre, *irritability* or *contractility*, which manifests itself only in the period of activity of the muscle and produces the shortening ; the other, on the contrary, regards the shortening as the return of the muscle to a state of repose. This latter hypothesis, which supposes that, during the period of apparent inactivity of the muscle, the nerves are constantly at work to maintain the forced extension of the contractile fibres, is certainly refuted by the incontestible fact that the section of the motor nerves does not cause the contraction of the muscle, but, on the contrary, the opposite state; nevertheless it approaches the truth much more closely than the former.

The observation of the phenomena of muscular contraction is presented to us in the *Vorticellæ* in the most simple condition which it is possible to imagine. In many Invertebrata an entire muscle is often represented by a single *primitive bundle*; in the Rotifera isolated fibrillæ form so many distinct muscles. The stalk of the *Vorticella* shows us the principal organ of locomotion of an animal composed of a single muscular fibrilla free in a canal in the centre of a perfectly transparent sheath, which allows us to see, with the greatest distinctness, all the changes which the contractile element undergoes during the states of activity and repose, of elongation and contraction.

When the animal is at rest, the stalk is at its maximum of elongation, and the body as far removed as possible from the point of attachment and refuge. The vibratile cilia alone are active, the body and the stalk remain perfectly immoveable. In this state the central filament of the stalk, the contractile fibrilla, is completely extended; nevertheless it is never straight, but constantly presents a torsion in a very elongated spire, like a ribbon twisted round its longitudinal axis, and of which the appearance exactly resembles that of a spiral watch-spring fixed and strongly extended by the extremities. As soon as any mechanical, electrical, thermic, or other excitant affects the animal, this elongated spiral, suddenly contracting upon itself, becomes transformed almost instantaneously into a perfectly regular spiral spring, with very close turns, which does not measure more than one-fifth of the length of the stalk in repose, and of which the transverse diameter has proportionately increased. This state generally persists only for a short time: the turns of the spring separating, it soon elongates, rather slowly, and the animal returns to its natural position.

The shortening and elongation of the contractile organ are here manifestly due to the approximation and separation of a spiral spring; but to which of these two states belongs the action of elasticity? which of them shows us the muscular spring in its natural form, in its state of repose? Observation establishes, in the first place, this important fact—namely, that the spiral filament never appears in its extreme elongation except when the animal is alive and uninjured. As soon as the animal is killed, or detached from its stalk, spontaneously or by violence, the turns of the spiral roll themselves up like a tendril, and remain in this state for an indefinite period; the same is the case if the animal be suddenly killed by poison or by the elevation of the temperature to 104° or 113° F.

It frequently happens, even during the life of the animal, that the contractile fibrilla breaks, and the continuity is broken between it and the body, the nutritive centre of the whole animal; in this case, if the sheath be intact and continuous, the body, living and swimming by means of the vibratile cilia, drags along at its posterior part the dead contractile fibrilla rolled up like a tendril, persisting in this state of contraction, and having lost for ever the faculty of elongation.

I have several times observed that as soon as the body of a *Vorticella* detaches itself from the stalk to which it normally adheres, the contractile stem begins to execute a series of movements of rotation round the axis. Each of these movements is accompanied by the formation of a spiral turn; and when the whole of the stalk is thus converted into a close spiral, the movement ceases, and no elongation afterwards takes place.

The elongation of the spiral fibrilla, the organ of muscular movement in the *Vorticellæ*, is therefore dependent on the state of life—that is to say, on the continuity of nutrition and the exchange of materials. From the moment when nutrition is suppressed by the death of the animal, or by the separation of the fibrilla from the nutritive centre, the contractile element takes and retains the natural form inherent in its structure—that of a spiral spring, of which the turns are at the maximum of approximation in the state of repose.

The contraction of the muscular fibre of the stalk of the *Vorticella* corresponds with the state of repose of the spring; it is the immediate consequence of its elasticity; the elongation of the fibre is the result of the forced extension of the spring by a cause of movement dependent on the act of nutrition, and acting during the apparent repose of the contractile organ. As soon as the source of this antagonistic force is exhausted, elasticity, recalling the muscle to its natural form, produces the so-called movement of contraction.

Is this a phenomenon peculiar to a singular organ of locomotion, the stalk of the *Vorticella*? or is it the condition of muscular contraction in all animals?

I shall have the honour very shortly to communicate to the Academy the results of numerous experiments which I have undertaken upon muscular contraction in the higher animals, their results establishing:—

1. That a recent hypothesis, according to which permanent contraction is essentially constituted by a series of successive shocks or vibrations, is in absolute contradiction to well-observed facts.

2. That a tendency towards extreme contraction is a property inherent in living muscular fibre, a necessary consequence of its structure and elasticity.

3. That during life this tendency to contraction is combated by a cause of extension which predominates during the repose of the muscle, is developed in the exchange of nutritive materials, increases with the activity of their access, diminishes or becomes extinguished by their exhaustion, and may be momentarily suspended by all the excitants of muscular contractility—nervous action, heat, the electric shock, &c.—*Comptes Rendus*, June 3, 1867, pp. 1128–1132.

On the Regeneration of the Limbs in the Axolotl (Siren pisciformis). By J. M. Philipeaux.

On the 24th of September, 1866, I had the honour to bring before the Academy some experiments demonstrating that the limbs of the newt (*Triton cristatus*) are only regenerated when at least the basal part of these members is left in its place (that is to say, the scapula, when, as in my experiments, we have to do with the anterior limbs). It appeared to me necessary to repeat these experiments upon other animals of the same class, in order to see whether we have to do in this case with a constant fact, as, indeed, everything would lead us to suppose.

By the kindness of M. Duméril, I have had at my disposal ten Axolotls bred in the menagerie of reptiles at the Museum of Natural History. On the 4th of October, 1866, I removed the left anterior limb, including the scapula, from five of these Axolotls ; from the five others, on the same day, I amputated the right anterior limb, with scissors, at the surface of the body, consequently leaving in place not only the scapula, but also the head of the humerus.

It is now more than eight months since the operation was performed ; and it is easy to prove that it has furnished the results which I had foreseen. In the Axolotls of the first series cicatrization has taken place in the most regular manner ; but there has not yet been the least indication of any regeneration. In those of the second series, on the contrary, very soon after the operation, the cicatrix began to rise, and there was formed a projection which has gradually increased, and I was able to trace day by day the phenomena of the regeneration of the limb. Already, and indeed for a long time past, this limb has been completely reproduced, with all its normal characters of form and structure.

Thus all the experiments which I have made since I commenced studying the question of the reproduction of removed parts constantly lead me to the same conclusion. Whether we have to do with the removal of entire limbs, as in the Batrachia, or with that of more deeply seated organs, such as the spleen in the Mammalia, regeneration never takes place except when the operation has left in position, and with its normal anatomical connexion, a portion of the limbs or of the spleen. This constancy in the results already attained has encouraged me to try other experiments, the results of which I will hereafter communicate to the Academy.—*Comptes Rendus*, June 10, 1867, p. 1204.

On the Development of the Brown Aphis of the Maple. By MM. Balbiani and Signoret.

The facts recently observed by M. Dareste in the evolution of the common fowl, and the deductions which he has drawn from them with regard to the production of races in animals, with the conclusive analogous examples in plants made known by M. Naudin, demonstrate that, in both kingdoms, certain anomalies of development may be the starting-point of peculiar races. The following observation proves not only that simple races are produced in this manner, but that forms described as species, or even as actual genera, sometimes acknowledge no other origin.

In 1852 an English naturalist, Mr. J. Thornton, indicated, under the name of *Phyllophorus testudinatus,* an Hemipterous insect which he had found on the leaves of the common maple (*Acer campestre*), and which he regarded as the larva of an undetermined species of *Aphis*. Subsequently, in 1858, Mr. Lane Clark also observed it, and placed it, under the name of *Chelymorpha phyllophora,* in a genus intermediate between the *Aphididæ* and the *Coccidæ*. Lastly, in 1862, M. van der Hoeven, of Leyden, described it, also as a new genus, replacing the generic names *Phyllophorus* and *Chelymorpha* by that of *Periphyllus,* the other names being previously employed to designate other genera of insects; and our Hemipteron received from the illustrious Dutch naturalist the name of *P. testudo*. Like Mr. Thornton, M. van der Hoeven regarded it as the larva of an *Aphis* of which the adult form was still unknown.

These brief historical indications form a summary of all that was known about this insect when we on our part undertook some investigations upon it, the results of which we now propose to communicate. We first ascertained that, far from constituting a new genus or even a distinct species, the *Periphyllus* is really nothing but the larva of one of the known species of Aphides which live on the maple —namely, *Aphis aceris,* a brown species which is to be met with during a great part of the year upon the leaves and at the extremities of the young shoots of that tree. But, at the same time that we ascertained this fact, we were set on the track of a most unexpected discovery, constituting a new and very remarkable peculiarity in the development of the animals of this group, already presenting such curious phenomena in connexion with their reproduction.

This was the faculty, become transmissible to all the generations of a particular species, of engendering two kinds of individuals—one normal, the other abnormal—of which the former alone, after their birth, continue the course of their development, and become capable of reproducing the species; whilst the latter retain throughout their existence the form which they possessed on coming into the world, and appear to be incapable of propagating. Moreover these two categories of individuals present such marked characters that, without having watched their birth, and being thus convinced that they are really produced by identical females, and sometimes even by one and the same mother, one would inevitably consider them to belong to two species, nay even to two completely different genera. Now one of these is nothing but the *Periphyllus* mentioned at the commencement of this note as having been described by the authors who had observed it as a separate genus in the family of the Aphides.

Such is, in summary, the singular observation that we have made upon *Aphis aceris*. We may now give some fuller details upon each of the two kinds of individuals of which this species is composed.

When we examine with the naked eye or with a lens the embryos of the brown Aphis of the maple at the moment of their being produced by the females, or after opening the bodies of the latter, we see at once that all of them have not the same coloration. In some they are of a tolerably bright green, whilst in others their colour is more or less brownish or greenish brown. The brown embryos present no peculiarities, and only differ from their mothers by characters analogous to those which are remarked in all species of Aphides between the newly born young individuals and the adult females. As in these latter, their bodies and appendages are furnished with rather long simple hairs, and, like all young Aphides at the moment of their birth, they already contain rudiments of embryos in the interior of their generative apparatus. If, on the other hand, we examine the green embryos, we at once detect, besides their peculiar coloration, very marked differences between them and their brown congeners. The various parts of the body and limbs do not present the same conformation as in the latter, but one is especially struck by the extraordinary development and the unusual appearance of their tegumentary system. Thus their surface is no longer furnished only with simple hairs, but also and principally with scaly transparent lamellæ, more or less rounded or oblong, and traversed by divergent and ramified nervures. These lamellæ occupy especially the anterior margin of the head, the first joint of the antennæ (which is very stout and protuberant), the outer edge of the tibiæ of the two anterior pairs of legs, and the lateral and posterior margins of the abdomen. Moreover the whole dorsal surface of the latter and of the last thoracic segment is covered with a design having the aspect of a mosaic composed of hexagonal compartments, and which is not without analogy to the pattern formed by the scaly-plates of the carapace of tortoises. These peculiarities give our insect a great elegance of appearance, which causes it to be much in request with the amateurs of the microscope in England, where it is commonly known under the name of the "leaf-insect." The entire animal is strongly flattened, and resembles a small scale applied to the surface of the leaf upon which it reposes, and on which it requires a certain amount of care to detect it.

Another remarkable character of these abnormal individuals of *Aphis aceris* is the rudimentary state of their generative apparatus. This is reduced to a few groups of small pale and scarcely visible cells, none of which arrives at maturity to become transformed into an embryo; and it retains this character as long as it is possible to observe the animal. The functions of nutrition, also, are performed in them in a very unenergetic manner; for from the moment of their birth until that at which we cease to observe them, they increase but little in size, attaining scarcely 1 millimetre. They undergo no change of skin, never acquire wings like the reproductive individuals, and their antennæ always retain the five joints which they present in all young Aphides before the first moult. Nevertheless they possess a well-developed rostrum and an intestinal canal, the peristaltic contractions of which we have distinctly observed. In short, although we have observed them for several months (that is to say, from May to November), no change in their condition was ascertained; and they disappeared with the leaves which bear them, without its being possible to ascertain what becomes of them subsequently.

The question naturally arose, What was the signification of these abnormal individuals of the *Aphis* of the maple, and what part did they fulfil in the reproductive functions of the species to which they belong? They are evidently not males, since their generative apparatus retains the same rudimentary form at whatever epoch we examine them. Moreover in no known species of *Aphis* are the males produced at the same time as the viviparous individuals, which are not the true females of the species. There is therefore no other alternative but to regard them as a modification of the specific type constantly reproduced with the same characters by the successive normal generations. Our abnormal Aphides are indeed deprived of the faculty of reproduction, either by sexual generation or in any other manner; but after the observations of M. H. Landois upon the law of sexual development in insects, we know that in them the sexes depend simply upon the conditions of alimentation of the larva. Because, in the present state of things, these conditions have not yet occurred for one of the two sorts of larvæ of *Aphis aceris*, there is no reason for our concluding that they may not some day be realized; and by thus acquiring, with the attributes of the sexes, the faculty of propagating directly in an indefinite manner, these abnormal individuals will become in their turn the origin of a new species produced by deviation from an anterior specific type.—*Comptes Rendus*, June 17, 1867, pp. 1259–1262.

Cervus megaceros *previously known in the Fens.*

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—If Mr. Norman Moore will turn to pp. 466–467 of Prof. Owen's 'British Fossil Mammals,' he will find it recorded more than twenty years ago that "remains of the *Megaceros* found eight and a half feet below the surface of the peat-bog at Hilgay, Norfolk, are preserved in the collection of Mr. Whickham Flower, F.G.S." Various specimens have come under my notice in the last five or six years; and these facts I have recorded, by enumerating the species as one of the peat-fauna mammals, in the 'Geological Magazine' for November 1866, and in the 'Quarterly Journal of the Geological Society' for the same date.

I remain yours, &c.
H. Seeley.

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[THIRD SERIES.]

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XX.—*On Venomous Fishes.* By M. Auguste Duméril*.

There are numerous instances on record of poisoning due to the use of certain fishes as food: the manner in which such venomous properties are acquired has long been matter of research.

Causes of the Poisonous effects produced by the Flesh of Fishes.

I.

It is evident that the nature of the waters in which they live must exercise a considerable influence upon the qualities of the flesh.

A. Waters in which textile plants have been allowed to rot, or in which carcasses have become decomposed—all such, in fact, as have been corrupted by the presence of matter in a state of putrefaction will be capable of rendering unfit for food any fish which may inhabit them. This was the case with the waters of the Loire in 1794, when, on account of the number of persons drowned at Nantes, the police were obliged to forbid not only drinking of the river, but even fishing in it.

B. Another source of such taint is to be apprehended from the discharge of the refuse of different manufactures into the waters.

II.

Herrings, both salted and smoked, sometimes occasion accidents of this kind, when, from long keeping, the ingredients employed in their preservation have lost their efficacy.

Sometimes deleterious effects are to be traced to the imperfect or bad curing of such fish. In other cases of this nature the

* Translated, from the 'Annales de la Soc. Linnéenne du Département de Maine-et-Loire,' 8[me] année, 1866, by Arthur W. E. O'Shaughnessy.

accident is mainly due to *idiosyncrasy* or some peculiar condition of the stomach, by which certain aliments, generally easy of digestion, become a sort of poison.

III.

The supposition has been put forward that the noxious properties of various fishes are dependent on circumstances connected with their aliment.

Thus Munier, in a letter to Sonnerat (Journal de Physique, 1774, t. iii. p. 129), says that in Bourbon and Mauritius, between December and March, or even April, none of the *Scari* which he calls "Vieille" and "Perroquet" (the precise determination of which, as Valenciennes has remarked*, is uncertain) are eaten. They are then regarded with mistrust, because, during the season when the coral is growing, they eat great quantities of the animal which constructs it.

According to Munier, the causticity of the juices of their prey is the only cause of their baneful properties.

Commerson, in his manuscripts, says, speaking of the "Cataubleue" (*Scarus capitaneus,* Cuv. et Val. t. xiv. p. 230), that this species, like its congeners, gnaws the coral, and is consequently looked upon with suspicion in both the Ile-de-France and Bourbon.

M. Dussumier, in the MS. catalogues accompanying the fishes brought by him from the Indian seas (Val. Hist. Poiss. t. xiv. p. 252), has noted that the inhabitants of Bombay regard with mistrust another *Scarus* (*Sc. harid*), its flesh being reputed dangerous when it has fed upon corals.

Certain Annelides of the northern seas, hitherto ill-determined, are sometimes so abundant as to give a red tint to the water. They are eaten by the herrings, and are thought to be capable of communicating hurtful properties to their flesh (Cuv. et Val. Hist. Poiss. t. xx. p. 71).

In Duhamel's 'Traité des Pêches' (2e partie, sect. iii. p. 549) are some remarks by Barbotteau relative to the sardine of the Antilles (*Harengula humeralis,* Cuv. et Val.). This fish is said to have a baneful effect, occasioning fevers, and often even death, when it has been taken in the vicinity of copper or has fed on the zoophytes named "Men-of-war" (*Physalia*). It is worthy of notice that Lherminier, who resided for a long time in Guadeloupe, observed it to be venomous in all seasons, and, indeed, to such an extent as to cause death in a few minutes.

The fish named *Courpata* at Nice, and which Risso has made the type of the genus *Tetragonura,* cannot be eaten. That

* Cuv. et Val. Hist. d. Poiss. t. xiv. pp. 237 & 238.

naturalist experienced the extent of its unwholesomeness by many very serious accidents. He says (Ichth. de Nice, p. 350) that its pernicious qualities arise from its feeding on a species of Medusa common in the Mediterranean, and belonging to the genus *Stephanomia,* which possesses acrid and irritating properties to an extreme degree. Valenciennes remarks with reason upon the strangeness of the fact that the internal membrane of the digestive tube of the fish may be brought into contact with so caustic a substance (the pernicious qualities of which are by no means destroyed by such contact, since they are capable of being communicated afterwards) without any ill effect upon the organs of the animal itself.

In many cases, then, such poisoning may be attributed to the kind of food which the fish partakes of: we cannot, however, consider this to be the sole cause. There are, in fact, venomous species where no polypes are to be found; and, on the other hand, some which are caught in islands like Marie-Galante, surrounded by these aggregated zoophytes, are not more dangerous than those from other quarters. Further, if such fishes do indeed, as is reported, retain the odour of the coral, it is not always because they have eaten of it, but merely from their having existed in its vicinity.

I must not here omit to mention the experiments made by Moreau de Jonnès with a view to obtaining light upon this subject. He placed in a basin occupied by species of fish which are considered capable of becoming venomous some *Aplysiæ,* sea-stars, medusæ, and portions of polypes; he found that this food was exceedingly repulsive to them, and that, after a long time, although having no other sort of nourishment, they had left them altogether intact. M. Moreau de Jonnès then forced them to eat a considerable quantity of the acrid substance of these animals, mixing and disguising it in farinaceous paste; and, thus involuntarily nourished upon that which they had previously rejected, they caused no sort of ill effect when eaten at table*.

Amongst the substances from feeding upon which fishes are supposed to derive their baneful properties, are the fruits of the Manchineel (*Hippomane mancinella,* Linn.), which are held in great dread in the Antilles; however, as M. Moreau de Jonnès

* Are the poisonous qualities of certain fishes of the Antilles attributable to their preying upon the abundant and much-dreaded *Meletta thrissa,* Val.? Ferguson ("On the Poisonous Fishes of the Caribbee Islands," in Trans. Roy. Soc. Edinburgh, 1821, t. ix. p. 76) supports this notion. He says that, in localities where this Meletta abounds, accidents are more frequent; while they are almost unknown in those portions of the Antilles where it is rare.

asks, in his memoir already cited (pp. 19–26), is it ascertained that fishes really eat these fruits? Searching in their digestive organs with the utmost care, during his stay in Martinique, for the nuts of this euphorbiaceous fruit (the monospermic cells of which are rendered so remarkable by their minute pointed and sharp apophyses), he never succeeded in finding any. Judging, moreover, from the great quantities of these fruits which find their way into the sea, the margin of which is often covered with them, would not such accidents, resulting from the consumption of fish caught in such waters, be even more frequent than they are?

IV.

In some countries it is customary to cast noxious plants into the water, in order to render the fisheries more rapid and abundant. The fish, coming in crowds to the surface to die, are taken without difficulty in considerable numbers in a very short space of time. Many procedures of this kind are to be severely condemned as really capable of rendering the fishes poisonous. The fruits of the *Cocculus suberosus,* and many shrubs of the same genus confounded under the common name of "Coque du Levant," are more particularly employed for this purpose. The Indians bruise them, mix them with a species of crab, and make them into pellets of the size of a cherry, which the animals take with great avidity. The effect is very immediate.

M. P. F. G. Boullay, in a dissertation on the natural and chemical history of the "Coque du Levant," published in 1818, made known the use of this substance as the basis of several receipts current in Europe. Fish taken with the aid of such a bait putrefy very readily, and, if not cooked or prepared immediately, may become venomous, as shown by the experiments of M. Goupil de Nemours, who caused certain animals to eat the flesh of fishes poisoned with this substance (Bullet. Fac. de Méd. de Paris et de la Soc. établie dans son sein, t. i. 1807, p. 143).

I ought, however, to observe that there must still remain some uncertainty as to the reality of the accidents attributed to the use of such as food, since the "Coque du Levant" is frequently employed in India in fisheries whose product is intended for consumption.

A further example of the innocuousness of fishes subjected to the influence of certain poisonous plants is furnished by M. de Castelnau (Voy. dans les parties centr. de l'Amér. du Sud, 1855, Paris, pp. vi–viii). An extremely plentiful supply of fishes having been obtained on the great lake near the Rio Sarayacu, in the Missions of the Ucayale, by means of the poison residing in the stems of the Barbasco or Necklace-wood (*Jacquinia armil-*

laris, Linn.), these, after rapidly undergoing the destructive influences of the plant, were eaten without ill effect, and the natives even drank the waters of the lake with impunity*.

V.

Among the causes of the unwholesomeness of certain species we should perhaps mention, as exercising some influence on their qualities, the age and, by consequence, the size of the fish; for the most venomous may generally be submitted to culinary preparation while they are still young. The accuracy of this statement, which might seem somewhat singular, is attested by the fact that, at Havana, it is not forbidden to expose for sale in the market the *Caranx fallax,* Cuv. & Val., unless it weighs more than one kilogramme. In the island of Trinidad, as Dr. J. Court, who practised medicine there for some time, informs me, the Becuna or *Sphyræna* may be eaten with impunity if still of small size. He adds that the same rule applies to all the fishes held to be venomous: when they have not attained their full dimensions, there is nothing to dread from using them as food. The natives of Hayti hold the same opinion with respect to a *Serranus* (*S. rupestris,* Cuv. & Val.), there commonly called 'Grande gueule,' and designated also by the English name of Rock-fish. This fish may attain a length of $0^{m}{\cdot}80$; but when

* M. Mouchon, junr. (Journal de Méd. prat. de Bordeaux, 2e sér. 1840, t. xii. p. 152) gives two lists of plants which are known to be employed as such auxiliaries in the capture of fishes. These lists have been reproduced by MM. A. Chevallier and Duchesne (Mém. sur les Empoisonnements par les Huîtres . . . et par certains Poissons, p. 59; Ann. d'Hyg. et Méd. Lég., 1851, t. xlv.):—

I. Plants that are baneful in effect upon the human species, particularly if the precaution be not taken of well clearing and scraping the fish before preparing it for food:—1. *Cocculus suberosus,* DeCand., Coque du Levant: *the fruits.* 2. *Delphinium staphisagria,* Linn.: *the seeds.* 3. *D. Requienii,* DeCand.: *the seeds.* 4. *Hydnocarpus inebrians,* Vahl: *the fruit.* 5. *Menispermum lacunosum,* Lamarck: *the fruit.* 6. *Taxus baccata,* Linn.: *the leaves.* 7. *Veratrum sabadilla,* Retzius: *the capsules.*

II. Plants that are not hurtful to man:—1. *Barringtonia speciosa,* Rumphius, *Butonica speciosa,* Lam.: the *almonds* eaten by the Chinese sailors under the name of "square caps." 2. *Calophyllum inophyllum,* Lam.: affords the "Calaba" balm used for poisoning fishes. 3. *Cerbera ahouai,* Lam.: *the wood.* 4. *Daphne fœtida,* Lam.: *the seeds.* 5. *Euphorbia cotinifolia,* Linn.: *the entire plant.* 6. *Galega sericea,* Thunb.: *the root.* 7. *G. toxicaria,* Sw.: *the leaves.* 8. *Lepidium piscidium,* Forster: *the leaves and the seeds.* 9. *Paullinia pinnata,* Linn.: *the seeds.* 10. *P. triternata,* Linn., *Serjania lethalis,* St. Hil., "Liane à persil," "Timbo" of Brazil: *the leaves.* 11. *Phyllanthus brasiliensis,* Lam., *P. conami,* Wild., Poison-wood: *the twigs with leaves and the roots bruised.* 12. *P. virosus,* Roxburgh: *the shoots and leaves pounded.* 13. *Piscidia carthaginensis,* Linn.: *twigs and foliage crushed together.* 14. *Potalia amara,* Aublet: *the stems and leaves.* 15. *Robinia nicou,* Aubl., or *R. scandens,* Wilden.

of this size, it is dreaded as often proving poisonous (MS. note by Plée in Cuv. & Val. t. ix. p. 440); and Thomas (of Salisbury) (Traité Méd. Prat., translated by H. Cloquet, t. ii. p. 648) says that all fishes exceeding the average dimensions are regarded with mistrust by the fishermen.

VI.

The baneful properties would seem to be developed diversely, according to the season of the year. Thus, in the Loyalty Islands, as M. Jouan, captain of a frigate, has observed in a notice published by him relative to these islands (Mém. de la Soc. Impér. des Sc. Nat. de Cherbourg, t. xvii.), many species are dangerous, and even deadly, according to the time of the year at which they may have been taken. It often occurs, he says, that the natives poison themselves by partaking of fishes which at other seasons have been eaten with perfect impunity.

In the Antilles many fishes, as the 'Petit Nègre' (*Serranus nigriculus*, C. & V.) and others, should be avoided at certain periods of the year, in the same way that we cease to take oysters during the season of their reproduction.

It is, indeed, at the time of spawning that we observe such species to become dangerous. The Conger or sea-eel, for instance, will occasion dysentery at the time of depositing its ova (Risso, Ichth. de Nice, p. 93).

It is further known that the ova of the pike, barbel, and burbot are very efficient purgatives; and these fishes have more than once, when taken in the act of spawning, caused accidents due to the precaution having been omitted of completely clearing away both the organs and products of generation. Dr. Franque has published a curious observation relative to effects experienced by four persons who had eaten the ova of the barbel, while others, who had rejected the ova but partaken of the flesh of the fish, felt no ill consequence (Journ. für Kinderkrankheiten, & Gaz. Méd. 1859, p. 526).

VII.

To the different causes already enumerated we must now add, as holding an important place in the ætiology of this subject, such alteration as may supervene in the tissues, and more particularly in the flesh. How, in fact, otherwise shall we explain many very serious cases in which food, mode of capture, and such changes as are dependent upon age and season of the year have nothing to do with the effects produced?

Sometimes there is no cause whatever for apprehension; sometimes, on the contrary, results would justify any amount of previous mistrust and circumspection. Thus the Becuna of the

Antilles (*Sphyræna becuna,* Lacép.), which is a very savoury fish, is, however, eaten with considerable caution, on account of its often proving venomous; but when the roots of the teeth are not black, according to M. Poey's remark (Cuv. & Val. t. iii. p. 341), or when a silver spoon or coin, placed in the vessel in which the fish is being cooked, does not become blackened, the flesh may be eaten without fear *.

In the same category must be ranged the great *Sphyræna* (*S. barracuda,* Cuv. & Val.), sometimes named *Esox barracuda,* on account of its resemblance to the pike, both as regards its general form and the quality of its flesh. It is very often poisonous; and the tests employed are the same as in the case of the Becuna, a peculiar bitterness of the liver, however, being an additional sign in the case of this fish.

There is a belief in the Antilles that this fish becomes poisonous as a consequence of certain conditions of alimentation. However, according to MS. observations of Plée, reproduced by Cuvier (Hist. Poiss. t. iii. p. 346), "its venomous properties are due to a particular condition of the individual, which would seem to recur at different periods."

"If, on cutting it, a white watery fluid or matter, which is a certain sign of malady, be not seen to issue," it may be eaten with perfect safety.

"When salted," adds Plée, "it never produces any ill effects. At Ste. Croix it is customary to defer eating it until the day after that on which it has been subjected to the action of the salt."

Dr. Guyon, Sanitary Inspector of troops at Martinique, has expressed an opinion similar to that of Plée, in a MS. memoir which he has kindly communicated to me, and of which the 'Comptes Rendus Ac. Sc.' 1856, t. xlii. p. 340, have given only an extract referring to the symptoms attending the phenomena of poisoning. According to him, the real cause is a commencement of decay in the flesh of the fish.

Knowing the rapidity with which, in hot climates, a certain modification of tissue, not actually amounting to putrefaction, will set in (some species being, no doubt from various causes at present hidden from us, more particularly exposed to such modification than others), we can easily understand that such dire results should so frequently occur.

In support of this opinion, which I also share, M. Guyon alleges the following facts:—

* Thomas (*loc. cit.* p. 648) says, however, that implicit confidence is not to be placed in this as a preventive measure. He says that a surer method is that of giving to a duck, a cat, or a dog the intestines of the fish, which may be eaten with perfect security if, after an hour or two, no accident shall have happened to the animal.

1. The mackerel taken at St. Helena is, according to Quarrier, constantly poisonous if kept for a single night; if prepared, however, on the same day on which it is caught, it is not so.

2. The inhabitants of the Antilles say that the Bonito should be dressed for the table as soon as it is taken from the water*.

3. The Chinese eat the *Tetraodon ocellatus,* one of their best fishes, as soon as it is captured†.

4. The instances of poisoning belong almost exclusively to countries where the temperature is very high, and more especially to the great heats of the year—that is to say, when decomposition is most rapid.

5. Finally, it is to a phenomenon of this sort that we must attribute the change of colour which takes place on a silver spoon plunged into the vessel in which the fish is being cooked, black sulphuret of silver being formed as a consequence of the liberation of sulphuretted hydrogen, which is a sure indication of a decay of tissue.

VIII.

In fishes that are thus baneful, it is perhaps sometimes a condition of disease which alters the natural qualities.

IX.

I pass over in silence the *rôle* attributed to copperas-beds in certain marine bottoms. In the already cited memoir by M. Moreau de Jonnès (pp. 14–19) there are some remarks of sufficient weight, tending to demonstrate the impossibility of accepting the hypotheses which have been put forward on this subject.

In conclusion, it is evidently not proper to adopt any one of

* The necessity of eating this fish without delay has often been remarked; but an instance of the danger incurred by neglecting to do so is given in a memoir by M. Morvan de Lannilis (Journ. de Chim. Méd., Pharm., Toxicol., rédigé par A. Chevallier, 4e série, t. iii. p. 719, 1857), who relates that five persons, having experienced no ill effects after eating, on board the corvette 'Corneline,' at Teneriffe, some Bonitos freshly caught, suffered severely for an hour or two on the following day for having breakfasted on some of those reserved over night. M. Guyon witnessed at Martinique, in 1822, a case of poisoning which, though not mortal, disturbed the health of an entire company of soldiers for several hours most fearfully. The repast, which took place at 3 o'clock P.M., consisted of Bonitos bought in the afternoon of the preceding day, and supposed to have been taken in the morning of that day. Thus the thirty hours since the fish were first captured sufficed for a most considerable alteration in their condition.

† According to Forster, this is the fish eaten by the Japanese when they wish to commit suicide.

the foregoing explanations of these phenomena to the exclusion of the others. We have, in fact, seen that several of them are entitled to equal consideration. Further, in spite of what has been hitherto asserted, such poisonous action is not to be attributed to any poison of a particular nature, *sui generis.* There is, in fact, no known ichthyic venom*.

Enumeration of such Fishes as are known to be poisonous.

1. Of these there is certainly none more to be dreaded than the *Clupea* known by the name of "Cailleu-tassard" in the French colonies of the Antilles, and by that of "yellow-bill sprat" in the English colonies of the same islands (*Meletta thrissa,* Val.). I have already mentioned it when speaking of the opinion expressed by Ferguson that fishes acquire poisonous properties merely through having fed upon the 'Cailleu-tassard.' Making allowance for the exaggeration of this statement, we may nevertheless regard the poison residing in the flesh of various species as due to the influence of this *Meletta,* which is indeed venomous to an almost incredible degree, as attested by Rob. Thomas (of Salisbury), who practised the medical profession in these colonies. He relates that this fish has, in several instances, been known to occasion death, with frightful convulsions, in the space of half an hour (Nouv. Traité de Méd. Prat., transl. by Hipp. Cloquet, t. ii. p. 641). Death, prompt and certain, he says, is the consequence of a repast composed of this fish (p. 642)†.

2. Another *Meletta,* proper to the Indian seas (*M. venenosa,* Val.), is almost equally formidable. It is probably to this species that Capt. Jouan refers in a letter to me, dated 1861, from Port de France (New Caledonia), where he says the "Sardines," as they are vulgarly called, are nearly always poisonous‡.

* Hipp. Cloquet, in the Dict. d. Sc. Nat. t. xxii. p. 550 *et seq.*, has treated the present subject under the above title; but he has made use of this expression merely to designate poisonous effects produced by the alimentary use of different species, without connecting them with any special venomous properties residing in their flesh.

[It may be as well to call attention to Dr. Günther's discovery of a poison-organ in a Batrachoid fish (Proc. Zool. Soc. 1864, p. 155).—Tr.]

† Can it be true, as, indeed, the negro fishermen of Guadeloupe informed W. Ferguson ("On Poisonous Fishes of the Carribbee Islands," Trans. Roy. Soc. Edinb. 1821, t. ix. p. 69), that the 'Cailleu-tassard' is never venomous when taken in the Bay of La Basse-terre, even at the season when it is more particularly dangerous out of that bay, though at a very slight distance and along with other *Clupeæ* which cause no ill effects whatever?

‡ He informs me, in another letter, that many fearful and sudden accidents, occurring after the occupation of New Caledonia, caused several of the fishes of its coast to be regarded with suspicion. He asserts that their

3. In 1853, Dr. Pappe (Synopsis of the Edible Fishes of the Cape of Good Hope, p. 7 *et seq.*) drew attention to some serious accidents occasioned by the use as food of a *Tetraodon* which he referred to the *T. Honkenyi* of Bloch. This creature, he says, is the terror of the fishermen and inhabitants of the Cape. Many cases of death are cited as having been caused by it in the colony. Thus, at a period already remote, in the time of the war, when Muizenburg and its environs was occupied by the English troops, some soldiers perished from having imprudently eaten of this fish. In 1856 a ship-boy belonging to a Danish trading-ship, in 1845 two sailors attached to a Dutch vessel then at anchor in the Bay of Simon, and in 1846 a man belonging to the French corvette 'Oise' underwent a similar fate.

By reason of the frequency of these occurrences, Dr. Pappe expresses wonder that Government has not, with a view to preventing them, inserted amongst the regulations of the port an absolute interdiction of the use of so formidable a species.

4. In 1858, M. Fonssagrives, Physician in Chief to the Marine and Professor at the Faculty of Medicine at Montpellier, completed, with the aid of documents furnished by Dr. Praeger, the remarks and observations relative to poisonous fishes commenced in his 'Traité d'Hygiène Navale;' he calls particular attention to the external characters of the Spotted Tetraodon (*Geneion maculatum*, Bibr.). So frequent are the accidents caused by it, that ships anchoring at the Cape are now warned against it by the local authority (Bull. Acad. Méd. t. xxiii. p. 1059).

Thus the desire of Dr. Pappe relative to administrative measures has been realized in the colony.

To such instances as we have already cited Dr. Praeger has added another—that of two sailors in the Dutch brig 'Postillon,' who, in 1845, succumbed to the baneful influence of this fish, one of them having eaten only the liver.

Other Tetraodons undoubtedly produce similar effects. There is one in New Caledonia, not designated specifically, which is particularly terrible, since Captain Jouan (*loc. cit.* p. 8) has seen 5 *grammes* of its flesh occasion the death of a pig with dreadful convulsions.

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dangerous properties are due to their feeding on medusæ and polypes, and more especially on the coral when it is "in flower."

A very grave instance of poisoning, fatal in the case of three of the persons, had occurred previously at Port Balade (New Caledonia), in 1852, the parties concerned being sailors belonging to the corvette 'Catinat,' who had eaten of the venomous Meletta. A very particular account of this case has been given by M. Lacroix, surgeon-major to the corvette. (Revue Coloniale, 2e série, Mars 1856, pp. 257–265.)

5. A fish of the same family, of which, however, the lower jaw differs from the same in *Tetraodon* by presenting only a single dentary piece (the *Diodon orbiculare*), produces death, as attested by M. Moreau de Jonnès at Martinique, either immediately or after two months of suffering.

6 & 7. As formidable in the order Plectognathi, we may cite many *Balistes*, and in particular that called 'Vieille' (*B. vetula*, Bl.), and the 'Coffre cornu' (*Ostracion cornutus*).

8, 9, 10, 11, & 12. After the Becuna (*Sphyræna becuna*, Lacép., Cuv. & Val. t. iii. p. 340) and the great *Sphyræna* (*S. barracuda*, Cuv. & Val. t. iii. p. 343), I would also indicate the false *Caranx* (*C. fallax*, Cuv. & Val. t. ix. p. 95), the *Scarus* called 'Cataubleue' in Mauritius (*Sc. capitaneus*, Cuv. & Val. t. xiv. p. 228, pl. 403), and the *Lachnolæmus caninus* (Cuv. & Val. t. xiii. p. 288).

It is to one or other of these species that the accidents mentioned in a journal of Nov. 23, 1855, must be attributed:—

An American whaler, starting from Boston, in March 1854, for the Pacific, stopped to take in water at the islands of Juan Fernandez, situated at about 700 kilometres from Chili, to which they belong. During some hours of leisure the men took to fishing; and at night, when the anchor was raised, more than 200 kilogrammes of fish had been taken. Among many species, those commonly called by the sailors 'Carangue,' 'Capitaine,' and 'Vieille' &c. were remarked. The greater number were cooked for the men's supper, the officers distributing also a ration of arrack.

But a few hours elapsed after this repast before forty-two of the men out of the fifty-seven who formed the company of the ship were seized with dizziness, pains in the belly, nausea, and repeated vomitings. The pains in the intestines became intermittent, and were followed by prostration and a state of coma, which, after eleven hours of atrocious suffering, terminated in the death of thirty-four of the sailors, in spite of every attention and solicitude. The recovery of the remaining eight was very slow, and accompanied by pains and burnings in the limbs, pealing off of the skin, paralysis of part of the body (and, in the case of some, of all the members) for a longer or shorter time—eight days and a half with some, five days with the rest. The differences were evidently due to the quality of the various kinds of food which had been taken, and to the constitution of the individuals.

Of the fifteen who continued healthy, four suffered only from severe colics accompanied by pains in the stomach and followed by a dysentery which lasted not longer than two or three days.

The evening repast of the captain, mate, surgeon, and other officers was already over when the bell called the men to supper; and a reserve of the products of the fishery had been appropriated for their breakfast on the morrow: to this circumstance they owed their safety.

13–16. I have already made known the serious consequences which sometimes attend the introduction into the digestive passages of the flesh of the Bonito (*Thynnus pelamys*) when not dressed immediately after it has been taken from the water. This is not the only Scomberoid which should be used with caution. Thus the 'Tassard guarapucu' (*Cybium caballa*, Cuv. & Val. t. viii. p. 188) is indicated by Plée as being sometimes poisonous. Ferguson ("On Poisonous Fishes of the Carribbee Islands," Trans. Roy. Soc. Edinb. 1821, t. ix. p. 66) has given an account of a case of poisoning which occurred at St. Domingo, in the house of the Quartermaster-General, when every one present had partaken of a fine individual of this species. Each person was variously affected, according to the quantity taken. The negro cook died; and the wife of the Quarter-master, having dined almost exclusively on the fish, experienced the effects of the poison for several months.

The species of *Caranx* called *C. Plumieri*, Cuv. & Val. t. ix. p. 65, which is very similar to the mackerel in taste, and must not be confounded with the false Caranx (*C. fallax*) already spoken of as being always dangerous food, is also at times productive of harm. This is indicated by the bones displaying a red hue; and, according to Lherminier, the venomous property is then so virulent that the fish is used as a poisoned bait for rats. There is, in fact, no species of this family, even to the tunny (*Thynnus vulgaris*, so prized for the excellent quality of its flesh in all parts of the Mediterranean), which should not be subjected to strict scrutiny before being offered for sale; for there are on record various instances of persons suffering more or less severely from having eaten of this fish too long after its capture. M. de Martens, in the account of his Voyage to Venice (t. ii. pp. 432 & 433), relates the prudent administrative measures which, in that city, restrict the sale of the tunny to within four-and-twenty hours after its capture.

17 & 18. Among the Clupeidæ, the Anchovy of the Indian seas (named *Engraulis bœlama*, Cuv. & Val., or Anchovy of Forskål), like the *Meletta venenosa* already cited as an original inhabitant of those seas, is not less formidable than this latter species, when, in preparing it, the precaution of taking away the head and intestines has been neglected. M. Dussumier, in his Catalogue, says that one only of these anchovies will cause the death of a man.

To this list of fishes which are poisonous others might certainly be added; but the scientific determination of many is at present so uncertain that the mere mention of them would be of very little utility.

Accidents occasioned by the use of poisonous kinds of Fishes.

The preceding details have made known some of the symptoms of this species of poisoning. Their similarity in every case is remarkable. Many of them, it is true, especially those which characterize more properly the graver stages of functional affection, may be absent when the result is not destined to be fatal; but these symptoms, variable in their intensity, are constantly the same.

First of all supervenes dizziness, obscuring of the vision, and giddiness. To these feelings are constantly added palpitation of the heart, and a sensation of weight and heat in the stomach and entire abdomen. At the same time the pulse becomes slower and feebler, and the patient is soon obliged to resort to a horizontal position. Then commence the urticary symptoms so commonly attendant upon poisoning by means of mussels, and the essential character of which is the appearance on the face and on different parts of the body of numerous slight elevations, red or white blotches of irregular form and variable dimensions, resembling the blisters produced by the sting of nettles, and surrounded by a ring of matter of an almost crimson hue. The palms of the hands and soles of the feet are more particularly the seat of a sensation of burning, the concomitant of eruption. This is accompanied, according to the testimony of Thomas (of Salisbury) (Traité Méd. Prat., transl. by H. Cloquet, t. ii. p. 643), by a tingling of the hands when these are immersed in water—a certain indication, as he remarks, of the true nature of the malady.

The sensation of tingling was the culminating symptom of a case of poisoning observed by M. Gasquet, and of which Dr. Roux, junr., of Brignoles, furnished an account to the Société Imp. de Médecine de Marseille, prefacing the same by certain remarks on the poisonous properties of fishes (Bull. des Trav. of that Society, 1860, pp. 97–116*). "The palms of the hands and soles of the feet," says M. Gasquet, "were the seat of pains such as might be produced by the points of needles heated in flame. This tingling, which was unaccompanied by any redness or swelling, occasioned a continual agitation in the seven men who were under the influence of the poison: they could not remain at rest; and the least touch or the effort of walking caused

* The fish in this instance was a percoid, the species of which has not been ascertained.

acute agony, drawing cries from the patients. These sensations were so lasting that the sailors, when already in a satisfactory state and restored to their avocations, experienced them still, though in a modified degree. Later these gave place to a singular diminution of the sensibility: the impression produced by the resistance of the ground and the physical qualities of objects held in the hand were very imperfect, and repeated application of both touch and pressure became necessary to render them complete." Thus, as M. Gasquet remarks, the poison-principle had produced a sort of sideration of the nervous system. Perfect sensibility of touch did not return for a month after.

The urticary symptom extends also to the surface of the buccal mucous membrane. There are often pains in the limbs, and particularly at the articulations, where a considerable swelling is sometimes apparent.

When the case is not destined to prove fatal, a few vomitings will clear the digestive organs, whence Epsom salts will cause the ejection of various matters in a liquid form and commonly of a fetid odour. On the other hand, existence is generally seriously compromised when very frequent evacuations, attended by tenesmus and violent pains in the entrails and involuntary emission of urine, take place. Nevertheless these symptoms are not always precursors of death, even when they have been very intense during several hours. The condition of convulsion is a very troublesome complication; and during its continuance life may perhaps be arrested suddenly and rapidly; or, on the contrary, as in the remarkable case which I have alluded to, in which thirty-four out of forty-two men perished, it is during a profound insensibility, a sort of coma, that the victim succumbs.

In the number of these phenomena which have been observed we may range that mentioned by Thomas as experienced by himself. Under the noxious influence of the flesh of the Rock-fish (*Serranus rupestris*) he became completely yellow, as in jaundice—his urine, as also the liquid result of transpiration, assuming the same tint. In one or two patients, whom he mentions, the tegumentary surface presented a similar change of colour.

When convalescence takes place, it is accompanied by a desquamation of the skin (the epidermis of which is detached), and often also by a falling off of the hair both of the head and other parts of the body, and even of the nails. Further, it is in all cases effected but slowly, as the constitution receives a very severe shock, the effects of which are felt for years, and disappear only by degrees. It is necessary to remove to a cold climate, according to Thomas, who himself had recourse to this method for a cure, which, after all, he obtained only at the end of several years.

Treatment.

In cases of poisoning by means of fish there are two courses to be followed:—(1) to induce, as promptly as possible, an evacuation of the noxious substance; (2) to combat, or at least endeavour to diminish, the effects produced by it.

Emetics serve to clear the stomach, which must then be subjected to a process of rinsing or washing, by the free use of clear fluids, such as water, imbibed in constant draughts. It is necessary, moreover, when the constitution admits of it, to act upon the digestive tube by means of castor-oil or calomel. Such is the local treatment to be applied to these cases, the intensity of the symptoms in each being sufficient guide to the physician as regards the regulation of the measures.

The general treatment should consist principally of the administering of generous stimulants, such as tea and, in particular, coffee and alcoholic liquors. There are many examples of the good which results from the use of these latter. I may cite one. It is that of a case of poisoning by the flesh of a species of *Balistes*, said to be *B. vetula*: twenty persons were affected, the only exception being that of an old man who always drank rum instead of wine at his meals.

Preparations of opium become advisable if, in spite of the use of evacuants, the vomitings and irritation of the bowels continue. They are especially to be prescribed in cases where convulsions ensue, and then indeed, as Thomas recommends (*loc. cit.* p. 646), in rather considerable doses. He adds that, in order to diminish the heat, as also the dryness of the skin, slight doses of ipecacuanha should be administered when the irritation of the bowels has ceased.

After the removal of the symptoms, tonics are indispensable.

XXI.—*On the* Menispermaceæ.
By John Miers, F.R.S., F.L.S., &c.

[Continued from p. 20.]

55. Elissarrhena.

On previous occasions I have alluded to the fact that when two Menispermaceous plants present themselves differing considerably in their habit, especially in the nervation of their leaves, we may be nearly certain that this character will be found accompanied by some dissimilarities in their floral and seminal structure. So it has occurred with a plant from the Rio Negro, which I proposed as the type of a new genus, and named *Elissarrhena longipes* in my Synopsis of this family (*huj. op.* xiii. 124). This species has been since described and figured by Dr. Eichler under the name of *Anomospermum grandifolium*. Its branches are fistulose, with very large leaves, upon unusually long and stiff petioles: these leaves are flaccid in texture, conspicuously 5-nerved at base, the nerves being outwardly branched, little divaricating, extending in a nearly parallel direction for three-fourths of the length of the leaf, when they anastomose in an arching manner with the few lateral nerves which spring from the upper portion of the midrib; these nerves are all prominent and shining on both sides, as are also the very conspicuous transverse veins. In *Anomospermum*, on the contrary, the species are very lofty climbers, all the branches having a wood which is very compact and solid to the centre; the leaves are not a quarter the size of those of *Elissarrhena*, and upon shorter and slender petioles; they are coriaceous and finely reticulated, with three simple slender nervures, springing from the base, running for a short distance near the margin, and soon anastomosing with many others that spring from the midrib, so that they appear almost pinnately nerved, without the transverse veins which form so conspicuous a feature in *Elissarrhena*; or more frequently the nerves and reticulations are wholly immersed in the thick parenchyma, so that they become almost imperceptible. This extreme difference in the general appearance of the leaves is very striking. The inflorescence in *Anomospermum* is always glabrous, normally consisting of two axillary solitary flowers, each upon a pedicel the length of the petiole; but frequently upon the same plant we find in the axils a long aphyllous young branch, from which the nascent leaves have fallen away or are abortive, so that the inflorescence thus assumes the form of a very simple raceme, with two single pedicellated flowers in each axillule, and much longer than the entire leaf: the flowers are double the size, very glabrous; the petals are so very thick and compressed together that they resemble a central fleshy disk; the anthers consist of two oblong cells dorsally affixed, each cell bursting introrsely by a longitudinal fissure.

On the other hand, in *Elissarrhena* the inflorescence is very tomentose, five-sixths to nine-tenths shorter than the petiole, consisting of a peduncle with its apex separated into three very short branches and again divided, each branchlet bearing three flowers upon pedicels so very short that they appear almost sessile; all are thus closely approximated into a corymbulose and almost globular head on the summit of the peduncle: the sepals are pubescent on both sides; the petals are of thinner texture, more separated, cuneately orbicular, with the laterally lobed margins inflected, as in *Pycnarrhena* and *Antitaxis*, and embracing the filaments, as in the latter genus; the filaments are thick and fleshy, flat inside, very convex outside; the anther, as in *Anelasma*, is subglobose, formed of two collateral cells semiimmersed in the gibbous, incurved, clavated apex of the filament, and it opens horizontally by an introrse transverse suture into two gaping valves, each cell being rendered bilocellate by a semiseptum, as in *Anelasma*, *Antitaxis*, and *Pycnarrhena*. The flower in its structure thus most resembles that of *Anelasma*, only provided with petals, but still more that of *Antitaxis*, only that the floral parts are there tetramerous.

These differences are so many and so manifest that they justify the maintenance of *Elissharrhena* as a genus distinct from *Anomospermum*. I have remarked, under *Sciadotenia* (vol. xix. pp. 325, 327) the analogy that exists in several points between it and *Elissarrhena*, both from Guiana.

Elissarrhena, nob.—*Flores* dioici. *Masc. Sepala* 9, ternatim disposita, utrinque puberula, margine ciliata, quorum 3 exteriora bracteiformia, multo minora, 3 interiora intermediis 2-plo majora, orbiculata, concava, æstivatione imbricata, demum expansa. *Petala* 6, sepalis triplo breviora, sublobato-orbicularia, lobis lateralibus inflexis, imo cuneata, subcarnosa, glabra. *Stamina* 6, libera, æqualia, petalis opposita et unguibus affixa, illis fere duplo longiora; *filamenta* imo tenuia, subincurva, sursum gradatim incrassata, intus plana, extus convexa, summo gibboso-clavata; *antheræ* subglobosæ, introrsæ, filamento semiimmersæ, 2-lobæ, lobis rotundiusculis, connectivo angustissimo collateraliter adnatis, singulis rima horizontali bivalvatim hiantibus.

Frutex *Brasiliensis, scandens*; ramuli *fistulosi, tomentosi;* folia *majuscula, oblonga, e basi* 5-*nervia, nervis conspicuis extus ramosis et transversim venosis, submembranacea, textura flaccida, glaberrima, longe petiolata:* paniculæ ♂ *supra-axillares, solitariæ vel geminæ, tomentosæ, petiolo* 12-*plo breviores;* pedunculus *ebracteatus, apice breviter trichotomus,* ramis *iterum divisis,* ramulis *brevissimis, flores* 3 *fere sessiles gerentibus;* inflorescentia *hinc corymbulosa aut fere capitata;* flores *parvi, adpresse pubescentes.*

The only known species will be fully described in the third volume of my 'Contributions.'

Elissarrhena longipes, nob., huj. op. xiii. 124;—Anomospermum grandifolium, *Eichl. in Mart. Fl. Bras.* xxxviii. p. 169, tab. 37. fig. 1.—In Brasilia septentrionali: *v. s. in herb. variis*, Rio Negro (Spruce, 1538).

56. Synclisia.

This genus was established by Mr. Bentham in his 'Genera Plantarum' (i. 36); it is one of African origin and of much interest. Although nothing is known of its female flower or of its seminal structure, it is there placed in the same section as *Tiliacora* and *Abuta,* both very peculiar genera, remarkable for their seeds with deeply ruminated albumen and a very long, narrow, hippocrepiform embryo. The only apparent ground for this arrangement is the valvate æstivation of its inner whorl of sepals; but with equal or even greater reason it might be placed among the *Pachygoneæ,* near another African genus, *Triclisia,* in which the inner sepals have also a valvate æstivation and at their lower edges, though not agglutinated, adhere closely together by their tomentose margins, and the stamens are likewise partly monadelphous. Until its seed be known, it appears to me much safer to place it among the genera of doubtful position. One of its chief peculiarities is the agglutination of the inner whorl of sepals, for more than half their length, into a cylindrical 3-lobed tube, in which respect it bears some resemblance to *Cyclea* and *Peraphora*: the six more external sepals, in two series, are much smaller, quite free, linear, and very acute. It has six minute scale-like petals, and nine stamens one-third the length of the inner sepals; of these, three are more external, free, and a trifle shorter than the other six, which are briefly monadelphous at their base, and central. The inflorescence consists of two supra-axillary very slender pedicels, double the length of the petiole, each bearing a solitary flower, which is of rather a large size for the order. In its 1-flowered axillary pedicels it therefore bears some resemblance to *Pycnarrhena, Syrrhonema,* and *Antitaxis.* Only one species is known, which has very slender scandent branches, and distant, cordate, somewhat oval leaves, acuminated at the apex, with rather short petioles.

Synclisia, Benth.—*Flores* dioici.—*Masc. Sepala* 9, subcarnosa, in seriebus 3 alternatim disposita, quorum 3 exteriora bracteiformia, 3 intermedia paulo majora, cuncta linearia, acutissima, extus longe pilosa, intus glabra, 3 interiora 4-plo majora, in tubum cylindraceum apice 3-partitum agglutinata, laciniis tubo dimidio brevioribus, una cum tubo extus glabris, erectis, subobtusis, sepalis externis 3-plo latioribus, marginibus sericeo tomentosis, æstivatione valvatim clausis. *Petala* 6, minima, sepalis interioribus 10-plo breviora, suborbicularia, imo breviter unguiculata, glabra. *Stamina* 9, quorum 3 exteriora libera, paululo breviora, 6 centralia imo in stipite breviter monadelpha, sepalis interioribus 3-plo breviora; *filamenta* paulo compressa, sursum gradatim crassiora; *antheræ* bilobæ, exteriores subintrorsæ, centrales subextrorsæ, lobis connectivo subexcurrente sejunctis, filamento fere lateraliter adnatis, rima longitudinali subobliqua dehiscentibus.—*Fl. fœm.* ignoti.

Frutex *scandens Africæ occidentalis æquinoctialis;* ramuli *debiles;* folia *ovata, cordata, apice acuminata, imo* 5-*nervia, pilis sparsis munita:* inflorescentia *supra-axillaris, e pedicellis geminis unifloris;* pedicellus *petiolo* 2-*plo longior;* flos *pro ordine majusculus.*

The only known species will be fully described in the third volume of my 'Contributions to Botany.'

Synclisia scabrida.—In Africa æquinoctiali: *v. s. in herb. Hook.*, Gaboon River (Mann, 986); Congo (C. Smith).

57. Penianthus.

Among the plants arranged under *Fibraurea* in the Hookerian herbarium, I noticed one from the island of Fernando Po, which is very different in habit, particularly in its leaves, which are not triplinerved as in that genus; its inflorescence, instead of being a very long and laxly spreading panicle, is barely half an inch long, consisting of a very short supra-axillary peduncle that supports a number of umbellated 1-flowered pedicels of half its length, all being pubescent. It is a female specimen, its flowers having nine sepals in three series diminishing in size outwards and imbricated in æstivation, six minute petals affixed by their claws to the feet of as many sterile stamens seated round a raised gynæcium which supports three short, gibbously cylindrical, pilose ovaries, almost concealed (when seen from above) by their very large sessile stigmata, which resemble those of *Calycocarpum.* Its leaves are of considerable size, lanceolately oblong, narrowing towards both extremities, and acuminated at the summit, having many parallel divergent nerves that archingly anastomose together near the margin, in which respect they offer some resemblance to *Pycnarrhena.* I know of no genus to which this plant can be referred.

Penianthus, nob.—*Flores* dioici. *Masc.* ignoti.—*Fœm. Sepala* 9, alternatim in ordine ternario disposita, quorum 3 exteriora minora et bracteiformia, 3 intermedia ovata, paulo majora, glabra, 3 interiora adhuc majora, orbiculari-ovata, concava, carnosula, marginibus membranaceis, glabra, æstivatione imbricata. *Petala* 6, minima, staminibus opposita, late obovata, erecta, subcarnosula. *Stamina* 6 sterilia, libera, ovarii dimidio breviora; *filamenta* compressa, cum petalis gynæcio affixa, erecta; *antheræ* 2-lobæ, apicifixæ, filamento dimidio breviores, lobis oblongis, erectis, sine connectivo collateraliter adnatis, lateraliter sulcatis, effœtis. *Ovaria* 3, cylindrico-ovata, gibbosa, arcte conferta, gynæcio brevi insita, pilosa, 1-locularia, *ovulo* unico angulo ventrali appenso; *stylus* nullus; *stigma* maximum, sessile, horizontaliter reflexum, depressum, radiatim 3-lobum, lobis deltoideis, margine eroso-denticulatis. Cætera ignota.

Frutex *scandens, insulæ Fernando Po indigenus:* folia *majuscula, lanceolato-oblonga, utrinque subacuta, apice attenuata, glabra, penninervia,* petiolo *crassiusculo, subbrevi:* pedunculus ♀ *supra-axillaris, petiolo 4-plo brevior, apice* pedicellos *circiter* 7 *breves bracteolatos 1-floros gerens;* flores *parvi.*

Its single species will be described in the forthcoming volume of my 'Contributions to Botany.'

Penianthus longifolius, nob. huj. op. xiii. p. 124.—In insula Fernando Po: *v. s. in herb. Hook.,* loc. cit. (Mann, 194).

58. Selwynia.

This genus was founded on an Australian plant by Dr. F. Mueller, who described it in his 'Fragmenta,' iv. 153. It is evidently a climber, with slender branches, furnished with shining, glabrous, lanceolate leaves, somewhat acute at both extremities, 3-nerved as well as triplinerved at base, reticulated, and upon slender petioles. The ♂ inflorescence is axillary, paniculate, on a slender divaricated rachis half as long again as the leaves, with alternate, long, spreading branches, each again with alternate short branchlets bearing from five to seven others, which support from one to three sessile flowers on their apex: the flower consists of from eight to ten sepals, all orbicular, very concave, glabrous, the outer two ciliated on the margin, smaller than the others, which are subequal, submembranaceous, and much imbricated; it has from eight to ten petals, half the size of the sepals, cuneately oblong, with the lateral margins inflected and embracing the stamens, subfleshy; from eight to ten stamens the length of the petals and affixed to their claw, with 2-lobed introrse anthers, the lobes dorsally and collaterally adnate to the filament, each bursting by a longitudinal furrow. I have had no opportunity of seeing either the female flower or the fruit; but Dr. Mueller states that it bears three drupes (one or two sometimes abortive), subglobose and stipitate, enclosing a hard putamen of similar shape, rounded dorsally, somewhat compressed on its faces, the condyle being internal and intruding, thus rendering the cell hippocrepical and 4-locellate by a monstrous expansion of the intruding condyle—a formation which it is difficult to understand: the seed is said to be hippocrepiform, but whether with or without albumen is not stated, nor is the shape of the embryo known. The genus must for the present therefore be referred to the section made to include those of doubtful position.

Selwynia, F. Mueller.—*Flores* dioici. *Masc. Sepala* 8–10, orbicularia, valde concava, glabra, submembranacea, quorum 2–4 exteriora minora, margine ciliata, 6 interiora duplo majora, subæqualia, decussatim imbricata, omnino lævia. *Petala* 8–10, sepalis dimidio breviora, cuneato-oblonga, sepalis opposita, æquilonga, in unguibus iis affixa; *filamenta* subcomplanata, sursum gradatim latiora; *antheræ* introrsæ, filamento dorso adnatæ, 2-lobæ, lobis oblongis, collateraliter affixis, lateribus profunde sulcatis, in sulcis 2-valvatim dehiscentibus.—*Fœm. Flos* ignotus. *Drupæ* 3, vel abortu pauciores, subglobosæ, imo stipitatæ, basin versus stylo persistente signatæ: *putamen* durum, subglobosum, dorso convexum, in faciebus subcompressum, loculo hippocrepiformi; *condylus* internus, intra loculum longe intrusus. *Semen* hippocrepiforme. Cætera ignota.

Frutex *scandens Australiæ orientalis intertropicæ;* ramuli *teretes, tenues;* folia *ovato-lanceolata, imo 3-nervia et triplinervia, longe tenuiter petiolata:* panicula ♂ *axillaris, glabra, folio multo longior, divaricato-ramosa, bracteolata,* ramis *alternis, iterum ramulosis,* ramulis *ultimis* 5–7, *apice flores* 1–3 *sessiles gerentibus:* inflorescentia ♀ *simpliciter racemosa.*

The details of the only known species, as far as they are known, will be given in the 3rd volume of my 'Contributions.'

Selwynia laurina, F. Muel. Fragm. iv. 153.—In Australia orientali: *v. s. in herb. Hook.* ♂, Rockingham Bay (F. Mueller).

59. Aristega.

This genus is proposed for a plant in the Hookerian herbarium, obtained from the Collection of the East-India Company, and registered as from the Helford herbarium: no locality is stated; but it may be presumed to be of Indian origin. It has ovate leaves, rounded at the base, acuminated at the summit, 3-nerved as well as triplinerved, the nerves extending beyond the middle and archingly anastomosing with the few other lateral nerves; the petiole is short and slender. The inflorescence consists of two or more raceme-like panicles which spring out of the knotty axils of the leafless old branches; in these the rachis is slender, longer than the leaves, furnished sparsely with short branches again branched, the branchlets supporting from one to three pedicellated flowers, all bracteolated at the articulations and rigidly pubescent; the flowers have nine sepals in three series, alternately smaller, the outer bracteiform, the intermediate somewhat larger, the three inner ones double the length of the former, nearly orbicular, very concave, thick, with their margins valvate in æstivation; they have three petals, smaller than the sepals, fleshy, cuneately oblong, subconcave, emarginated at the apex, having as many free stamens fixed to their claws; the filaments, nearly as long as the petals, become much broader and flattened towards the apex, to which two distinct divaricately separated anther-lobes are dorsally affixed and partially imbedded, the lobes bursting introrsely by a longitudinal furrow. Here the chief peculiarity consists in the valvate æstivation of its orbicular fleshy inner sepals, in which respect it resembles *Tiliacora*, *Abuta*, *Anelasma*, *Limacia*, *Triclisia*, and *Synclisia*. From the first and fourth it differs in having only three free stamens, from the second and third in the presence of petals, from the fifth in its stamens being only three in number with three petals, and from the last in its sepals being orbicular and free to the base, not oblong and united for half their length into a tube: other differential features exist, which may be seen by comparing the respective generic characters. This valvate character of its stamens suggested the generic name *.

Aristega, nob.—*Flores* dioici. *Masc. Sepala* 9, in ordine ternario alternatim disposita, extus gradatim minora, quorum 6 exteriora bracteiformia, ovata, carnosula, præter margines tenuiores longe piloso-ciliatos, glabra, 3 interiora dimidio majora, suborbicularia, valde concava, apice inflexa, carnosa, marginibus crassis, æstivatione arcte valvata, glabra. *Petala* 3, sepalis tertia parte breviora, alterna, cuneato-oblonga, apice emarginata, canaliculatim concava, carnosa, glabra, staminibus paulo breviora et opposita. *Stamina* 3, libera; *filamenta* unguibus petalorum affixa, sursum gradatim latiora, crassiuscula, apice dilatata et rotundata; *antheræ* 2-lobæ, introrsæ, dorso semiimmersæ, lobis oblongis, segregatis, imo paulo divaricatis, utrinque sulco longitudinali dehiscentibus.

Frutex *scandens, origine ignoto, sed verisimiliter ex India orientali:* folia *ovata, acute attenuata, 5-nervia, reticulata, glaberrima, petiolo brevi et tenui:* paniculæ ♂ *racemiformes, solitariæ aut geminæ, e nodis aphyllis annotinis ortæ, folii circa longitudine,*

* From ἀρι, *valde*; στέγω, *tego*.

ramis *approximatis brevibus, iterum ramulosis,* ramulis *brevissimis, pedicellos* 1–3 *unifloros gerentibus.*

This plant will be more fully described in my 'Contributions to Botany:'—

Aristega lævifolia, nob.—Forsan ex India orientali: *v. s. in herb. Hook.* e musco Soc. Ind. orient. (hb. Helford).

[To be continued.]

XXII.—*On the Recent Zoology and Palæontology of Victoria.* By FREDERICK M'COY, Professor of Natural Science in the University of Melbourne, Director of the National Museum of Victoria, &c.

To the Editors of the Annals and Magazine of Natural History.

GENTLEMEN,

I drew up the following brief notice on the above subject for our Intercolonial Exhibition, just held in Melbourne. If any part of it should seem fit for your pages, I beg to place it at your disposal.

I am, Gentlemen,
Your most obedient Servant,
FREDERICK M'COY.

In the following pages I shall only refer to those species of animals affording economically useful materials, or of some special present interest in relation to unsettled scientific questions.

ZOOLOGY.

MAMMALIA.

Very few of the Victorian quadrupeds are economically useful. The skins of the various kangaroos (*Macropus* and *Osphranter*), wallabies (*Halmaturus*), and wombats (*Phascolomys*) afford various qualities of leather, but are at present very little used; and for food the only portions of any native quadruped appearing in the market are the tails of the larger kangaroo, for soup. The flesh of the smaller kinds, as well as that of wombats, opossums (*Phalangista vulpina* and *P. viverrina,* var. *Victoriæ**), hare-kangaroos, and kangaroo-rats (*Lagorchestes* and *Hypsiprymnus*)

* The common ring-tail opossum of Victoria has no specific relation to the rusty *P. Cooki* of New South Wales, and is constantly distinguishable from the *P. viverrina* of Tasmania, of which it is at least a variety which we may conveniently refer to under the name of *P. Victoriæ.*

and bandicoots (*Perameles obesula* and *P. fasciata*), afford abundant food to the natives and wanderers lost in the bush.

The gigantic red kangaroo (*Osphranter rufus*) is only found towards the warm northern boundary of the colony, where it occurs in immense numbers, along with the rather rarer sooty kangaroo (*Macropus fuliginosus*) and the *Macropus ocydromus* of Gould, which is certainly a good and distinct species. These three species are replaced in the cooler southern part of Victoria by the *Macropus major*—the great "Old Man," or "Boomer" kangaroo, as the male is termed by the colonists. Since the new law increasing the fencing of the country taken up for pastoral purposes, the number of individuals of those species of kangaroo has increased prodigiously; so that hundreds are on occasions killed on some of the squatters' runs merely to save the grass for the sheep. The extensive poisoning of the native dog, or dingo, by strychnine also tends of late years to increase very greatly the numbers of the plant-eating animals. The wallabies of the southern part of the colony are the *Halmaturus uallabatus*, chiefly of the islands in Bass's Straits, on some of which *H. Bennetti* also occurs; and, curiously enough, I find that *H. brachyurus*, looked upon by Gould as a rare species of Western Australia, is the common species of the south-eastern portion of Victoria.

As some uncertainty seems to have been felt as to the occurrence of the genus *Molossus* in Victoria, it may be interesting to state that I have lately got some additional examples of the *M. australis* (now in the museum) from a hollow tree near Melbourne; so that there can be no doubt of the fact of the genus extending to Victoria, although the habitat is so abnormal.

Of seals two species are not uncommon—the eared seal (*Arctocephalus lobatus*) and the large spotted "sea-leopard" (*Stenorhynchus leptonyx*); but they are so much less abundant than formerly that sealing has been quite given up for many years. The fur of the Victorian fur-seal is of good quality when properly dressed. Fur rugs of beautiful softness, close and warm, and often of elegant appearance, are annually made in thousands from the skins of the opossum and the "native cat" (*Dasyurus viverrinus*), not only as carriage-wraps, but for use instead of blankets by the great number of people whose business leads them to sleep in the open air. So abundant and easily obtained are these skins that a profitable export trade might possibly result from their becoming better known to the European furriers.

Of Cetacea, a great number of the smaller-toothed sorts, of no economic value, may be seen on our coasts; but also, occasionally, whalebone-whales of enormous size are stranded on the shores, and the oil and whalebone sent to market, without giving rise to any extensive whaling-expeditions into the southern waters. One of these whalebone-whales, 90 feet in length, was cast on our shores last winter, and I have secured the skeleton of it for our museum. It proves to be a new species of the genus *Physalus*, or "finner." The pectoral is about one-eighth of the total length, and the ribs are sixteen on each side, and there are about sixty vertebræ. It cannot be referred to the New-Zealand *Physalus antarcticus*, as the "baleen" is black. The largest blades of baleen are 18 inches wide at base, and 28 inches long. This species, of which I hope to publish a more detailed illustrated description shortly, I name *Physalus Grayi* (M'Coy), after my valued friend Dr. Gray, of the British Museum, whose researches on the Cetacea have so greatly aided and stimulated the recent investigations in this difficult branch of zoology. The whalebone of this whale, like that of the other "Finners," is only fit for splitting into the false bristles for brushes &c.

BIRDS.

As my friend Mr. Gould has recently published in his 'Handbook of the Birds of Australia' a list showing the geographical distribution of the species generally over the continent, I subjoin a list of those of Victoria, as the least-perfectly known of the colonies, and presenting several interesting modifications of Mr. Gould's list.

I would remark that the specimen of *Dendrocygna Eytoni* in the Melbourne Museum was purchased in the poultry-market, and seen by myself with the flesh untouched; so that there is no room for the doubt which has been expressed of the species occurring in Victoria. Another interesting species, the Indian and European little egret (*Herodias garzetta*), which is only doubtfully quoted by Mr. Gould as an Australian bird, I have carefully identified from a Gippsland specimen now in our Museum. The very rare *Pycnoptilus floccosus*, the locality of which Mr. Gould is not certain of, occurs not uncommonly in the dense brushes of the Yarra mountains. The new species of bristle-bird (*Sphenura Broadbenti*, M'Coy) is a very rare addition to this curious genus, easily distinguished by its rufous head from the previously known species. The *Pardalotus xanthopyge* (M'Coy) is a new species, brought under my notice by Mr. Leadbeater, and which seems to appear first in the north-west part of Victoria, and gradually to increase in numbers towards Adelaide, where it seems to replace the *P. punctatus*, with which it has previously been confounded.

LIST OF THE BIRDS OF VICTORIA

(*Specimens of all of which are in the National Museum of Melbourne*).

Ord. I. Raptores.

1. Fam. *Falconidæ.*

Aquila audax.
Polioaëtus leucogaster.
Falco hypoleucus.
—— melanogenys.
—— subuiger.
—— lunulatus.
Hieracidea berigora.
—— occidentalis.
Tinnunculus cenchroides.
Leucospiza Raii.
—— Novæ Hollandiæ (albino).
Astur approximans.
—— cruentus.
Accipiter torquatus.
Milvus affinis.
Elanus axillaris.
—— scriptus.
Circus assimilis.
—— Jardinii.

2. Fam. *Strigidæ.*

Strix Novæ Hollandiæ.
—— tenebricosus.
—— delicatulus.
Hieracoglaux strenuus.
—— connivens.
Spiloglaux boobook.

Ord. II. Insessores.

1. Fam. *Caprimulgidæ.*

Ægotheles Novæ Hollandiæ.
Podargus strigoides.
—— brachypterus.
Eurostopodus albogularis.

2. Fam. *Cypselidæ.*

Chætura caudacuta.
Cypselus pacificus.

3. Fam. *Hirundinidæ.*

Hirundo frontalis.
Hylochelidon nigricans.
Cheramœca leucosterna.

4. Fam. *Meropidæ.*

Merops ornatus.

6. Fam. *Alcedinidæ.*

Dacelo gigas.
Todiramphus sanctus.
—— pyrrhopygius.
Alcyone azurea.

7. Fam. *Artamidæ.*

Artamus sordidus.
—— personatus.
—— superciliosus.
—— leucopygialis.

8. Fam. *Ampelidæ.*

Pardalotus striatus.
—— punctatus.
—— affinis.
—— xanthopyge (M'Coy).

9. Fam. *Laniadæ.*

Strepera graculina.
—— anaphonensis.
Gymnorhina tibicen.
—— leuconota.
Cracticus torquatus.

10. Fam. —— ?

Grallina picata.

11. Fam. *Campephagidæ.*

Graucalus melanops.
—— mentalis.
Pteropodocys phasianella.
Campephaga Jardini.
—— humeralis.
Pachycephala glaucura.
—— melanura.
—— rufiventris.
—— rufogularis.
—— olivacea.
Colluricincla harmonica.
Falcunculus frontatus.
Oreoïca cristata.

12. Fam. *Dicruridæ.*

Chibia bracteata.

13. Fam. *Muscicapidæ.*

Rhipidura albiscapa.
—— rufifrons.
Sauloprocta motacilloides.
Seisura inquieta.
Piezorhynchus nitidus.
Myiagra plumbea.
—— concinna.
—— nitida.
Microeca fascinans.
Monarcha carinata.
—— trivirgata.

14. Fam. —— ?

Smicrornis brevirostris.

15. Fam. *Saxicolidæ.*

Erythrodryas rhodinogaster.
Petroica multicolor.
—— Goodenovii.
—— phœnicea.
Melanodryas cucullata.
Eopsaltria australis.

16. Fam. *Menuridæ.*

Menura superba.
Psophodes crepitans.

17. Fam. —— ?

Malurus cyaneus.
—— melanotos.
Stipiturus malachurus.
Sphenura Broadbenti (M'Coy).
Pycnoptilus floccosus.
Cisticola exilis.
—— lineocapilla.
—— ruficeps.
Sericornis osculans.
Acanthiza diemenensis.
—— nana.
—— lineata.
Geobasileus chrysorrhous.
Ephthianura albifrons.
—— tricolor.
—— aurifrons.
Calamanthus fuliginosus.
Chthonicola sagittata.

18. Fam. *Motacillidæ.*

Anthus australis.
Cincloramphus cantillans.
Ptenœdus rufescens.

19. Fam. —— ?

Sphenœacus gramineus.

20. Fam. *Sylviadæ.*

Calamoherpe australis.
Mirafra Horsfieldii.

21. Fam. *Fringillidæ.*

Zonæginthus bellus.
Ægintha temporalis.
Stagonopleura guttata.

22. Fam. *Merulidæ.*

Cinclosoma punctatum.
—— castaneonotum.
Oreocincla lunulata.

23. Fam. *Paradiseidæ.*

Ptilonorhynchus holosericeus.
Chlamydodera maculata.
Mimeta viridis.

24. Fam. —— ?

Corcorax melanorhamphus.

26. Fam. *Corvidæ.*

Corvus australis.

28. Fam. *Crateropodidæ.*

Pomatostomos temporalis.
—— superciliosus.
—— ruficeps.

29. Fam. *Meliphagidæ.*

Meliornis longirostris.
Lichmera australasiana.
Glyciphila fulvifrons.
—— albifrons.
Ptilotis Lewinii.
—— leucotis.
—— auricomis.
—— ornata.
—— penicillata.
—— fusca.
—— chrysops.
Plectorhyncha lanceolata.
Meliphaga phrygia.
Entomophila picta.
Anthochæra carunculata.
Anellobia mellivora.
—— lunulata.
Tropidorhynchus corniculatus.
—— citreogularis.
Acanthorhynchus tenuirostris.
Myzomela sanguinolenta.
—— nigra.
Entomyza cyanotis.
Melithreptus gularis.
—— lunulatus.
Myzantha garrula.
Manorhina melanophrys.
Dicæum hirundinaceum.

30. Fam. —— ?

Zosterops cærulescens.

32. Fam. *Certhiadæ.*

Climacteris scandens.
—— erythrops.
—— leucoptera.
Sittella chrysoptera.

33. Fam. *Cuculidæ.*

Cacomantis pallidus.
—— flabelliformis.
—— insperatus.
Lamprococcyx plagosus.

34. Fam. *Psittacidæ.*

Cacatua galerita.
—— Leadbeateri.
—— roseicapilla.
Licmetis tenuirostris.
Calyptorhynchus Leachii.
—— funereus.
—— naso.
Callocephalum galeatum.
Polytelis Barrabandi.
—— melanura.
Aprosmictus scapulatus.
Platycercus Pennantii.
—— adelaidensis.
—— zonarius.
—— flaveolus.
—— eximius.
Psephotus hæmatorrhous.
—— hæmatonotus.
Euphema chrysostoma.
—— elegans.
—— aurantia.
—— pulchella.
—— Bourkii.
Melopsittacus undulatus.
Calopsitta Novæ Hollandiæ.
Pezoporus formosus.
Lathamus discolor.
Trichoglossus multicolor.
—— chlorolepidotus.
Glossospitta australis.
—— porphyrocephala.
—— pusilla.

Ord. III. Rasores.

1. Fam. *Columbidæ.*

Phaps chalcoptera.
—— elegans.
Ocyphaps lophotes.
Geopelia tranquilla.
Stictopelia cuneata.

2. Fam. *Megapodidæ.*

Leipoa ocellata.

3. Fam. *Turnicidæ.*

Turnix varia.
—— scintillans.
—— velox.
—— pyrrhothorax.
Pedionomus torquatus.

4. Fam. *Perdicidæ.*

Coturnix pectoralis.
Synoicus australis.
—— diemenensis.
—— sordidus.
Excalfactoria australis.

Ord. IV. Grallatores.

1. Fam. *Struthionidæ.*

Dromaius Novæ Hollandiæ.

2. Fam. *Otitidæ.*

Chloriotis australis.

3. Fam. *Charadriadæ.*

Œdicnemus grallarius.
Hæmatopus longirostris.
—— fuliginosus.
Lobivanellus lobatus.
Sarciophorus pectoralis.
Charadrius orientalis.
Eudromias australis.
Cirrepidesmus asiaticus.
Ægialites monacha.
—— nigrifrons.
Erythrogonys cinctus.
Ochthodromus inornatus.
—— bicinctus.

5. Fam. *Himantopidæ.*

Himantopus leucocephalus.
Cladorhynchus pectoralis.

6. Fam. *Recurvirostridæ.*

Recurvirostra rubricollis.

7. Fam. *Limosidæ.*

Limosa melanuroides.
—— uropygialis.

8. Fam. *Tringidæ.*

Limnocinclus acuminatus.
Ancylochilus subarquatus.
Actodromas australis.
Glottis glottoides.

9. Fam. *Scolopacidæ.*

Gallinago australis.
Rhynchæa australis.

10. Fam. —— ?

Numenius cyanopus.

11. Fam. *Tantalidæ.*

Carphibis spinicollis.
Threskiornis strictipennis.
Falcinellus igneus.
Platalea regia.
Platibis flavipes.

12. Fam. *Gruidæ.*

Grus australasianus.

14. Fam. *Ardeidæ.*

Ardea pacifica.
Herodias alba.
—— egrettoides.
—— garzetta.
Demiegretta Grayi.
Nycticorax caledonicus.
Botaurus poiciloptilus.
Butoroides flavicollis.
Ardetta pusilla.

15. Fam. *Rallidæ.*

Porphyrio melanotus.
Tribonyx ventralis.
Gallinula tenebrosa.
Fulica australis.
Hypotænidia philippensis.
Rallus brachypus.
Porzana fluminea.
—— palustris.
—— tabuensis.

Ord. V. Natatores.

1. Fam. *Anatidæ.*

Chenopsis atrata.
Cereopsis Novæ Hollandiæ.
Anseranas melanoleuca.
Chlamydochen jubata.
Casarca tadornoides.
Anas superciliosa.
—— punctata.
Stictonetta nævosa.
Spatula rhynchotis.
Malacorhynchus membranaceus.
Dendrocygna Eytoni.
Nyroca australis.
Erismatura australis.
Biziura lobata.

2. Fam. *Laridæ.*

Larus pacificus.
Bruchigavia Jamesonii.

3. Fam. *Sternidæ.*

Sylochelidon caspia.
Thalasseus poliocercus.
Sternula nereis.
Hydrochelidon leucopareia.

4. Fam. *Procellariidæ.*

Diomedea exulans.
—— cauta.
—— culminata.
Phœbetria fuliginosa.
Ossifraga gigantea.
Nectris brevicauda.
Daption capensis.
Prion turtur.
Pelagodroma fregata.
Haladroma urinatrix.

5. Fam. *Pelecanidæ.*

Pelecanus conspicillatus.
Phalacrocorax Novæ Hollandiæ.
—— leucogaster.
—— melanoleucus.
—— stictocephalus.
Plotus Novæ Hollandiæ.
Tachypetes aquila.
Sula australis.

6. Fam. *Podicipidæ.*

Podiceps australis.
—— Nestor.
—— gularis.

7. Fam. *Spheniscidæ.*

Eudyptula undina.
Chrysocoma catarractes.

REPTILIA.

Of this division of the animal kingdom there are scarcely any Victorian forms of economic importance. The edible "green" turtle (*Chelonia viridis*) is a very rare visitor to our shores, two examples being all that I have any knowledge of, both now in the museum. An example of the leathery turtle (*Sphargis coriacea*), caught at Portland, on our west coast, gives the most southern range of the species known. Our two freshwater Chelonians, *Chelodina oblonga* and *C. longicollis*, are only found in the rivers towards the northern boundary of Victoria, where they are common. Of these a kind of turtle-soup was made at the dinner of the Melbourne Acclimatization Society; but the taste for it has not yet been acquired.

The Crocodilia do not come down the Australian coast so far south as Victoria, the largest of the Sauria being the *Hydrosaurus varius,* called "iguana" by the colonists, of five or six feet. Of the skin of this species some slippers and other small articles in the Intercolonial Exhibition now open in Melbourne are manufactured with much elegance. The natives use it for food. The *Trachydosaurus rugosus, Cyclodus gigas, Hinnulia tæniolata,* and *Grammatophora barbata* abound in the warmer north part of the colony, but gradually disappear towards the south coast.

Of snakes, the following species occur, and the larger and more common are roasted and eaten by the natives:—*Morelia variegata,* or carpet-snake, the only Python and non-venomous snake in Victoria, and confined to the northern boundary; *Acanthophis antarctica,* or "death-adder," also confined to the northern boundary; *Hoplocephalus curtus,* or "tiger snake," common about Melbourne, and the cause of most of the accidents from snake-bites; *H. flagellum,* or "little whipsnake," *H. coronoides,* and *H. superbus.* This latter species, with fifteen rows of scales, the two outer rows with red centres, is very common about Prahran, near Melbourne, though said to occur only in Tasmania; the neck is not dilatable into a flat hood, as in the *H. curtus.* The "black snake" (*Pseudechis porphyraicus*) is rather rare; and the *P. australis* is only found with us near our northern boundary. The common "brown snake" may possibly include two species; but I doubt the distinctions between *Pseudonaja nuchalis* and *Diemenia superciliaris* being permanent; at any rate, specimens with the proportions of the rostral shield of the latter are common, and several intermediate proportions varying to that characteristic of the former occur. *Diemenia reticulata* is very common on the Lower Murray boundary.

The Batrachia, with the exception of the common green frog (*Ranhyla aurea*) are rarely seen or heard,—the true tree-frogs (*Hyla*) inhabiting the lofty gum-trees, and the *Lymnodynastes tasmanicus, L. dorsalis,* and *L. affinis* burrowing in the sand during the day.

PISCES.

The species of fish good for the table are very much fewer in Victoria than in Europe; and great interest attaches, therefore, with many of the general public, to the endeavours of the

Acclimatization Society of Victoria to introduce the salmon and other good British fish into the waters of the colony, independently of the scientific interest of the experiment. Large English trout are now in considerable numbers, from ova imported, packed in ice, by our Victorian Acclimatization Society, acting in conjunction with the Tasmanian government. Not only were numbers of parr hatched in the Victorian and Tasmanian rivers from the salmon-ova imported in this way, but there is now in the Exhibition one caught a few weeks ago in the Tamar River, about ten inches in length, which has lost the marks of the parr, and assumed the bright silvery aspect of the migratory stage of development, or "grilse." This is a great success for acclimatization and pisciculture, and shows that none of the insuperable difficulties which were supposed in England to bar our success with the Salmonidæ really exist, but that food and climate, and quality of water of such of our rivers as flow all the year, are sufficiently suitable to permit of success.

The cartilaginous fishes are supposed to be so abundant here as greatly to diminish the chance of the acclimatized salmon returning in safety from the sea; but I do not think they are as numerous as in Britain.

The *Callorhynchus antarctica,* or Southern Chimera, is common near Portland, at short distances from the shore; and all round our coast the Port-Jackson shark, or "bulldog shark," as it is called by the colonists (*Cestracion* (*Heterodontus*) *Philippi*), is not uncommon. The most beautiful and curious of our sharks is that called "carpet shark" by the colonists—the *Crossorhinus barbatus.* The largest of our sharks, the "black-finned shark" (*Carcharias melanopterus*), is so rare that I have seen only one specimen (fifteen feet long), from Hobson's Bay. The European "hammer-headed shark" (*Sphyrnias zygæna*) is not very uncommon. But, what is very curious, we find the common English "tope" (*Galeus canus*) common in the bay; and, more extraordinary still, the common English "smooth-hound" (*Mustelus vulgaris*) is the commonest dogfish or small shark of our coast, occurring in great numbers in Hobson's Bay, undistinguishable from Cornish specimens. The large *Odontaspis taurus* is, perhaps our commonest large and very destructive species, although the Indian *Heptranchus indicus* is not uncommon also. Another large shark, perfectly identical with the English species, is the "angelfish" (*Squatina vulgaris*), not very uncommon. Intermediate between the sharks and rays we have the tentaculated "sawfish" (*Pristiophorus cirratus*) in abundance, and the rare *Trigonorhina fasciata.* These, with one or two rays (*Raja Lemprieri* &c.), two large "sting rays" (*Trygon*), and a rare *Cephaloptera,* are the chief predaceous Chondropterygii. One small lamprey is not uncommon in the Murray, and another (*Mordacia*) in the Saltwater River.

Of bony fish there are numerous genera and species; of these I need only now advert to a few used for food or otherwise interesting. Of the Percidæ one of the very best table fish is the *Lates colonorum*, or "Gippsland perch," which has appeared of late years in the market. Also of this family is our most gigantic river-fish, the "Murray cod-perch" (*Oligorus macquariensis*), which is often three feet long and upwards of twenty pounds weight; it is perhaps the most commonly seen at table of all the Victorian fish, although not at all the best; it is now brought to the Melbourne markets in great numbers by the railway. The next example is the most abundant and cheapest of the marine fish, never seen at the best tables, but used very extensively as food by the poorer people. It has the reputation of very frequently causing, even when perfectly fresh, the most violent symptoms of fish-poisoning, accompanied by a peculiar redness of the face and great suffering, sometimes ending in death—although so irregular in its action that other persons eating of the same fish have experienced no ill effects. It is the *Arripis georgianus*, and is called by the fishermen "salmon" when old and of a uniform olive tint, and "salmon trout" in the younger spotted stage of growth. I have no doubt the *Centropristis georgianus* (C. & V.), *C. salar* (Rich.), *C. truttaceus* (C. & V.), and *Perca marginata* (C. & V.) are all synonyms of this one common species. An excellent river-fish of this family is the *Dules ambiguus* of the Murray; it is popularly known as the "Murray golden perch," or sometimes "Murray golden carp," and far exceeds in general estimation any of the other freshwater fish for the table. Of the Pristipomatidæ the Murray River affords an excellent table fish, the *Therapon ellipticus*, known in the market and to the colonists generally as the "Murray silver perch," and it is now brought to Melbourne in great numbers by railway.

Amongst the mullets (*Mullidæ*) we have a representative of the European red mullet, forming an equally delicious delicacy when cooked in the same way; it is the Australian red mullet, the *Upeneichthys porosus*, which, like its home representative, is only occasionally found, and must be considered a rarity. The family Sparidæ affords the most important fish for the table found in the Victorian seas, when we take its size (occasionally reaching twenty pounds weight), abundance, and excellence together into account; it is the *Pagrus unicolor*, or "snapper" of the colonists: and to this family also belongs one of the most popular fishes with the anglers in the mouths of the rivers near Melbourne, as giving good sport and forming an agreeable addition to the dinner table: it is the "bream" of the colonists, the *Chrysophrys australis*. The *Chironemus marmoratus* is not uncommon in the market: I have heard the name "carpet-fish" applied to it; but I may here remark that the community is so new that the vulgar or popular names are not to be relied upon as in older countries, and vary irregularly within short distances. A nearly allied fish, universally known as the "butter-fish," and often found at table, although not very good, is the *Chilodactylus nigricans*: the uniform colour supposed by authors to characterize this species only occurs in the nearly adult examples, I find; and the young are marbled with brown and bluish grey. The *Chilodactylus macropterus*, although common in the market, seems to have no common name. The finest of all the Australian marine fishes for the table is the "trumpeter" of the colonists, formerly supposed to be confined to Tasmania, but now found so abundantly on some fishing-banks in the track of the steamers plying to Melbourne that at certain seasons it is abundant in the Victorian markets: it is the *Latris hecateia*. Several species of *Platycephalus*, of which *P. tasmanius* and *P. lævigatus* are the most common, are confounded under the common popular name of "flat-head," given to the commonest edible fish of the Victorian coasts—found abundantly and easily caught by line all the year round: these are eaten by people living on the coasts, and are always in the market, but not good enough to be held in any esteem for the table. Of "gurnets," the beautiful *Lepidotrigla vanessa* and the *Trigla kumu* and *Trigla polyommata* are not uncommon occasional visitors, but more noted for their extraordinary beauty than as food, for which I have not known them used. In the family Trachinidæ, several species of *Uranoscopidæ*, vulgarly called "stone-lifters," of which the *Kathetostoma læve* is the commonest, occur on our shores, but are not used for food. Of the same family, however, there is one fish, called "whiting" by the colonists (although not at all like the European fish of that name), very abundant, always in the market, and so good as to be found at the best tables usually: it is the *Sillago punctata*. Of the family Sciænidæ, one example is a not uncommon occasional visitor, an exceedingly fine fish, of excellent quality for the table, and often four feet in length; it is called "king-fish" by the Melbourne fishermen and dealers: I believe it to be perfectly identical with the "maigre" of the Mediterranean and Cape of Good Hope—the *Sciæna aquila*. Of the family Sphyrænidæ a tolerably good table fish is very common at times in the markets: it is the "pike" of the colonists, *Sphyræna Novæ Hollandiæ*. Of the allied family Trichiuridæ an equally abundant and even larger fish is found in great numbers in the market at certain seasons—the "barracouta," perfectly identical with the *Thersites atun* of the Cape; it is one of the few fish dried and preserved in large quantities in Victoria. Of the Scombridæ, the only true Mackerel are rare visitors, the *Scomber australasicus* having only occurred to me twice in several years, and the *S. pneumatophoris* very lately; but of the tunny we have a new species, *Thynnus australis* (M'Coy), a not uncommon visitor; and the *Echeneis remora* is occasionally found in Hobson's Bay. The true dory (*Zeus faber*), perfectly identical with Mediterranean specimens, is a not very uncommon straggler into our seas; but in fish-markets the infinitely inferior table fish, the Australian "boarfish" (*Histiopterus recurvirostris*), is constantly sold under this name, although easily distinguished from the dory, even by unscientific purchasers, by the want of the round dark spot in the middle of the sides. The *Cyttus* (*Capros*) *australis* is common, but too small to be used for the table. Of the allied family Carangidæ, many interesting species occur in our seas. The common "horse-mackerel" (*Trachurus trachurus*), perfectly identical with English specimens, appears occasionally; and the *Caranx georgianus*, under the name of "silverfish," is still more common. A fine species of *Seriola*, nearly three feet long, is occasionally caught in numbers, and is sometimes called by the fishmongers "yellow tail," as at St. Helena; and sometimes it is sold and noticed in the newspapers under the name of "Bonito," with which its size and quality of flesh caused them to confound it; it differs only in small details from the *Seriola Lalandi*, of which I believe it to be a mere trifling variety. A curious instance of an almost cosmopolitan fish of this same family (Carangidæ) is the "skipjack" (*Temnodon saltator*), of which I have obtained many specimens in Hobson's Bay exactly identical with examples from New York, or the West Indies, or the Cape of Good Hope. There are many small species of *Gobius*, *Callionymus*, and *Blennius*, many of the latter viviparous; but they are not specially interesting or important. The *Clinus despicillatus* and *Cristiceps* abound amongst the seaweed between high- and low-water marks. The gourami (*Osphromenus olfax*) has been introduced and lived in a pond in my botanic garden at the university for nearly two years, until devoured by the herons; and it also lived in the ponds of the Acclimatization Society long enough to show that the experiment of the acclimatization of this famous table fish may be expected to succeed in ponds or tanks favourably placed. Two species of *Atherina* and two of *Mugil* are not uncommon in the bay; but the commonest "mullet" found abundantly in the fish-market for the table is the *Agonostoma Forsteri*. Two species of *Glyphidodon* or *Melambaphes* are common, and may often be found in the market, although not very good for the table: these are the *M.* (*Glyphidodon*) *nigroris,* called the "black perch," and the *Glyphidodon Victoriæ,* commonly called the "rock perch." The *Parma squamipennis* has occurred also to me not very uncommonly in the bay. Several brilliantly coloured fish of the family Labridæ occur as rare occasional visitors, but they are not worth special notice, the commonest and best-known being that called "parrot-fish;" it is the *Labrichthys ephippium.* The *Labrichthys laticlavius, L. psittacula,* and several others also occur occasionally. A much esteemed fish in the Yarra and other Victorian rivers is called "black fish" by the colonists; it is abundant, and sometimes exceeds a foot in length: it belongs to the genus *Gadopsis,* so remarkable for combining a spiny first dorsal fin with all the other characteristics of the *Anacanthini;* it is a mere variety, apparently, of the fish called "freshwater trout" in the Tasmanian rivers, the *Gadopsis marmoratus.* The *Lotella callarias* is a rare visitor, confounded with the *Pseudophycis barbatus* and two other species of *Pseudophycis* under the common name of "cod" and "rock cod" by the fish-dealers. The "flounder" of the colonists is a good table fish, with which the market is now regularly supplied; it seems peculiar to these seas, and is the *Rhombosolea flesoides.* A true sole (*Solea*), nearly allied to the *Solea margaritifera,* also occurs, although rarely, at the Heads. Amongst the Siluroid fishes the most important is the *Copidoglanis tandanus,* which is now regularly supplied to the Melbourne market by railway from the river Murray, under the name of "Murray catfish." The Yarra Yarra and some other of the rivers near the southern coast contain in great abundance a beautiful and active fish, excellent for the table, and affording capital sport to the angler. By ichthyologists following the classification of Cuvier it would be referred to the Salmonidæ, the adipose second dorsal fin being well marked; and so much does it resemble a grayling, in the cucumber smell when caught, in general appearance, habits, mode of rising to the fly, and playing, as well as in flavour, that anglers are in the habit of calling it now the "Australian grayling;" its close resemblance in food and habits to the true Salmonidæ helped the Acclimatization Society to argue that certain of our rivers would serve for the experiment of acclimatizing the European salmon and trout, and, as experience has since shown, successfully; it is vulgarly also called the "Yarra herring," and is the *Prototroctes marœna.* There is only one other fish known in Victoria with the second adipose dorsal fin and other characteristics of the Cuvierian Salmonidæ (but now referred to the Scopelidæ); it is the large and beautifully coloured marine form, the *Auropus purpurisatus,* of which I have got four specimens from Hobson's Bay for the museum; it is too rare, however, to have a popular name or be eaten.

Of the family Clupeidæ, or herrings, there is only one of much importance in our seas. A specimen of this was first brought to me in August 1864, from a small shoal, then seen for the first time in Hobson's Bay, and quite unknown to the fishermen. It was supposed by the sender to be the "Yarra herring" or "grayling" gone out to sea; but, on examination, I found it was the *Clupea melanosticta* of Temminck, or the species of pilchard so abundant on the shores of Japan. In the same month in the succeeding year, they appeared in greater abundance in the bay, and were caught by thousands for the market. After remaining for a few weeks they disappeared until the same time in 1866, when they arrived in such countless thousands that carts were filled with them by simply dipping them out of the sea with large baskets; hundreds of tons of them were sent up the country to the inland market, and through the city for several weeks they were sold for a few pence the bucketful; while the captains of ships entering the bay reported having passed through closely packed shoals of them for miles. They may probably be now expected every year as a very important addition to the food-fishes of the country. I imagine some alteration of the bed of the sea, from the earthquake disturbances north of Australia about that time, may have facilitated or induced the extension of the shoals in such unusual quantities from Japan to our coasts. Duperrey (or Lesson and Garnot) found it in New Zealand; and Cuvier and Valenciennes referred their specimen to the genus *Alausa*. I find, however, that the authors of the 'Histoire des Poissons' were in error, and Temminck in the right, in the former assigning five, and the latter seven, gill-rays; and it has also a row of teeth on the tongue, as was correctly stated by Temminck and erroneously denied by Cuvier and Valenciennes. The fish is therefore a *Meletta*, and not an *Alausa*, and should be referred to as the *Meletta melanosticta* (Temm. sp.). A true anchovy I find in great abundance in Hobson's Bay; it is the *Engraulis australis* (Wh. sp.), and if identical, as Cuvier supposes, with all the synonyms he groups under his *E. Brownii*, would be almost a cosmopolitan species. The *Chatoesus come* is occasionally to be found in the market. Of the family Galaxidæ are several interesting species in our rivers, going under the vulgar names of "gudgeon" and "trout." The species of *Galaxias* bearing the latter name in the Yarra and the Gippsland rivers is a beautiful new species, *Galaxias ocellatus* (M'Coy), marked with large circular eye-like spots, representing closely the *G. truttaceus* of Tasmania. The species called popularly "gudgeon" in the Yarra is the *Galaxias* *pseudoscriba* (M'Coy), related to the *G. scriba* (Cuv. and Val.), but with the depth of the body one-eighth of the total length, and other differences of proportion. The family Murænidæ, or eels, is represented in the bay by a large congor; and the *Anguilla australis* is the extremely abundant eel of the Yarra, Saltwater River, and many other streams and the adjacent swamps filled by them. Of the family Balistidæ there are a great number of species, all going under the popular name of "leather-jackets," having the reputation of being poisonous, and of no economic value. Of the family Tetraodontidæ, the *Tetraodon Hamiltoni* is extremely abundant along the shores, and popularly called "toadfish."

MOLLUSCA.

There are scarcely any molluscous animals of economic importance in the colony, the two species of oysters used for food being imported from Sydney of late years. The *Venus strigosa* is sold in the fish-shops under the erroneous name of "cockle;" and the *Lunetta undulata* is eaten by persons near the coast under the equally erroneous name of "winkles."

ARTICULATA.

Of the articulated animals there are only a few Crustacea applied to any use. The great Murray-River crayfish or lobster (*Astacoides serratus*) is brought in great numbers with the Murray fish by railway now to market, and is generally used at table as the lobster is in Europe. The smaller river crayfish (*Astacoides quinquecarinatus*) is not sold in the markets, but is commonly eaten in the vicinity of the many streams and reservoirs in which it is found in abundance. The great marine spiny crayfish or lobster, found abundantly at the Heads, is constantly found in the shops, and used at table in salads &c.; it seems to be a variety of the *Homarus annulicornis*, or a very closely allied species. A most destructive enemy to the submarine timbers of our piers belongs to this division of the animal kingdom: it is the little *Mylostoma* or *Chelura*, multiplying in the timbers, and causing them to crumble to pieces, as in Europe. Of the Insecta no species are used for any useful purpose at present, although several species of the *Coccus* affording dyes abound. Of the Annulata almost the only useful form is the species of leech (*Hirudo*) found so abundantly in the Murray River, which has the mouth so nearly like that of the *H. officinalis* of Europe that it is collected and used in immense quantities for medical purposes.

RADIATA AND PROTOZOA.

Of these divisions there are no economically useful kinds known, a few sponges alone having been applied to any useful purpose.

PALÆONTOLOGY.

The palæontology of Victoria and the adjacent parts of Australia is of very great interest, from the many unsettled scientific questions on which it bears.

POST-PLIOCENE AND PLIOCENE PERIODS.

The most recent geological period in Victoria, as in Europe, may be illustrated by the remains of bones found in caverns and in the superficial drifts and clays deposited, apparently, at the same time as that at which the caverns became closed. These Pleistocene and newer Pliocene periods are in Victoria, as in Europe, remarkably rich in osseous remains of warm-blooded animals, some of which are still inhabitants of the spot; others still live, but in other countries; and many are extinct—generally of the same type of structure as the more characteristic living animals of the country, but of species frequently immensely superior in size to any that now live—repeating, in fact, in Australia that appearance of gigantic antitypes of the peculiar geographical groups of zoological structure marking the living zoology of the great regions of the earth at the present day. I believe the majority of the so-called alluvial gold-deposits to be of this newer Pliocene period. In the sinkings into the various drifts at the Ballarat gold-fields, remains of timber and the characteristic fruits of the *Banksia* or "honeysuckle"-trees of the colonists are common, and apparently of the species still growing in the vicinity. In the clay-beds leaves are occasionally found in abundance, and perfectly preserved, undistinguishable from the foliage of the common "stringy-bark" tree (*Eucalyptus obliqua*) of the neighbouring forests. In these gold-drifts no marine remains have yet been found, and, indeed, few fossils of any kind; but in some of them (as, for instance in the gold-"cement" of Dunolly) I have found the jaw of a wombat, of the generic type (*Phascolomys*) so characteristic of the southern part of Australia and the adjacent island of Tasmania, but forming a distinct species (*Phascolomys pliocenus*, M'Coy), easily distinguished from the three living species of the same size by the greater antero-posterior length of the grinders. In the living and fossil lower jaws, having the same length from the tip of the incisor to the back of the hindermost grinder, the whole grinding series, of one premolar and four molars, only measures as much as the four molars of the fossil species, the premolar of which thus stands entirely in front of the corresponding tooth in the three living ones of the same size. This wombat enables me thus to connect the gold-drifts in age with the more superficial red clays, in which the bones of the lake-timboon &c. are found. And here we find, with the living dingo, or native wild dog, inhabiting the neighbouring localities at present, skulls and teeth of the *Sarcophilus ursinus*, or "Tasmanian devil," which now is only known to exist in Tasmania, and has never been known on the mainland; with these are the bones and teeth of the gigantic extinct kangaroos (the *Macropus Titan* and the *M. Atlas*), as well as bones and teeth of the gigantic extinct genera *Nototherium* and *Diprotodon*. The species of the latter occurring in Victoria is quite distinct from those of the more northern parts of the continent; it is the *Diprotodon longiceps* (M'Coy), readily distinguished by the more slender, elongate proportion of the jaws. The ordinary gold-drifts of Victoria, from the association (more or less direct) with these fossils, may thus be taken to be of the newer Pliocene or Mammaliferous Crag period, like those of Russia, determined by Sir R. Murchison.

MIOCENE PERIOD.

Under the Pleistocene and Pliocene deposits above alluded to are a series of plant-beds in a few localities, with a totally different facies from the recent flora of the country, not one species being identical; nor are the characteristic genera represented, but an entirely extinct series of species having generic and general resemblance to the foliage of Asiatic plants of tropical types of dicotyledonous plants, of which the *Laurus* is the most conspicuous. Many of the forms are closely allied to those of the Miocene plant-beds of the Rhine country. In apparently the same position, in much more numerous localities, the marine deposits of sands and clays full of shells, echinoderms, corals, with occasional fish, and with still rarer marine mammalian remains, occupy wide areas just under the Pliocene beds. These have the general facies (and even specific identity) of so many species so clearly marked, that there cannot be the slightest doubt of the great thickness of those beds being lower Miocene of the date and general character of the Faluns of Touraine, the Bordeaux and the Malta beds, while the base of the series blends imperceptibly with a series of beds having a slightly older facies, and rendering the adoption of the Oligocene formation of Beyrich as convenient for Victorian as for European geologists. The only marine mammal of which I have seen portions which could be identified in those beds is a new species of *Squalodon* or *Phocodon* (*P. Wilkinsoni*, M'Coy), from the Miocene Tertiary sands of the Cape Otway coast: and as the genus is only known in Miocene strata of Malta and the French falun, the occurrence of a new species of so restricted a genus is not only valuable as an addition to palæontology, but an interesting fact as showing that the zoology of Australia, as I have on former occasions endeavoured (contrary to received opinions) to establish, was not, during the older Tertiary period, of the isolated exceptional character it now has, but was then closely related generically, and even specifically, as I shall show, to that of many parts of Europe and America. The molar teeth of *P. Wilkinsoni* are smaller than the Maltese *P. scillæ*, and agree most nearly with the *Squalodon* (*Phacodon*) *Grateloupi* (Meyer) of the Miocene beds near Bordeaux, from which the Australian species differs chiefly in smaller size, some details of proportions, and the relatively larger roots, indicating a greater depth of jaw. In these same beds remains of fish are not uncommon; and these are almost all of well-known European and American Miocene and Upper Eocene Tertiary extinct species of Plagiostomi: the most abundant widely distributed species is, I have no doubt, perfectly identical with the *Carcharodon angustidens* (Ag.) of the Bünde and other well-marked European Lower Miocene and Oligocene beds. The *C. megalodon* (Ag.) is an almost equally common Australian Miocene species, and (on comparison, as in the former case, of specimens) undoubtedly identical with the Lower Miocene and Oligocene Tertiary specimens from Malta, Bünde, and other European sections, and with those from the Eocene London Clay and North-American localities. The *Otodus Desori* (Ag.), *Lamna elegans* (Ag.), and *L. contortidens* (Ag.), of the European and United-States Miocene localities, are also common in many of our Victorian Miocene beds, in which I have also identified the *Lamna denticulata* (Ag.), and the large teeth of *Oxyrhina trigonodon* (Ag.), exactly agreeing with those of the Lower Miocene beds of the Rhine country. Along with these entirely extinct plants, mammals, and fish, there are many genera and species of Mollusca entirely extinct, many identical with extinct species of the same geological age in other localities both in Europe and North America, and many of the commonest forms are identical with living species, none of which are found in the adjacent seas of Victoria, but in the warmer seas north of New Zealand, Philippines, and South Africa), with one or two rare exceptions of species extending into colder latitudes in the northern hemisphere.

A fine new *Aturia* (*A. australis*, M'Coy) is the most common and important of the fossil Cephalopoda, closely related to the *Aturia ziczac* of the Lower Miocene and Upper Eocence beds of Germany, France, and England. No species of *Aturia* lives now, the angulated septa contrasting strongly with the waved ones of recent *Nautilus*.

The Gasteropoda are very abundant and for the most part peculiar, several of them being closely representative types of well-known Miocene and Eocene European species, while others are identical with European and North-American Miocene and Upper Eocene species. Of these, one of the most striking is a *Dentalium* found in extraordinary abundance in nearly every locality of our Victorian Miocene Tertiaries; and yet no species of the genus has ever been found living in the Victorian seas. The fossil species is manifestly identical with the Belgian Miocene Tertiary *D. Kickxii*; and the Victorian examples also agree completely, on the most minute comparison, with specimens I have from the Lower Miocene and Oligocene beds of Flonheim, as well as with North-American specimens I have from the Upper Eocene beds of Vicksburg, described by Conrad under the name *D. mississippiense,* without observing its identity with the European Miocene species. This *Dentalium,* occurring together with the above-named extinct species of fish so abundantly in Australia, as in the United States, France, and Germany, is a very curious additional instance of the general identity in facies of the marine zoology of Australia with that of Europe and Northern America during the Miocene period, when all of these localities seem to have had a warmer climate than at present. Amongst the representative types the most extraordinary case is that of an entire series of Volutes in the Oligocene clay-beds near Mount Martha and Mount Eliza on one side of Hobson's Bay, and the sandy beds of slightly younger age on the other side of the bay south of Geelong, representing in the most complete manner the series of common species of *Volutilites* of the Upper Eocene or Oligocene beds of the Isle of Wight, the Hampshire coast, and the corresponding French, Austrian, and Belgian strata of the basins of Paris, Vienna, and Limbourg. In fact the *V. suturalis* and *V. cingulata* (varieties of our species) of the "Tongrien" or Lower Miocene beds of Lattorf, near Bernberg, is so exactly represented by a species which I have called *Voluta anticingulata* (M'Coy), that, on comparison of specimens with the tip of the spire absent, it would be almost impossible to separate them as the most trifling varieties; yet the European *V. cingulata* has the acute regular apex of the spire characteristic of the Eocene genus *Volutilites,* while our Australian representative form has the obtuse mammillated tip of the more recent true genus *Voluta*. In the same Lower Miocene or Oligocene on both sides of Hobson's Bay, we have great numbers of another species, the *Voluta anti-*

scalaris (M'Coy), which so completely resembles the *Volutilites scalaris*, equally common in the Isle of Wight and Hampshire cliff beds, that, on comparing specimens from the two localities, the nicest eye could scarcely find character for a variety, except the same generic difference of the acute regular tip to the spire in the European, and the obtuse mammillary tip in the Australian shell; and so with several others. None of these resemble living species, and they are accompanied by many others (as *V. Hannafordi* and *V. macroptera*, M'Coy) equally removed from any known living or fossil ones. In the same beds species of *Cypræa* are common, of the most extravagant forms when compared with any known living or fossil types. Thus one species, the *Cypræa gastroplax* (M'Coy), has the underside dilated into a flat circular plate between three and four inches in diameter. Another huge species, the *Cypræa gigas* (M'Coy), is commonly eight or nine inches in length, far exceeding any living species in size. Other Gasteropods are equally remarkable for representing fossil European species of the same age: thus the common *Cassidaria depressa* of the German Lower Miocene beds is so closely imitated by the *C. reticulospira* (M'Coy) in the Victorian strata, that the reticulation of the extreme apex of the spire is almost the only character for distinction. The common *Trivia avellana* of the European strata is represented by an equally common curiously similar species, the *T. avellanoides* (M'Coy). Amongst the singular forms in these Australian Tertiary beds, recalling Oolitic European ones, is a *Pleurotomaria* (*P. australis*, M'Coy) as large as the Mesozoic *P. anglica*, and a concentrically costated *Trigonia* (*T. semiundulata*, M'Coy) strongly contrasting with the radiated species which are alone found living now. The old notion, found in many books, that the marine Oolitic fauna, as well as the terrestrial, exists still in Australia in the modern times, has no definite foundation when closely examined. The genus *Trigonia* has often been quoted as a case in point of a genus common in old-world Mesozoic formations, not occurring in the Tertiaries, but found living in Australian waters. I have now described two Tertiary Australian abundant species, the above one, and a radiated species, the *T. acuticostata* (M'Coy), filling up the geological gap in the range in time of the genus, yet both perfectly distinct specifically from the four recent ones.

With these strange forms are abundance of a very small percentage of recent species, none of which, however, occur in Victorian waters, but in warmer seas, thus following the rule in this respect of recent species in Miocene strata in Europe being usually recent in some warmer latitude. All our evidence, in fact, goes to show that there was no glacial period in Victoria succeeded by a warmer modern one, but that there has been a regular and gradual falling of the temperature to the present day.

The most abundant living shell in almost every locality of our Victorian Miocene or Oligocene beds is the *Pectunculus laticostatus* of the warm seas of North New Zealand, found in thousands, and perfectly identical with the living one, though having no relation to any found in the seas of Australia. The *Cucullæa concamerata* and *granulosa* (Reeve), living in the warmer seas of southern China, but not found living south of the equator, is not uncommon in the fossil state in our Victorian Miocene beds. One of the commonest fossils in the same beds is the *Limopsis Belcheri*, previously only known as a very rare living species dredged from deep water off the Cape of Good Hope, where the Mozambique current heats the sea more than the latitude would account for. Almost equally common, however, and mixed with it, is the *Limopsis aurita* (Sassi), perfectly undistinguishable, on a minute comparison of specimens, from examples from the Coralline Crag of Suffolk and the Miocene Fahluns of Flonheim, Rheinhessen, or from living specimens from the seas of the northern hemisphere. The only other excessively common living species of shell in our Miocene or Oligocene beds is the *Corbula sulcata* (Lam.), of the tropical seas of the west coast of Africa, whence I have procured living specimens, so that, as in the other cases of identity of species spoken of, I might not run the chance of misleading my readers by erroneous identifications based on comparisons with figures or descriptions only.

The Brachiopoda, although not very abundant, present many representative and peculiar forms, with one doubtful recent species, and another certainly identical with the very rare *Rhynchonella lucida* (Gould), found living in the Sea of Japan. The Echinodermata are all extinct, and closely related to Maltese species. The corals are few and all extinct, and peculiar to the locality.

MESOZOIC PERIOD.

It is generally supposed that no marine Mesozoic strata occur in Australia. The announcement will therefore have some interest, that I have lately determined clearly the existence of the lower cretaceous rocks in nearly the centre of Australia, with the characteristic genera and closely representative species of the corresponding beds in Europe.

CRETACEOUS PERIOD.

From the head of the Flinders River Messrs. Carson and Sutherland have forwarded me specimens of an olive-coloured argillaceous and sandy rock, containing two large species of *Inoceramus* (*I. Carsoni* and *I. Sutherlandi*, M'Coy), so nearly agreeing in size and shape with the English Cretaceous *I. mytiloides* (Sow.) and the English and French *I. Cuvieri* respectively, that at first sight they might be readily confounded. With these are two species of *Ammonites*, one (*A. Flindersi*, M'Coy) so closely agreeing in size, number of whorls, shape, markings, and septa with the common *Ammonites Beudanti* (Br.) of the French Lower Chalk, that, except for being slightly less compressed and a slight difference in some of the septal lobes, it could scarcely be separated, even as a variety.

With these is a Belemnite (*Belemnitella diptycha*, M'Coy) so exactly like in size and shape the *B. plena* of the English and French Lower Cretaceous rocks that they can only be distinguished by a slight difference in the distance of the two great longitudinal furrows.

The most wonderful occurrence which I am able to announce along with those molluscan forms are three new species of Enaliosaurian reptiles of Cretaceous genera, and most nearly allied to cretacean European species. One of these is an *Ichthyosaurus* (*I. australis*, M'Coy), of which I have recognized a large number of vertebræ, the large skull, with the eye and its bony sclerotic ring perfectly preserved, and part of one of the paddles. The other two are species of *Plesiosaurus*,—one (*P. macrospondylus*, M'Coy) differing from the nearest known species in the greater proportional length of the bodies of the vertebræ, and the other (*P. Sutherlandi*, M'Coy) more nearly approaching the ordinary proportions of the genus and the New-Zealand species of Owen.

LOWER MESOZOIC.

The coal-bearing rocks of Victoria belong, I have no doubt, to the Mesozoic period, from the characteristic plants being such as are found with the Mesozoic coal in Yorkshire, Germany, &c., and from the total absence of all the genera characteristic of the Palæozoic coal. At Cape Paterson and Bellerine we find in the shales alternating with the coal three well-marked species of *Zamites* (*Z. ellipticus* and *Z. Barklyi*, M'Coy, and a rarer species, *Z. longifolius*, M'Coy, which I have seen from the N.S.W. beds), a *Tæniopteris* (*T. Daintrei*, M'Coy) of the size and shape of the *T. vittata* of the English Oolitic coal-beds, but differing in the number of transverse veins in a given space, and the *Phyllotheca australis*, identical with the New-South-Wales coal-species. The association of these genera alone would indicate the beds to be Mesozoic and not Palæozoic with certainty; but the association of the same plants with other species in other localities furnishes much additional interesting information. Thus the *Phyllotheca australis* is found with the *Glossopteris Browniana* in the New-South-Wales coal-beds of the Hunter River; so that, although the latter plant has not yet been found in Victoria, it is by this association brought to bear on our beds. Then, again, I have found the *Tæniopteris Daintrei* associated in New Zealand with a new species of *Camptopteris* (*C. Novæ Zealandiæ*, M'Coy); and thus by this association we get yet another Mesozoic genus of plants to support the view of the Mesozoic age of the Victorian coal. Besides these generic forms, so unlike those of Palæozoic coal, there are numerous species of *Pecopteris, Neuropteris, Sphenopteris,* and other genera having a greater range in time, and, as generic forms, therefore, of no interest in the discussion of the age of our coal-beds; but the species are generally nearly related to the Burdwan and Rajmahal coal-beds in India, and the Scarborough ones in the Oolitic series of England. One of these, found commonly near Bellerine (the *Pecopteris australis*), I have recently compared carefully with specimens of the English Oolitic *P. Whitbiensis*, and am convinced that there is no specific character to separate the Australian fossil, which at most can only rank as a slight variety incapable of definition. The Indian beds of Rajmahal, so closely related to the Australian coal-deposits near Sydney, are now, I believe, satisfactorily connected with the marine Mesozoic beds of that country containing Oolitic Ammonites, Belemnites, &c.

It is worthy of note that the collections illustrative of the coal-deposits of New South Wales sent to the Intercolonial Exhibition by the Rev. W. B. Clarke and Mr. Keene, having been carefully examined by myself in company with Mr. Selwyn, entirely fail to give the slightest support to the view of those gentlemen that the plant-beds and coal are there Palæozoic, as there is no trace of the *Sigillaria, Stigmaria, Calamites,* &c., said to be so abundant. The fish have the *facies* of Permian or Triassic forms rather than of Carboniferous, of which period the characteristic abundant forms *Psammodus, Cochliodus, Ctenoptychius, Gyracanthus, Rhizodus,* &c. are as completely absent as the Palæozoic plants in the plant-beds. Both in New South Wales and Victoria a *Lepidodendron* occurs, *but in beds* entirely below those we are speaking of. I some years ago determined the Oolitic age of some marine fossils, including *Pentacrinites, Belemnites, Ammonites,* &c., which had been sent from New-South-Wales localities to Mr. Clarke, and by him transmitted to His Excellency Sir H. Barkly, for my "opinion as to the geological epoch to which they belonged."

The sandstones of Bacchus Marsh, probably inferior in position to the coal-beds, contain one plant often of the size, shape, and reticulated neuration of the *Glossopteris Browniana,* but without the midrib. For this I have proposed the name *Gangamopteris*; and of this generic form a species, *G. angustifolius* (M'Coy), occurs in New-South-Wales coal-plant beds along with the *Glossopteris Browniana.*

In all the marine Australian Mesozoic fossiliferous beds which I have seen, the genus *Trigonia* is absent.

TRIASSIC AND PERMIAN PERIODS.

I was able to suggest the existence of Trias deposits in Australia from the muschelkalk genus *Myaphoria,* which I recognized in some fossils from Wollumbilla sent by Mr. Clarke; and the Permian I suggested to exist at Mantuan Downs, also in New South Wales, from the *Productæ* and *Aulesteges* of that period submitted to me in the same collection.

CARBONIFEROUS PERIOD.

The sandstones of the Avon in Gippsland are the only traces of this formation that I can recognize in Victoria; and the only fossil I have seen from it is the *Lepidodendron* referred to above, identical with that recognized by me many years ago from New South Wales, and which I have lately seen also from Queensland.

DEVONIAN PERIOD.

It is with great pleasure I announce the fact of my having been able satisfactorily to determine the existence of this formation also in Australia, the limestone of Buchan in Gippsland containing characteristic corals, Placodermatous fish, and abundance of the *Spirifera lævicostata,* perfectly identical with specimens from the European Devonian Limestones of the Eifel.

UPPER SILURIAN PERIOD.

I have been able to recognize the Mayhill Sandstones and the Wenlock rocks with certainty in many localities in Victoria. At Broadhurst Creek, for instance, the beds are filled with numbers of the *Phacops* (*Odontochila*) *longicaudatus,* exactly as the corresponding English beds of Cheney Longville are in Shropshire; and here, as in every part of the northern hemisphere, the *Spirifera reticulata* is the commonest Brachiopod; and many others identical with species of England, Bohemia, and North America occur with it.

The Ludlow rocks are indicated by the *Orthoceras bullatum* and a series of starfish closely representing those of the English Ludlow beds, together with a beautiful new *Homalonotus* (*H.*

Harrisoni, M'Coy), which I have named after the discoverer, as well as the *Graptolites Ludensis.* The *Hemithyris diodonta* (Dalm.) is as abundant in the Mayhill Sandstone of Victoria as in the corresponding English beds at Malvern; and the same appearance of oblong smooth *Pentamerus* (*P. australis,* M'Coy) marks this sandy base of the Upper Silurian in Victoria as in England and Wales and North America.

CAMBRIAN PERIOD OF SEDGWICK, LOWER SILURIAN OF MURCHISON.

It is to this period that I have been able without hesitation to refer the whole of the slates containing gold-quartz veins or reefs in Victoria; and all the slates containing these gold-bearing veins are identical in age and character with those of North Wales, in which the Romans worked the gold-mines of Gogofau.

Not only are the majority of the fossil Graptolites found in the Welsh Llandeilo Flags and in the corresponding Cumberland and Scotch slates, also found in those beds in Victoria, but we have in these formations the most extraordinary proof of the unexpected fact which I announced on a former occasion, that there was in the Cambrian or Lower Silurian period a nearly complete specific uniformity of the marine fauna, not only over the whole northern hemisphere, but across the tropics, extending to this remote temperate latitude of the southern hemisphere.

In the slates of the gold-fields the principal fossils are Graptolites; and, what is very extraordinary, I have identified specifically here nearly the whole of the series of remarkable compound Graptolites first made known from the similar slates of Canada by the researches of Professor Hall. Many of the species have not yet been recognized in any but the Canadian localities in the northern hemisphere; and to find nearly the whole series here is most interesting, as their powers of locomotion could only be exercised in the short ovarian and free stage; so that, except on the supposition of a uniform marine fauna at this earliest zoological period of the earth's history, we could scarcely account for their width of distribution, and still less so of the littoral or shallow-water Mollusca which accompany them in other beds. The *Diplograpsus mucronatus* (Hall), so common in the Utica Slates of New York, I find in equal abundance here in the slates of Bendigo or Sandhurst, and with it abundance of the *D. quadrangularis* (M'Coy), completely identical with those I described many years ago from the slates of Dumfriesshire. The *Diplograpsus pristis* (His., sp.) also occurs in these same slates, mixed with the others as in Sweden, Bohemia, and Scotland; but in certain different sandy beds it covers the whole of the planes of deposition in millions, to the exclusion of everything else, exactly as it does in certain beds of the English Caradoc Sandstone near Church Stretton. In some localities these are replaced by great numbers of the Bohemian *Diplograpsus palmeus* (Barrande), on the upper end of many specimens of which I find a large, smooth, pear-shaped or heart-shaped appendage which I believe to be an ovarian vesicle. I should remark that I have observed exactly the same appendage (bearing out, I think, the idea, which I have supported formerly on other grounds*, of the affinity of the Graptolites with the Hydroida) in specimens of this species from the slates of the typical locality in Bohemia, when carrying out the direct careful comparisons of specimens of species which I state to be identical in Victoria and other countries; so the frequent observation of this apparent ovicell in the Victorian specimens does not at all affect the identity of this species with that of the basin of Bohemia, of which there can be no doubt. The *D. ramosus* (Hall) in our slates is also identical with those of the Utica Slate of New York. Of the group of compound Canadian Graptolites, the commonest in the Victorian gold-field slates of many localities is the *Didymograpsus caduceus* (Salt.), first described from the Quebec Slates. In many localities the specimens of this species are as small as the first-described Canadian ones; but in others they acquire a greatly increased size, occasionally twice the length and nearly three times the width; and the angle of divarication of the two branches varies from 5° to 70°. This is usually accompanied by the *D. serratulus* (Hall), identical with those of the New York Slates, and generally also by the very large Canadian *D. bryonoides* (Hall), which it is possible may be hereafter found to be the perfect development of my *G. latus*. The *D. nitidus* (Hall) is more rare, but perfectly identical with the Canadian types. The *Graptolites gracilis* (Hall), identical with the New-York and Canadian species, is one of the rarer compound forms. The curious radiating compound forms, which created so much astonishment when published first by Professor Hall in his Decades of the palæontology of this part of Sir H. Logan's Geological Survey of Canada, I find in just as great abundance in the slates of the same age in Victoria. *D. octobrachiatus*, *D. quadribrachiatus*, and *D. Logani* (Hall) are, especially the latter, not uncommon in many of the gold-field localities. The curious Canadian quadrifid Graptolite, named *Phyllograptus typus* by Hall, is one of our most abundant Australian Graptolites; but, although sometimes upwards of an inch in length, small specimens, I find, on comparison with Swedish specimens of the *G. folium* of Hisinger, are perfectly identical therewith; and,

* British Palæozoic Rocks and Fossils.

further, on carefully comparing Bohemian specimens of the *G. ovatus* of Barrande with the Swedish *G. folium*, I have no doubt they belong to one variable species, and are identical with the smaller examples of the Australian and Canadian species, and, further, that the European specimens are truly quadrifoliate, like Hall's *Phyllograptus*; and in this way the difference in the different descriptions, as to the width of the midrib, becomes intelligible.

As a general rule, the Graptolite-slates in every part of the world contain no other fossils. I many years ago discovered in Wales, near Builth, the only shell I ever heard of in Graptolite-slates (the *Siphonotreta micula*, M'Coy); and I was greatly surprised to recognize it also in Victoria, in the Deep Creek section. The Crustacean genus *Hymenocaris* is represented by a new species, *H. Salteri* (M'Coy), found in most of the Graptolite-slate localities.

In a different set of sandy, marly, and mud-stone beds (as at Woori Yallock, Yarra) we find:—an extensive series of the genera and many of the species of Corals, Trilobites, and Mollusca of the "Bala beds" of North Wales; species of *Favosites**, *Palæopora, Calymene, Phacops, Beyrichia, Strophomena, Leptagonia depressa, Spirifera reticularis, Orthis elegantula*, the characteristic little genus *Cucullella, Murchisonia, Conularia*, &c.; and some species new, and some identical with British ones, forming a group so completely reproducing the well-known Bala beds as to afford a second case in support of the view of the general specific identity of the marine fauna over both hemispheres of the whole world in the earliest palæozoic times.

It is curious that I have not yet seen any trace of the genus *Trinucleus* in Australian beds, nor *Ampyx*, while all the above-mentioned genera of Trilobites, with *Acidaspis, Chirurus*, &c., are well marked.

I can scarcely close this part of the subject without drawing attention to the curious confirmation offered in Victorian geology of the view of Professor Sedgwick and myself, that there was a real systematic line of division between the Upper Silurian and the Cambrian and Lower Silurian, at the base of the Mayhill Sandstone and over the Caradoc Sandstone—the Mayhill Sandstone, which we first defined and demonstrated to have Upper-Silurian fossils only, and the true Caradoc Sandstone full exclusively of Lower-Silurian or Cambrian types,—the previous confusion of these two sandstones, from the erroneous mingling

* It is worthy of remark that as on the continent of Europe the Devonian genus *Pleurodictyum* has now been found in Silurian strata, so in those beds in Victoria I find a new species (*P. megastoma*, M'Coy), with cells half an inch in diameter.

of their fossils in collections, having given Sir Roderick Murchison the erroneous impression that his Upper and Lower Silurian groups of fossils (the distinctness of which he himself was the first to point out) were mixed together in the Caradoc Sandstone, and that consequently the Bala beds, identical in fossils with those of the Caradoc beds (although formerly recognized by him as the type of the Cambrian system), could not be separated palæontologically from the Upper Silurian group. The Mayhill Sandstone was one of the first formations I recognized, on landing near Melbourne, with the usual Upper-Silurian fossils; and it is now found here, as in Wales, to be slightly unconformable to the Cambrian or Lower Silurian, forming the obvious base of the former and totally distinct from the latter.

XXIII.—*Notes on Spiders, with Descriptions of several Species supposed to be new to Arachnologists.* By John Blackwall, F.L.S.

Tribe Octonoculina.

Family Mygalidæ.

Genus Filistata, Walck.

Filistata distincta, n. sp.

Length of the male (not including the falces) $\frac{7}{16}$ of an inch; length of the cephalothorax $\frac{3}{16}$, breadth $\frac{3}{20}$; breadth of the abdomen $\frac{1}{6}$; length of an anterior leg $1\frac{1}{3}$; length of a leg of the third pair $\frac{15}{16}$; length of a palpus $\frac{13}{24}$.

The cephalothorax is oval, clothed with yellowish-grey hairs, moderately convex, with a longitudinal indentation in the medial line, and an abrupt prominence in the cephalic region, on which the eyes are seated, the space between the prominence and the frontal margin being sloped forwards; its colour is brownish yellow, the medial region being the darkest. The falces are small, subconical, prominent, united at the base, somewhat hollowed on the inner surface, armed with a very short, curved, red-brown fang, and have a pointed tooth near their extremity, on the inner side; the maxillæ, which are strongly curved towards the lip, have the palpi articulated on the outer side, nearer to their extremity than their base; the lip is long, and somewhat pointed at its apex; and the sternum is oval and hairy. These parts have a brownish-yellow hue, the falces, which are rather the darkest-coloured, being tinged with red at the extremity. The eyes are closely grouped on the cephalic prominence, and are diaphanous; three on each side, of an oval figure, form an irregular triangle, the anterior ones being the largest of the eight, and between these groups two round eyes are placed transversely. The legs are long, moderately robust, provided with hairs and spines, and are of a brownish-yellow colour, the tibiæ, metatarsi, and tarsi having a tinge of red; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the small inferior one is inflected, and has a few fine teeth at its base: the palpi are very long, and resemble the legs in colour; the radial nearly equals the humeral joint in length, and the short digital joint is terminated by the oval red-brown palpal organs, which have a prominent, spiral, dark red-brown spine at their extremity. The abdomen is oviform, clothed with hairs, slightly convex above, and projects a little over the base of the cephalothorax; it is of a yellowish-brown colour, the under part being the palest.

The immature female is rather darker-coloured than the adult male, and its legs are stronger and much shorter, but their relative length is the same; its palpi, which are comparatively short and robust, have the dark-brown digital joint terminated by a curved claw.

It is very difficult to determine the position that the spiders of the genus *Filistata* should occupy in a systematic arrangement of the Araneidea. They possess few characteristics in common with the *Mygalidæ,* in which family they are usually placed by arachnologists. By the disposition of the eyes, the relative length of the legs, and the structure of the falces they are allied to the spiders of the genus *Artema*; but by their general structure and economy they appear to have the nearest affinity to the *Drassidæ,* and particularly to certain species of the genus *Drassus.*

The adult male described above, and two immature females were captured in the island of Jamaica.

Family Lycosidæ.

Genus Lycosa, Latr.

Lycosa ingens.

Lycosa ingens, Blackw., Ann. & Mag. Nat. Hist. ser. 2. vol. xx. p. 284.

The male is smaller than the female, but it resembles her in colour. Its palpi have a red-brown hue, and are clothed with greyish-brown hairs, the digital joint, which is the darkest, having a few white hairs at its base; the radial is larger than the cubital joint, and has some white hairs at its extremity; the digital joint is of an oblong-oval figure, slightly convex above, compact at the extremity, which is provided with several strong spines, and has a concavity at its base, on the underside, which comprises the palpal organs; these organs are moderately developed, rather complex in structure, and of a red-brown colour at the base, the hue of the anterior part, whose black inner margin is curved, being dull yellow; from a small dark red-brown piece, situated near the middle of the outer side, project two pointed processes, one of which is prominent and the other is directed outwards towards the margin of the digital joint.

Since the female of this fine species of *Lycosa* was described in the 'Annals and Mag. of Nat. Hist.,' I have received from the Barão do Castello de Paiva specimens of both sexes, which had been captured in the islands of Madeira, Porto Santo, and Deserta Grande.

Family Salticidæ.

Genus Salticus, Latr.

Salticus diligens, n. sp.

Length of the male (not including the spinners) $\frac{5}{24}$ of an inch; length of the cephalothorax $\frac{1}{10}$, breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{12}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{3}{16}$.

The minute intermediate eye of each lateral row is rather nearer to the anterior than to the posterior eye of the same row. The cephalothorax is large, glossy, somewhat quadrilateral, sloping abruptly at the base and projecting a little beyond the falces in front; it has a curved indentation in the middle, whose convexity is directed forwards, and is of a reddish-brown colour; the lateral eyes are seated on brown spots, and there are some white hairs on its sides. The falces are short, subconical, vertical, and have a brownish-red hue. The maxillæ are straight, and enlarged and rounded at the extremity, and the lip and sternum are oval. These parts are of a yellowish-brown colour. The legs are robust, especially those of the anterior pair, and are provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; they are of a brownish-yellow colour, the inferior surface of the femora of the anterior pair having a brown hue; the first pair is the longest, then the fourth, and the second and third pairs are nearly of equal length; each tarsus is terminated by two curved claws, below which there is a small scopula. The palpi resemble the legs in colour; the cubital and radial joints are short, the latter being the shorter; the digital is long, of nearly equal breadth, slightly convex and hairy above, compact at the extremity, with a concavity at the base, on the underside, comprising the palpal organs, which are moderately developed, with a slender, curved, reddish-brown spine near the extremity, on the outer side, and are of a yellowish-red colour. The abdomen is oviform, clothed with hairs, somewhat depressed, and projects over the base of the cephalothorax; the upper part is of a yellowish-brown colour, with a series of yellowish-white angular lines in the middle, whose vertices are directed forwards; three dark-brown spots occur on each side of the medial line, and above the prominent yellowish-red spinners there is a yellowish-white space, which comprises two contiguous, brown, angular lines; the upper part is encompassed by a white band, and the sides and under part have a dark-brown hue, a dull-yellow band extending along each side of the latter.

This *Salticus* was captured in the island of Madeira.

Salticus vafer, n. sp.

Length of the female $\frac{1}{6}$ of an inch; length of the cephalothorax $\frac{1}{12}$, breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{12}$; length of a posterior leg $\frac{1}{6}$; length of a leg of the second pair $\frac{1}{8}$.

The cephalothorax is glossy, somewhat quadrilateral, and slopes from the posterior eyes to both extremities; it projects a little beyond the falces in front, has a broad, shallow indentation in the middle, and is of a brown colour, the medial line and the sides, which are much the palest, having a tinge of red; and the hue of the cephalic region and narrow lateral margins is brownish-black. The minute intermediate eye of each lateral row is rather nearer to the posterior than to the anterior eye of the same row. The falces are short, subconical, and vertical; the maxillæ are straight, and enlarged and rounded at the extremity; and the lip and sternum are oval. These parts are of a red-brown colour, the falces being the darkest, the maxillæ much the palest, and the base of the lip having a dark-brown hue. The legs are moderately robust, and are provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; they are of a dull-yellow colour, with a red-brown annulus at the base of the tibiæ, metatarsi, and tarsi; the fourth pair is the longest, then the third, and the second pair is the shortest; each tarsus is terminated by two slender, curved claws, and below them there is a small scopula. The palpi are short, and have a pale-yellowish hue. The abdomen is oviform, thinly clothed with hairs, convex above, and projects over the base of the cephalothorax; it is of a yellowish-white colour, the under part being the palest; the sides are irregularly marked with brown intermixed with yellowish-white; a broad yellowish-white band, which extends along the middle of the upper part, and is broadest at its anterior extremity, projects from each side, at somewhat more than a third of its length from the spinners, a ray of the same hue, which is directed obliquely downwards and backwards; the anterior part of the band comprises several brown spots, and there are in the posterior part two or three angular lines of the same colour, having their vertices directed forwards; the under part is without spot, and the sexual organs, which are not highly developed, have a red-brown hue.

Salticus vafer was captured in the island of Madeira.

Salticus catus, n. sp.

Length of an immature female (not including the spinners) $\frac{3}{16}$ of an inch; length of the cephalothorax $\frac{1}{12}$, breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{16}$; length of a posterior leg $\frac{1}{6}$; length of a leg of the second pair $\frac{1}{8}$.

The legs are moderately robust, provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs, and are of a brownish-yellow hue; the fourth pair is the longest, then the third, and the second pair is the shortest; each tarsus is terminated by two curved claws, and below them there is a small scopula. The palpi are short and resemble the legs in colour. The cephalothorax is convex, glossy, somewhat quadrilateral, sloping to each extremity, and projecting a little beyond the falces in front; it has a slight indentation near the middle, and is of a brown colour, tinged with yellow in the medial line and on the sides, and the cephalic region has a brownish-black hue. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are short, subconical, vertical, and armed with one or two small teeth on the inner surface; the maxillæ are straight, and enlarged and rounded at the extremity; and the lip is oval. These parts have a brown hue, the falces being tinged with red. The sternum is oval and of a yellowish-brown colour. The abdomen is oviform, glossy, pointed at the spinners, which are prominent, convex above, and projects a little over the base of the cephalothorax; the upper part has a dark-brown hue, with irregular lateral margins, and a brownish-yellow dentated band extends along the middle, which comprises a series of angular lines of a dark-brown hue, whose vertices are directed forwards; the sides and under part are of a pale brownish-yellow colour, the former being marked with a few longitudinal dark-brown streaks, and the latter having a black spot near the base of the spinners.

This species was captured in the island of Madeira.

Salticus sublestus, n. sp.

Length of the female $\frac{1}{8}$ of an inch; length of the cephalothorax $\frac{1}{16}$, breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{24}$; length of a posterior leg $\frac{3}{20}$; length of a leg of the second pair $\frac{1}{10}$.

The cephalothorax is rather long, glossy, and somewhat quadrilateral; it slopes abruptly at the base, projects a little beyond the falces in front, and is of a dark-brown colour, the cephalic region being the darkest. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The falces are short, subconical, and vertical; and the maxillæ are straight, and enlarged and rounded at the extremity. These organs have a brownish-yellow hue, the former having a tinge of red. The lip and sternum are oval, and of a dark-brown colour. The legs are robust, particularly those of the first and second pairs, and are of a brownish-yellow hue; they are provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; the fourth pair is the longest, then the third, and the second pair is rather shorter than the first; each tarsus is terminated by two slender, curved claws, and below them there is a small scopula. The palpi are short, and resemble the legs in colour. The abdomen is oviform, glossy, convex above, and projects a little over the base of the cephalothorax; it is of a brown hue, with two nearly parallel, short, white streaks at each extremity of the upper part, the posterior ones being the broader; there are a few obscure, oblique, whitish streaks on each side of the medial line, and two longer ones on the posterior half of each side: the sexual organs are moderately developed, and of a red-brown colour.

The male is darker-coloured than the female, and the whitish marks on its abdomen are less conspicuous. The legs have a brown hue. The palpi are long and resemble the legs in colour; the cubital and radial joints are clavate, and the latter, which is rather the shorter, has a straight, pointed apophysis at its extremity, in front, towards the outer side, and a minute one on the underside; the digital joint has an oblong-oval form; it is convex and hairy above, compact at the extremity, with a concavity underneath comprising the palpal organs, which are well developed, not very complex in structure, with a short, pale, pointed process at their extremity, and are of a brown colour.

This small *Salticus* inhabits the island of Madeira.

Salticus vigilans, n. sp.

Length of an immature female (not including the spinners) $\frac{11}{48}$ of an inch; length of the cephalothorax $\frac{1}{10}$, breadth $\frac{1}{12}$;

breadth of the abdomen $\frac{1}{12}$; length of an anterior leg $\frac{1}{5}$; length of a leg of the second pair $\frac{1}{7}$.

The legs are robust, especially those of the anterior pair, and are provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs; they have a dull-yellow hue, the anterior pair being tinged with red; the first pair is the longest, then the fourth, and the second pair is slightly shorter than the third; each tarsus is terminated by two curved claws, below which a small scopula is situated. The minute intermediate eye of each lateral row is nearly equidistant from the eyes constituting its extremities. The cephalothorax, which is somewhat quadrilateral, slopes abruptly at its base, and projects a little beyond the falces in front; it is glossy, with a shallow indentation in the middle, and is of a brownish-red colour, the lateral eyes being seated on brown spots. The falces are short, subconical and vertical; the maxillæ are straight, and enlarged and rounded at the extremity; and the lip and sternum are oval. These parts are of a brownish-red colour, the falces being the darkest. The palpi are short, and resemble the legs in colour. The abdomen is oviform, glossy, pointed at the spinners, which are prominent, moderately convex above, and projects over the base of the cephalothorax; it is of a brown-yellow hue; the under part, which is the palest, has an obscure brown band extending along the middle, and on each side of the medial line of the upper part there is a longitudinal row of four brown spots.

Immature females of this species have been received from the island of Madeira.

Family Thomisidæ.

Genus Philodromus, Walck.

Philodromus ambiguus.

Philodromus pallidus, Blackw., Ann. & Mag. Nat. Hist. ser. 2. vol. xx. p. 499; Spiders of Great Britain and Ireland, p. 93, pl. 5. fig. 56.

This spider, when originally described by me, was supposed to be specifically identical with the *Philodromus pallidus* of Walckenaer and the *Artamus griseus* of Koch; but a comparison of these species, made subsequently, has not only convinced me that it is distinct, but has also induced the belief that it is new to arachnology; the specific name *ambiguus* therefore is substituted for that of *pallidus*.

Genus Sparassus, Walck.

Sparassus ornatus.

Sparassus ornatus, Walck., Hist. Nat. des Insect. Apt. tom. i. p. 583;

Sund. Vet. Akad. Handl. 1832, p. 271; Koch, Die Arachn. Band xii. p. 90, tab. 417. fig. 1021.

An immature male of this handsome spider, which has not hitherto been recorded as indigenous to Britain, was transmitted to me from Exeter, by Mr. Edward Parfitt, in August 1866. This specimen, which had not undergone its final ecdysis, was captured in Devonshire.

Family Drassidæ.

Genus Drassus, Walck.

Drassus Collingsiæ, n. sp.

Length of an immature female (not including the spinners) $\frac{3}{10}$ of an inch; length of the cephalothorax $\frac{1}{10}$, breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{10}$; length of a posterior leg $\frac{3}{8}$; length of a leg of the third pair $\frac{1}{4}$.

The eyes, which are seated on black spots, are disposed in two transverse, slightly curved rows, on the anterior part of the cephalothorax; the posterior row is rather the longer, and the two intermediate eyes are nearer to each other than they are to the lateral eyes of the same row; the intermediate eyes of the anterior row, which is situated immediately above the frontal margin, are the largest and darkest-coloured of the eight. The cephalothorax is convex, glossy, compressed before, rounded on the sides, which are marked with furrows converging towards a narrow indentation in the medial line of the posterior region, and is of a brownish-yellow colour, with narrow, soot-coloured lateral margins. The falces are conical, rather prominent, and have one or two small teeth on the inner surface; the maxillæ are convex near the base, depressed transversely near the middle, enlarged at the extremity, and inclined towards the lip, which is somewhat quadrate, being rather longer than broad; and the sternum is oval, with small eminences on the sides, opposite to the legs. These parts have a brownish-yellow hue, the lip being the brownest, and the sternum, which is the palest, having soot-coloured lateral margins. The legs are moderately long, hairy, and of a pale brownish-yellow colour; the inferior surface of the metatarsi and tarsi are clothed to a greater or less extent with greyish-brown hair-like papillæ, and the tibiæ and metatarsi of the third and fourth pairs are provided with sessile spines; the fourth pair is the longest, then the first, and the third pair is the shortest; the tarsi are terminated by two curved, pectinated claws. The palpi resemble the legs in colour, and the digital joint, which is the darkest, has a small curved claw at its extremity. The abdomen is of an oblong-oviform figure, tapering a little to the spinners, which are prominent and cylindrical; it is slightly convex above, projects a little over the base of the cephalothorax, and is clothed with adpressed grey hairs; the upper part is of a yellowish-brown colour, with some long blackish hairs at its extremity, in front, and an obscure, brown, fusiform band extending thence, in the medial line, about half its length; the under part is of a pale dull-yellowish hue; the basal joint of the spinners has a yellowish-white tint, and the other joints of those organs are of a brownish-black colour.

I have much pleasure in connecting with this *Drassus* the name of Mrs. Louisa E. Collings of Serk, who on various occasions has obligingly forwarded to me numerous interesting species of Araneidea captured in that island, and among them several specimens of this *Drassus* in different stages of growth, but all in a state of immaturity.

Family Ciniflonidæ.

Genus Veleda, Blackw.

Veleda pallens.

Veleda pallens, Blackw., Ann. & Mag. Nat. Hist. ser. 3. vol. ix. p. 372.

I am informed by Frederick Pollock, Esq., of Thurlow, who has resided in the island of Madeira, that he has found specimens of *Veleda pallens* in that island, associated with *Nephila aurelia*, at an elevation of 800 feet above the level of the sea. This species, he remarks, constructs a horizontal geometric snare, and invests one of the radii with a loosish thread. Should a young *Nephila* venture to trespass on the snare, the *Veleda* rapidly approaches it with a vibratory motion, and envelopes its victim with silk drawn from the spinners by a lateral motion of the posterior legs.

Family Theridiidæ.

Genus Theridion, Walck.

Theridion triste.

Theridion triste, Hahn, Die Arachn. Band i. p. 89, tab. 21. fig. 67.
Theridium triste, Koch, Die Arachn. Band viii. p. 83, tab. 276. figs. 653, 654.

Two females of this species (now first recorded as British) were found under a stone, in a pasture near Hendre House, on the 16th of June, 1864. They were placed in a phial; and one of them constructed therein two balloon-shaped cocoons of white silk, of a loose texture, the larger of which measured $\frac{1}{6}$ of an inch in diameter, and contained about thirty spherical eggs of a pale-yellow colour.

The *Theridion triste* of Walckenaer (Hist. Nat. des Insect.

Apt. tom. ii. p. 291) is a much larger spider than the *T. triste* of Hahn and Koch, and is probably specifically identical with the *Phrurolithus lunatus* of the latter author (Die Arachn. Band vi. p. 107, tab. 206. fig. 509).

Theridion grossum.

Theridion grossum, Walck., Hist. Nat. des Insect. Apt. tom. ii. p. 328.
Theridium grossum, Koch, Die Arachn. Band. iv. p. 112, tab. 140. fig. 321.

Length of the female $\frac{3}{8}$ of an inch; length of the cephalothorax $\frac{1}{6}$, breadth $\frac{1}{8}$; breadth of the abdomen $\frac{3}{16}$; length of an anterior leg $\frac{3}{4}$; length of a leg of the third pair $\frac{5}{12}$.

As the adult female of *Theridion grossum,* which, like certain species of the genus *Latrodectus,* does not acquire its sombre hue till it arrives at maturity, has been well described by Koch, I shall merely supply, in addition to the measurement given above, a few particulars that have been omitted.

The eyes are disposed on the anterior part of the cephalothorax in two transverse rows; the four intermediate ones describe a trapezoid, the two anterior ones, which form its shortest side, and are seated on a protuberance, being the smallest and darkest-coloured of the eight; the eyes of each lateral pair are placed obliquely on a tubercle and are contiguous. The maxillæ are obliquely truncated at the extremity, on the outer side, and inclined towards the lip, which is somewhat quadrate, being broader at the base than at the apex. These parts have a reddish-brown hue, that of their extremities being yellowish-white. The sexual organs, which are well-developed and semicircular, have their posterior margin curved and prominent, and are of a red-brown colour, that of the branchial opercula being dull yellow.

The immature female and adult male of this species do not appear to be known to arachnologists. They differ remarkably from the adult female, the upper part of the abdomen being of a dull yellowish-white hue, densely freckled with minute white spots, and having a series of broad, curved, transverse, soot-coloured bands in the middle, whose extremities extend to the sides. The legs have a brownish-yellow hue.

The male is much smaller than the adult female, and its slender legs are much lighter-coloured. Its palpi are short, and the radial, which is larger than the cubital joint, is produced at its extremity, on the outer side; the digital joint is of an elongated oval form and of a reddish-brown colour; it is pointed at the extremity, convex and hairy externally, concave within, comprising the palpal organs, which are well developed and are terminated by a large curved spine, whose extremity is in contact with some white membrane; their colour is red-brown intermixed with brownish-yellow.

An adult male and female, and specimens of immature females, of *Theridion grossum* have been transmitted to me by Mrs. Louisa E. Collings from the island of Serk, in which locality they were captured.

Genus Latrodectus, Walck.

Latrodectus Erebus.

Length of the female $\frac{9}{20}$ of an inch; length of the cephalothorax $\frac{1}{5}$, breadth $\frac{1}{6}$; breadth of the abdomen $\frac{3}{10}$; length of an anterior leg $\frac{9}{10}$; length of a leg of the third pair $\frac{11}{24}$.

The *Latrodectus Erebus* of authors was considered by M. Dugès to be the adult female of *Latrodectus malmignatus* (Annales des Sciences Naturelles, seconde série, Zoologie, tome vi. p. 169); and his opinion appears to be well founded. Adult living specimens of this species, captured in the island of Porto Santo, in 1865, and forwarded to me by the Barão do Castello de Paiva, were received in vigorous health, and fed freely on the insects with which they were supplied; but they could not be induced by any means I could devise to inflict a wound with their short and weak fangs on my forearm, or on any other part to which they were applied. The failure of this experiment is to be regretted; for, had it been brought to a successful issue, it would have served to test the accuracy of the belief entertained in Italy and in the Canary Islands that the bite of *Latrodectus malmignatus* produces very alarming symptoms, which frequently terminate fatally.

The cocoon of this spider is balloon-shaped, of a very compact texture, and of a pale dull-yellowish colour; it measures $\frac{2}{3}$ inch in length, $\frac{1}{2}$ inch in diameter in its broadest part, and comprises between two and three hundred eggs. The young, on completing their first ecdysis, have the abdomen marked with white spots.

Tribe Senoculina.

Family Dysderidæ.

Genus Segestria, Latr.

Segestria perfida.

A female of this species, which had to undergo its final ecdysis, was taken in Exeter, on a vine growing against a wall having a south aspect, in May 1865, by Mr. Edward Parfitt, by whom it was presented to me.

Segestria perfida was included in the 'History of the Spiders of Great Britain and Ireland,' part second, page 373, solely on the authority of Dr. Leach, who has recorded an instance of its capture at Plymouth. The additional evidence supplied by Mr. Parfitt of its claim to be regarded as indigenous to Britain is highly interesting.

As the falces of this species do not appear to acquire their brilliant green hue till it becomes adult, M. Dugès was induced to regard it, when in a state of immaturity, as identical with the *Segestria senoculata* of authors (Annales des Sciences Naturelles, seconde série, Zoologie, tome vi. p. 169).

XXIV.—*On some new Species of* Oliva, *and a new* Trivia. By Frederick P. Marrat.

The Cones, Cowries, Mitres, and many other genera have been carefully studied, and the result is that a large number of species have been described belonging to each genus. The Olives have scarcely had twenty new species described in as many years: but this is not all; the species that were known, and many of those that were described, have not been brought under the notice of conchologists. I am now alluding to the shells figured by Duclos, in his excellent work published in the year 1835.

The following new species have been named in my cabinet for several months, and during that time I have found no reason for altering my views respecting the validity of the species now described.

1. *Oliva violacea*, Marrat.

Shell ovate-fusiform; spire exserted, conical, canaliculate, impressed; colour white, with pale zigzag lines and numerous halfmoon-shaped dots; interior of aperture and base of pillar beautiful violet.

Obs. Intermediate between *O. reticularis* and *O. episcopalis*; differs from both in having the folds at the base suffused with beautiful violet. Loc. unknown.

2. *Oliva jamaicensis*, Marrat.

Shell cylindrically fusiform; spire short, canaliculate, rather flattened; colour reddish brown, with triangular cream-coloured spots and two broad indistinct bands; mouth purple; pillar reddish brown on the plaits at the base.

Jamaica.

Obs. Somewhat intermediate between *O. splendidula* and *O. reticularis*, approaching the former in form and the latter in markings.

3. *Oliva polita*, Marrat.

Shell elongately fusiform; spire much produced, canaliculate, colour yellowish white, with triangular brown markings, with two broad indistinct bands; columellar lip with few plaits; aperture pale purple, almost white.

Obs. Resembles the *O. jaspidea*, Duclos, *O. Duclosii*, Reeve, but may at once be known by its oblique and narrow form. A very pretty shell, and I have seen at least twenty specimens.

4. *Oliva piperata*, Marrat.

Shell obliquely fusiform; spire elongated, blunt, canaliculate; aperture widening downwards; colour white, with purple-brown spots; suture edged with pencilled lines, which terminate in dark triangular brown blotches.

Obs. Allied to *O. conoidalis*, Lam., but much more elongated, and the markings are altogether different.

5. *Oliva faba*, Marrat.

Shell cylindrical; spire short; whorls rounded, canaliculate; colour yellowish white, with brown zigzag markings; mouth purple brown; plaits on the columella numerous.

Philippines.

Obs. This species appears somewhat intermediate between *O. todesina*, Ducl., and *O. ispidula*, resembling the former in form and the latter in the open sutural groove.

6. *Oliva blanda*, Marrat.

Shell ovate-cylindrical; spire callous; colour dark drab with dark-brown zigzag lines; aperture purplish brown; pillar-lip swollen, plaits sharp; size about 1 inch.

7. *Oliva cylindrica*, Marrat.

Shell cylindrically fusiform; spire depressed, canaliculate; colour either light or dark drab, with brown zigzag lines shaded with yellow, and sometimes two interrupted bands; aperture from pale to very dark purple; folds at the base stained with brown.

Borneo.

Obs. This is allied to the Borneo form of *O. irisans*, Lam., the spire of which is callous.

8. *Oliva ornata*, Marrat.

Shell ovate-subcylindrical, rather inflated; spire callous, apex papillary; cream-coloured, with light-brown markings, sometimes double-banded with dark-brown spots; pillar thickened, white, slightly plaited.

North Australia.

Obs. The only species having a callous spire from Australia.

9. *Oliva similis,* Marrat.

Shell ovate-cylindrical, inflated; spire small, canaliculate, apex dark; colour from light drab to dark yellowish brown, with light-brown or purplish wavy lines, and sometimes dark angular spots forming two interrupted bands; suture edged with fine purple pencilled lines; interior purplish brown; columellar plaits numerous.

10. *Oliva pallida,* Marrat.

Shell cylindrically fusiform; spire short, conical; colour white or very pale, with faint flexuous lines and two pale brown bands; interior either white or light pink.

Eastern Seas.

Obs. In collections this shell is not uncommon, named *O. literata, O. scripta,* or *O. reticularis.* It differs from all in having a short spire and pale interior.

11. *Oliva oblonga,* Marrat.

(Duclos, plate 9. figs. 3 & 4, *reticularis,* var.)

Shell oblong-fusiform, very thick; spire conical, elongate, canaliculate; colour yellowish white suffused with ash-grey, with brown wavy markings, generally crowded so as to form two indistinct bands; interior cream-coloured; plaits almost obsolete.

Central America.

Obs. Most conchologists, when examining this shell, pronounce it distinct.

12. *Oliva truncata,* Marrat.

Shell cylindrically ovate; spire rather shortly conical, apex papillose; colour greyish, with zigzag dotted brown markings; suture canaliculate, edged with pencilled brown lines; aperture very pale purple, almost white.

Cape of Good Hope.

Obs. Shell much narrower than *O. palpasta,* without the dark-brown spots, and from a very different habitat.

On a new Trivia.

Trivia affinis, Marrat.

Shell oblong-ovate, transversely coarsely ribbed; beaks projecting, broad; teeth acute, dorsal groove obsolete; very pale, but indications of colour in one of the specimens.

Obtained from a dealer's stock among West-Indian species.

Obs. Resembles a large *T. insecta,* Mighels, but may at once be known by its coarse ribs and obsolete dorsal groove.

XXV.—*Descriptions of some remarkable new Species and a new Genus of Diurnal Lepidoptera.* By A. G. Butler, F.Z.S.

[Plate IV. figs. 4–9.]

Genus Euchloë, Hübner.

Euchloë Coliagenes, sp. nov. Pl. IV. figs. 4 & 5.

♀. Alæ supra sulphureo-fulvæ: anticæ margine apicali late brunnescente, a maculis fulvis interrupto; basi cellæ discoidalis pallide grisescente; puncto cellam terminante nigro; costa minime flavo-ochracea: posticæ margine externo maculari fusco: corpus thorace cinereo, pilis fulvis, capite colloque ochreo-flavescentibus; abdomine fulvo.

Alæ subtus fulvæ: anticæ pallidiores, fascia antemarginali lunulata; margine apicali ochreo tincto; puncto cellulari velut supra nigro: posticæ ochraceæ, fascia tenui discali subobliqua angulari, apud angulum analem trimaculari: corpus pallescens luteum.

Exp. alar. unc. $1\frac{13}{16}$.

Hab. White Nile. B.M.

This species is chiefly noticeable from its great resemblance to the *Hyale* type of the genus *Colias*: it seems to belong to the *Ione* group of *Euchloë*. It would be very interesting if we could get the male, to see whether it would have the violet tips to the front wings, so characteristic of the *Ione* type.

Genus Taygetis, Hübner.

Taygetis albinotata, sp. nov. Pl. IV. figs. 6 & 7.

♂. Alæ supra olivaceo-fuscæ: anticæ integræ, maculis sex submarginalibus pallidioribus: posticæ margine externo sinuato, nigrescente; maculis quatuor punctoque subanali niveis: corpus fuscum.

Alæ subtus basi pallidiores; fasciis tribus ochreis pallidis; interna et media posticarum ad angulum ani coëuntibus, media latissima; externa nigro marginata, posticarum extus sinuata; linea marginali et margine ipso nigro-fuscis: anticæ ocello uno subapicali nigerrimo, albo pupillato et minime pallido cincto: posticæ ocellis sex ochreo cinctis, primo et ultimo minoribus; tertio et quarto subreniformibus roseo-cinereis, lunulis albidis pupillatis; aliis nigerrimis puncto albo pupillatis; ciliis niveis fusco variis: corpus fuscum.

Exp. alar. unc. $3\frac{1}{8}$.

Hab. Bolivia. B.M.

This species is totally distinct from all the other species of the genus; and I have often been asked why I did not describe it. I should have done so long since, but that I was anxious to give a figure of the insect.

CALLEREBIA, gen. nov.

Gen. *Erebiæ* simillimum, differt forma et alarum scriptis, quæ multo illis *Callistonis* simulant; antennis quoque tenuioribus minus distincte clavatis, palpisque magis angulatis.

The type species of this genus, *C. scanda*, greatly resembles *Callisto*; the markings are very similar, and the hind-wing anal angle is frequently produced and lobe-shaped. The genus is nearly allied to *Erebia*, but has a totally different aspect; and as it does differ in several structural details, I have thought it best to concede to the wishes of my brother lepidopterists by separating it as a distinct genus.

Sp. 1. *Callerebia scanda*. Pl. IV. figs. 8 & 9.

Erebia scanda, Kollar, in Hügel's 'Kaschmir,' iv. pt. 2. p. 452, taf. 17. figs. 3, 4 (1844).

Hab. Cashmere, Northern India. B.M.

Var. *a*. Alis omnino pallidioribus, fasciis subtus subobsoletis; ocellis posticarum duobus analibus rotundatis valde distinctis oblique positis.

Var. *b*. (? an *C. annada*, Moore). Alis piceis marginibus pallidioribus; angulo anali posticarum valde producto: subtus posticæ magis albido roratæ; ocellis subanalibus duobus cæcis distinctis (variat posticis minus productis ocellisque subtus minus oblique positis).

Var. *c*. Alis posticis, non productis, velut in varietate *a*: subtus pallido nec albido roratis; ocellis posticarum analibus rotundatis distinctis nec oblique positis, ocelloque minimo discali simili (variat posticis subtus uniformiter fuscis; ocellis duobus discalibus distinctis, omnibus albo pupillatis).

This species varies considerably: it would be quite impossible to link the two extreme varieties in our Collection, did we not possess all the intermediates, as they are far more distinct than many species.

Sp.? 2. *Callerebia annada*.

Erebia annada, F. Moore, Cat. Lep. Mus. East Ind. Comp. p. 226. n. 475 (1857).

Hab. Bootan (Moore).

Sp.? 3. *Callerebia nirmala*.

Erebia nirmala, F. Moore, Proc. Zool. Soc. London, p. 501. sp. 91 (1865).

Hab. North-western Himalayas (Moore).

As I have not yet seen the types of these two forms, I am unable to say whether or not they are identical with any of the varieties of *scanda*.

XXVI.—*Description of a new Species of Tiger-Moth in the possession of Mr. T. W. Wood.* By ARTHUR G. BUTLER, F.Z.S.

[Plate IV. figs. 1–3.]

THE species of Tiger-Moth described in the present paper is the most beautiful that I have yet seen; it appears to be quite new, and to belong to the genus *Mazæras,* characterized by Mr. Walker in his 'Catalogue of the Lepidoptera Heterocera in the British Museum;' the *Eucharia sacrifica* of Hübner's 'Zuträge exotischer Schmetterlinge' seems also to belong to this genus: all the species are South American. This group will now stand as follows:—

Genus MAZÆRAS, Walker

(Cat. Lep. Het. Brit. Mus. pt. iii. p. 632, genus 14.)

"Corpus longum, validum, cylindricum: proboscis corporis dimidio brevior: palpi ascendentes, longiusculi; articulus secundus arcuatus, primo multo longior; tertius conicus, minimus: antennæ mediocriter pectinatæ, corporis dimidio non longiores: abdomen alas posticas longe superans: pedes validi, longiusculi; tibiæ posticæ calcaribus quatuor longis. Alæ angustæ, sat longæ."—*Lep. Het.*

Sp. 1. *Mazæras conferta,* Walker, p. 633.

"Saturate rufa; palpi apice nigri; antennæ nigræ; thorax ocello discali maculisque quatuor nigris: abdomen luteum, e maculis nigris trivittatum; tibiæ tarsique nigræ; alæ anticæ fuscæ maculis rufis strigisque transversis testaceis."—*Lep. Het.*

Exp. alar. unc. $2\frac{1}{4}$.

Hab. Brazil. ? ♀. B.M. Pl. IV. fig. 1.

Sp. 2. (*Eucharia*) *sacrifica,* Hübner

(Zuträge exot. Schmett. figs. 473, 474 (1806).)

Olivaceo-fusca; thorax collò albicante; abdomen supra viridescente fasciatum, punctis lateralibus albis, ano rufescente: alæ anticæ roseo-albo fasciatæ, subtus ad marginem albo rubroque maculatæ: posticæ punctis marginalibus lunulatis maculisque quinque subapicalibus albidis; maculis submarginalibus rubris.

Exp. alar. unc. $2\frac{1}{4}$.

Hab. Ipaunema (Brazil).

The genus *Eucharia* is characterized by Hübner in his 'Verzeichniss,' p. 181. n. 1865–1867 (1816); he does not, however, include his *sacrifica,* which certainly is not congeneric with those species which he does include.

Sp. 3. *Mazæras Woodii,* sp. nov. Pl. IV. figs. 2, 3.

♀. Alæ supra nigerrimæ; anticæ striola punctoque ad cellæ finem, subcostalibus et fascia lata angulis duobus alternis discum totum interruptante luteo-ochreis, ad basim flavescentibus: posticæ macula luteo-ochrea subquadrata subapicali, a venis tripartita; fascia valde irregulari submarginali coccinea apud apicem attenuata: corpus nigerrimum; collo flavo fasciato; abdomine flavo fasciolato, fasciolis regularibus in medio et ad latera interruptis; antennis palpisque nigris.

Alæ subtus nigerrimæ; anticæ macula discoidea apud cellæ finem, altera disco-cellulari, ovalibus, tertia triangulari subanali, striola apud marginem apicalem, punctoque basali, omnibus coccineis; macula submedia costali triangulari luteo-ochrea; fascia velut supra irregulari sed tripartita; punctis tribus submarginalibus apicalibus cinereis: posticæ puncto basali coccineo, aliter velut supra: corpus nigerrimum; pedes postici tarsis albido fasciolatis; segmentis abdominalibus minime flavo marginatis; ano flavo.

Exp. alar. unc. $2\frac{1}{2}$.

Hab. Bahia. Possidet T. W. Wood.

Most closely allied to *sacrifica,* but quite distinct; it does not show any pectinations to the antennæ, and the hind wings are proportionally larger than in *conferta.* This species has been kindly lent to me by my very obliging friend Mr. T. W. Wood.

XXVII.—*Notes on the Skulls of Hares* (Leporidæ) *and Picas* (Lagomyidæ) *in the British Museum.* By Dr. J. E. Gray, F.R.S.

Having had occasion to examine the skulls of hares in the British Museum, I have made the following notes.

It has been usual to unite the Leporidæ and Lagomyidæ into one family; but the entire form of the skull forbids such a union, and I follow Professor Lilljeborg in regarding them as belonging to two distinct groups of the suborder Duplicidentata of Illiger.

Dr. Spencer Baird, in his excellent essay on the Hare of North America, has shown how the hares of that country might be divided into natural sections; and I have verified the accuracy of this from the skulls contained in the British Museum, and have added one or two groups for skulls which did not come under his observation.

The determination that the hare of the Holy Land is distinct from the common European hare is interesting. It is more allied to the hare of Tunis and the southern shore of the Mediterranean, and it may be only a large variety of that species; but there are several characters in the skull that make it probably a distinct kind.

Suborder II. DUPLICIDENTATA, Illiger.

Cutting-teeth $\frac{4}{4}$; upper with a deep angular central groove; molars rootless, $\frac{6}{5} \cdot \frac{6}{5}$ or $\frac{5}{5} \cdot \frac{5}{5}$. Skull with the two optic foramina united.

Fam. 1. Lagomyidæ = *Lagomys*, F. Cuvier.

Tail none visible; ears short, rounded; hind legs short; toe-pads naked, small. Skull depressed, expanded behind. Maxilla with a large perforation in front of orbit. Grinders $\frac{5}{5} \cdot \frac{5}{5}$, the upper hinder with a small third lamina on the hinder side; the front grinders shelving backwards.

1. OGOTOMA. Skull: the orbits very large; space between the orbits narrow; nose narrow, bent down.

Ogotoma Pallasii. (*Lagomys ogotoma*, Cuvier, Waterh. Glir. 17. *Lepus ogotoma*, Pallas, Glires, 30, t. 3, 4 A. f. 16 *a*.) B.M.

2. LAGOMYS. Skull: the orbits large; space between the orbits broad and flat; nose broad, shelving, nearly in a line with the forehead.

Asia.

1. *Lagomys alpinus*, Cuvier, Waterh. Glir. 15, fig. (*Lepus alpinus*, Pallas, Glires, 30, t. 2, t. 4 A. f. 13 *a*, *b*). Siberia. B.M.
2. *Lagomys pusillus*, Desm., Waterh. Gl. 19. (*Lepus pusillus*, Pallas, Glires, 30, t. 1, t. 4. f. 4, 9). South Siberia; Ural. B.M.
3. *Lagomys rufescens*, Gray, Ann. & Mag. Nat. Hist. 1842, p. 266; Waterh. Gl. 20. Cabul. B.M.
4. *Lagomys Hodgsoni*, Blyth, J. A. S. B. 1841, x. 816, t.; Waterh. Gl. 23. Ladakh.
5. *Lagomys nepalensis*, Hodgson, J. A. S. B. 1841, x. 854, t.; Waterh. Gl. 24. Thibet? Nepal. B.M.
6. *Lagomys Roylii*, Ogilby, Royle, Himal. t. 4; Waterh. Gl. 26. Choor Mountains.
7. *Lagomys hyperboreus*, Wagner, Waterh. Gl. 36. (*Lepus hyperboreus*, Pallas.) North-east Siberia.

America.

8. *Lagomys princeps*, Richards. F. B.-A. 227, t. 19; Waterh. Gl. 28; Baird, N. A. M. 619; Aud. N. A. Q. t. 83 (skin). Rocky Mountains. B.M.
9. *Lagomys minimus*, Lord, P. Z. S. 1863, p. 98. North-west coast of America. B.M.

Fam. 2. Leporidæ, J. Gray (Lilljeb. 59).

Ears large, elongate, often longer than the head. Tail short, bushy; the hind legs much longer than the fore legs, strong. Skull high, more or less compressed; the nose arched; maxillæ netted in front of the orbits. Cutting-teeth (upper) with a subcentral groove; molars $\frac{6}{5} \cdot \frac{6}{5}$, each formed of two plates united by enamel, except the upper hinder one, which is small and formed of only one plate. The upper hinder grinder is like the third plate in the former family; but it is distinct, forming a separate tooth.

Section I. *Skull high, rather compressed. Nose compressed; cheeks nearly flat, separated from the orbits by a strong ridge, and edged above by the prominent upper hinder elongated process of the intermaxillaries. Orbits large, roundish. Cutting-teeth moderate.*

A. Hares. *The hinder nasal aperture of skull broad, deep, rounded above, and with nearly erect sides. Young born with the eyes open and the body covered with hair. Living in "forms" on the surface of the earth.*

I. *Postorbital process more or less soldered with the skull.*

1. Hydrolagus. *Lepus* § F, Baird, N.A.M. 575. Feet very short, weak, covered with scattered hairs, exposing the toes; claws acute. Skull and incisors comparatively large and massive; muzzle about as wide as high. Postorbital process completely fused into the skull for its entire length, leaving neither foraminal notch nor suture. "Water-Hare."

* *Tail elongate, white beneath.*

1. *Hydrolagus aquaticus.* (*Lepus aquaticus,* Bachm. J. A. N. S. Philad. vii. 319, t. 22. f. 2; Baird, N. A. M. 612, t. 59. f. 1 (skull). *L. Douglasii,* var. 1, Gray, Mag. N. H. 1837, p. 586.)

** *Tail very short, dusky beneath.*

2. *Hydrolagus palustris.* (*Lepus palustris,* Bachm. *l. c.* t. 25, 26; Baird, N. A. M. 615, t. 59. f. 2 (skull). *L. Douglasii,* var. 2, Gray, Mag. N. H. 1837, p. 586.)

2. Sylvilagus. *Lepus* § D, Baird, N. A. M. 575. Skull about twice as long as wide, very convex and much arched behind; muzzle rather wider than high. Postorbital process moderate, united behind and laterally by anchylosis with the skull, with a distinct suture bounding a small narrow foramen in front. Cutting-teeth narrow. Hind feet nearly as long as the head. Burrows for protection (*Clark*).

* *Soles very densely furred.*

1. *Sylvilagus nanus.* (*Lepus nanus,* Schreb. t. 234 b; Dekay. *L. americanus,* Desm. *Lepus sylvaticus,* Bachm., Waterh. Gl. 116; Aud. N. A. Q. t. 22; Baird, N. A. M. 600, t. 58. f. 1 (skull).) Grey Rabbit. B.M.

2. *Sylvilagus Artemisia,* Bachm., Waterh. Gl. 126; Baird, N. A. M. 602. (*L. artemisianus,* Wagner. ? *L. Nuttalli,* Bach., Aud. N. A. Q. t. 94.) Sage Rabbit. New Mexico. B.M.

*** Soles of feet very sparsely furred.*

3. *Sylvilagus Bachmanni.* (*Lepus Bachmanni,* Waterh. P. Z. S. 1838, p. 103, Glir. 124; Aud. N. A. Q. t. 108; Baird, N. A. M. 606.)

3. Eulagos. Skull rather elongated; face broad, rounded above; the intermaxillary bones form a ridge on each side; anterior orbital notch narrow; postorbital aperture oblong, elongate, narrow, behind complete from the coalescence of the hinder end of the postorbital process with the skull. Grinders $\frac{6}{5}$, the hinder upper grinder very small and very close to the penultimate, which has caused it to be overlooked.

1. *Eulagos mediterraneus.* (*Lepus mediterraneus,* Wagner, Waterhouse, Glires, 48. *L. meridionalis,* Géné. *L. granatensis,* Schimper. *L. timidus,* var. *c,* Blasius, Säugeth. Deutschl. 412.) Tunis, Fraser. B.M.

Mr. Waterhouse overlooked the hinder upper grinder; and Blasius confounded this very distinct species with *L. timidus.*

Length of skull 3 inches 3 lines, width at zygomata 1 inch 5 lines, of nose in front of orbit 9 lines. The upper edge of the orbits narrow, ascending.

2. *Eulagos Judææ.* The Holy Land *Buneas,* Tristram, B.M. The skull is much larger than that of *E. mediterraneus,* nearly as large as that of the common hare, *Lepus timidus.* Length of skull 3 inches 10 lines, width at zygomata 1 inch 9 lines, at front of orbits 1 inch. The upper edge of the orbits wide, expanded, forming a concave hood.

II. *Postorbital process separate from the skull.*

4. Lepus, Linn. *Lepus* §§ A & E, Baird, N. A. M. 575. Skull narrow, slightly curved above; face margined by the upper edge of the intermaxillaries. The front lower edge of the zygoma swollen, rounded, solid. Postorbital process very large, the hinder part nearly parallel with the skull, but separated from it by a slit. Grinders $\frac{6}{5} \cdot \frac{6}{5}$, hinder upper very small; cutting-teeth narrow, upper with a central groove. Born covered with hair, and the eyes open. Lives on the surface or behind stones.

European.

1. *Lepus timidus,* Linn., Waterh. Gl. 39. (*L. europæus,* Pallas.) Europe. B.M.

2. *Lepus hybridus,* Desm., Waterh. Gl. 45. (*L. medius,* Nils-

son. *L. aquilonius,* Blasius. *L. altaicus,* Eversm. *L. russata,* F. Cuv.) Russia. Mus. Leyden.

3. *Lepus variabilis,* Pallas, Schreb. t. 235 A, B; Waterh. Gl. 51. (*L. borealis,* Nilsson. *L. albus,* Brisson, Jenyns. *L. hibernicus,* Bell, B. Q.) Scotland, Ireland, North Europe. B.M.

4. *Lepus canescens,* Nilsson, i. 172; Waterh. Gl. 57. (*L. borealis,* var., Nilsson, Illum. t. 22.) Scandinavia. B.M.

African.

5. *Lepus ægyptius,* Geoffr. Desc. Egypt. t. 6. f. 2; Waterh. Gl. 65. Egypt. North Africa.

6. *Lepus habessinicus,* Hemp. & Ehr. S. P. t. 15. f. 2. Abyssinia.

7. *Lepus isabellinus,* Rüppell, Atlas, t. 20; Waterh. Gl. 88. (*L. æthiopicus,* Hemp. & Ehr. S. P. t. 13.) Nubia. B.M.

8. *Lepus capensis,* Linn., Waterh. Gl. 95. (*L. ochropus,* A. Wagner. *L. arenarius,* I. Geoff.) South Africa.

9. *Lepus saxatilis,* F. Cuv., Waterh. Gl. 92, t. 1. f. 1. (*L. rufinucha,* A. Smith. *L. longicaudatus,* Gray. *L. fumigatus,* Wagner.) Berg Haas, South Africa. B.M.

10. *Lepus crassicaudatus,* I. Geoff. Mag. Zool. 1832, t. 19; Waterh. Gl. 99. (*L. rupestris,* A. Smith. *L. melanurus,* Rüppell.) Roode Haas, South Africa, Natal.

Asiatic.

11. *Lepus arabicus,* Hemp. & Ehr. S. P. t. ; Waterh. Gl. 84. Arabia.

12. *Lepus syriacus,* Hemp. & Ehr. S. P. t. 14. f. 2; Waterh. Gl. 81. Syria.

13. *Lepus sinaiticus,* Hemp. & Ehr. S. P. t. 14. f. 1; Waterh. Gl. 83. Arabia Petræa.

14. *Lepus nigricollis,* F. Cuv. Mamm. t.; Waterh. Gl. 72. (*L. melanauchen,* Temm. *L. kurgosa,* Gray. *L. hurgosa,* Buch. Ham.) Malabar. B.M.

15. *Lepus ruficaudatus,* I. Geoff., Waterh. Gl. 74. (*L. macrotus,* Hodgson.) Bengal. B.M.

16. *Lepus tolai,* Pallas, Gl. 30; Waterh. Gl. 48. (*L. dauricus,* Erxl.) Mongolia. B.M.

17. *Lepus tibetanus,* Waterh. P. Z. S. 1841, p. 7; Gl. 58. (*L. oiostolus,* Hodgson, Waterh. Gl. 61.) Tibet.

18. *Lepus pallipes,* Hodgson, J. A. S. B. xi. 288, t.; Waterh. Gl. 62. Tibet.

19. *Lepus brachyurus,* Temm. F. Japon. t. 11; Waterh. Gl. 69. Japan. B.M.

20. *Lepus sinensis,* Gray, Ill. I. Z. t.; Waterh. Gl. 90; Swinhoe, P. Z. S. 1862, p. 359. Formosa, China. B.M.

21. *Lepus altaicus,* Brandt. Altai. B.M.

American.

† *Hind feet considerably longer than the head.*

* *Changing colour in winter; postorbital widely divergent.*

22. *Lepus arcticus*, Leach, Ross's Voy. Append. 2. 151, 1819. (*L. glacialis*, Leach, *l. c.* 170, 1819; Audub. N. A. Q. t. 32; Baird, N. A. M. 577, t. 56. f. 1 (skull); Waterh. Gl. 102. *L. timidus*, O. Fab.)

23. *Lepus americanus*, Erxl., Waterh. Gl. 108; Baird, N.A.M. 579. (*L. hudsonius*, Pallas. *L. nanus*, Schreb. *L. virginianus*, Harlan. *L. borealis*, Schinz.) B.M.

24. *Lepus Washingtonii*, Baird, 1855, N. A. M. 583, t. 15.

25. *Lepus campestris*, Bachm., Baird, N. A. M. 585, t. 56. f. 2 (skull); Waterh. Gl. 127. (*L. Townsendii*, Bachm., Aud. N. A. Q. t. 3. *L. virginianus*, Rich.) Prairie Hare. Missouri River, Columbia.

** *Not changing colour in winter; postorbital diverging, but in contact behind.*

26. *Lepus caltotis*, Wagner, 1830; Baird, N. A. M. 590, t. 57. f. 2 (skull); Audub. N. A. Q. t. 63; Waterh. Gl. 138. (*L. nigricaudata*, Bennett. *L. flavigularis*, Wagner. *L. texianus*, Waterh. Gl. 136.) Sonora.

27. *Lepus californicus*, Gray, Mag. N. H. 1837, p. 586; Waterh. Gl. 171; Audub. N. A. Q. t. 112; Baird, N. A. M. t. 57. f. 1 (skull). (*L. Richardsonii*, Bachm.? *L. Bennetti*, Gray, Voy. Sulph. t. 14.) California. B.M.

28. ?*Lepus longicaudatus*, Gray, Mag. N. H. 1836, p. 586. Magellan's Straits.

†† *Hind feet apparently shorter than the head; postorbital process scarcely in contact with the cranium behind; ears as long as or longer than the head.*

29. *Lepus Audubonii*, Baird, N. A. M. 608, t. 13, 58. f. 2 (skull). Coast of California.

30. *Lepus Troubridgii*, Baird, N. A. M. 610, t. 14. California.

5. Tapeti. Skull like *Lepus*, but the hinder supraorbital notch narrow, the lobes short, with a sharp inner edge; the front of the lower edge of the zygoma dilated, sharp-edged, porous above; hinder nasal opening rather narrower. Tail none. Ears short.

1. *Tapeti brasiliensis*. (*Lepus brasiliensis*, Linn. *L. tapeti*, Pallas.) Para and Bolivia. B.M.

B. Rabbits. *Skull: the hinder nasal aperture narrow, deep, angular, contracted above, with sloping sides. Living in burrows; young born blind and naked.*

6. Cuniculus. *Lepus* § C, Baird, N. A. M. 575. Skull:

hinder supraorbital notch narrow, elongate, contracted behind by the inflection of the sharp tips of the lobes; upper edge of orbits narrow; the hinder nasal opening narrow, very deep; sides flat, contracted at the top; lower front edge of the zygoma rather dilated, solid. Hind legs short.

"Skull more than twice as long as wide; muzzle and nasal bones very long, the former wider than high, anterior to the molars. Postorbital processes divergent, not in contact behind with the skull." (*Baird.*)

1. *Cuniculus fodiens*, Klein. (*Lepus cuniculus*, Linn., Waterh. Glir. 64. *L. magellanicus*, Lesson; Blasius, Faun. Deut. (fig. of skull). *L. vermicula*, Thompson.) Europe, North Africa. B.M.

Var. *Lepus nigripes*, Bartlett, P. Z. S. 1857, p. 159, t. 56.

Section II. *Skull conical, subcylindrical; nose thick, subcylindrical; cheeks very convex; the front edge of the orbits and the upper hinder processes of the intermaxillaries scarcely raised. Orbits moderate, oblong. Cutting-teeth large, strong; the hinder upper orbital notch open, short; the zygomatic arches broad, flat, and produced behind, over the temple.*

7. Carpolagus, Blyth, J. A. S. Beng. 1845, p. 247. Ears shorter than the head; fur harsh. Skull solid; face broad, rounded on the sides; upper edge of the intermaxillaries thin, even with the nasals. Cutting-teeth very broad; grinders broad; palate long and broad. Anteorbital foramina nearly closed by oblique, transverse, bony spicules. Zygomata very long. Supraorbital processes continued forward uninterrupted; anterior notch quite filled up with bone, hinder less deep.

Carpolagus hispidus, Blyth. (*Lepus hispidus*, Pearson, Waterh. Gl. 78.) Burrows? Assam. B.M.

XXVIII.—*Descriptions of two new Saurians from Mossamedes (West Africa).* By J. V. Barboza du Bocage.

Scapateira (?) *reticulata*.

Characters.—Head narrow, with the muzzle elongated and pointed. No occipital shield. Nostrils situated in the midst of three slightly inflated shields—one naso-rostral and two naso-frenals. No teeth on the palate; tongue emarginate at apex, covered with imbricated squamiform papillæ. Inferior eyelid granular. Palpebral disk bordered with granules without and behind, and preceded by a large shield placed between two very small ones. Subocular shield situated between the seventh and eighth labials. Anterior margin of the ear furnished with three denticulations. Upper parts and sides of the neck, and the anterior half of the back clothed with very small rounded scales, smooth and not imbricated; on the posterior half of the back and on the base of the tail these scales gradually become larger and more distinctly keeled and imbricated; the rest of the tail is covered with large keeled scales above and below. Ventral shields quadrilateral, smooth, arranged in longitudinal and transverse series; the widest of the latter includes eighteen shields. In the middle of the præanal region there is a large scale surrounded by smaller ones. Femoral pores twenty to twenty-two. Digits smooth beneath, but denticulated on the edges; the anterior less compressed than the posterior.

Coloration.—Above (on a ground sometimes fulvous, sometimes with a bluish tinge) all our specimens present a reticulate design of a dark-brown colour. On the head predominates an olive tint punctured or marbled with brown. A blackish streak, more or less interrupted, follows the middle of the dorsal surface of the tail; another similar streak extends along each side of the tail, from its origin to its extremity. The upper surface of the limbs resembles the back. The inferior regions are white or yellowish white.

Dimensions.—The largest of our individuals measures 150 millims. in length, of which the head occupies 14, the trunk 37, and the tail 99.

Habitat.—Mossamedes, Western Africa. The natives call it *Cocola,* a name which they also give to several other Saurians. The five individuals which we possess were sent to us by our indefatigable travelling naturalist, M. d'Anchieta.

In its characters this reptile seems to approach most closely to the genus *Scapateira.* Thus the position of the nostrils in the midst of three shields, the existence of numerous femoral pores, the structure of the dorsal scales and ventral shields, the denticulations with which the edges of the digits are furnished, and the presence of an antepectoral fold are so many characters which it has in common with the single species of that genus, *Scapateira grammica.* Nevertheless it presents certain differences of some importance, such as the absence of an occipital shield, and especially the conformation of the anterior digits, which have no well-marked flattening. This is why we hesitate in referring it to the genus *Scapateira.*

Pachyrhyncus, genus novum.

This new genus that we propose is established upon the examination of a single adult individual lately received from Mossamedes through M. d'Anchieta.

It belongs to the Lacertia (*Cœlodontes pristidactyles* of the 'Erpétologie Générale'). From its general organization it is in the vicinity of the genera *Acanthodactylus* and *Eremias*, perhaps between the two, that it should be placed; but the flattening of its head and the extraordinary widening of its muzzle give it a peculiar physiognomy, and render it perfectly distinct from all other Saurians in general.

Generic characters.—Head wide and flattened; muzzle much depressed, wide, spatulate, with its trenchant margins greatly exceeding the outline of the opening of the mouth (figs. 1 & 2).

Fig. 1.

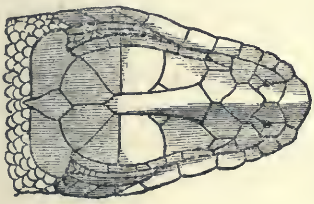
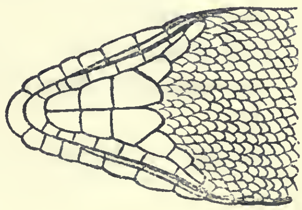


Fig. 2.



Tongue sagittate, emarginate at its extremity, covered with squamiform papillæ. Palate not furnished with teeth. Nostrils looking directly upward, placed in the midst of three shields, as in *Eremias*. Rostral shield much depressed, forming with the first seven superior labials the projecting border of the muzzle. No free antepectoral fold. Ventral shields smooth, forming regular longitudinal and transverse bands. Tail broad and depressed at the base, rounded throughout the rest of its extent. No femoral pores. Five unequal digits on each foot; these are compressed, covered with smooth scales beneath, and denticulated at the edges.

Pachyrhyncus Anchietæ, sp. n.

No occipital plate. Lower eyelid covered with granulations. Auricular opening narrow, its anterior margin smooth, without denticulations. Nostrils bordered by three shields—one nasorostral and two freno-nasals. Nine superior labials, of which the first seven form with the rostral the trenchant margin of the muzzle. One subocular shield, in contact by its lower margin with the fifth, sixth, and seventh superior labials. Scales of the back and base of the tail very small, smooth, slightly inflated, not imbricated; those of the rounded portion of the tail large, imbricated, and keeled. Ventral shields quadrilateral, of moderate size, nearly equal, arranged in from twenty to twenty-four longitudinal rows, and bordered upon the flanks by several rows of similar but smaller shields. Præanal scales numerous, small, nearly equal.

We may refer to figs. 1 and 2 for more ample details as to the scaling of the head.

Coloration.—The upper parts exhibit a fine golden-yellow tint; an elongated black spot covers the occiput; a black streak is continued upon the dorsal line from the region of the fore limbs as far as the anterior third of the tail; on both sides the back is covered, down to the flanks, with a large-meshed black network, having a very pretty effect; the upper surface of the limbs presents a similar pattern. The head and the temples are variegated with black; beneath each eye a great number of small black spots form an elongated spot, which is prolonged from the fourth to the last of the labials. A black line follows the lateral margin of the tail from the base. The lower parts are of a uniform white or whitish tint.

Dimensions.—Total length 112 millims.; head 17, trunk 13, tail 57.

Habitat.—Mossamedes. A single individual.

We have received from the same locality, through M. d'Anchieta, several rare and interesting reptiles, such as—

Sauria: *Chamæleo namaquensis* (Smith), *Homodactylus Bibroni*, *Euprepes Olivieri*, *E. Merremii*, *Mochlus afer*, *Anelytrops elegans*.

Ophidia: *Cerastes caudalis*, *Psammophis*, sp.?

Batrachia: *Dactylethra Mülleri*, *Bufo spinosus*.

Lisbon, July 9, 1867.

MISCELLANEOUS.

On the Development of the Ctenophora. By A. Kowalewsky.

The author has carefully traced the development of the egg in various Ctenophora, and has arrived at some very curious results, especially with regard to the first phases of evolution.

In the *Eschscholtziæ* (and the other Ctenophora seem to be in the same case) two layers may be distinguished in the vitellus,—the external one very thin, formed of true protoplasm, the other central, consisting of an emulsion of large fatty drops. Acetic acid produces a granular precipitate in the former, but has no action on the second. The distinction of these two layers is important, as the former alone plays the part of a formative vitellus, the second behaving as a vitellus of nutrition.

The segmentation into two and then into four and eight parts is effected in such a manner that each of the spheres of segmentation presents the two layers, like the original vitellus. These spheres are *completely destitute of nuclei*. At this period a remarkable phenomenon takes place. In each of the eight spheres of segmentation the external protoplasmic layer passes entirely to one side, forming a sort of cap upon each sphere. The division into sixteen then takes place, in such a way that the eight caps separate to form eight spheres of protoplasm, side by side with the eight spheres of fatty emulsion. From this moment the formative vitellus is completely separated from the eight large spheres of nutritive vitellus. In *Eschscholtzia cordata* the latter is never composed of more than sixteen spheres ; the former alone continues to become rapidly segmented, and the nuclei suddenly make their appearance when the *small* spheres have reached the number of thirty-two. In other species the spheres of the nutritive vitellus continue to multiply by division for a certain time, but always more slowly than the formative vitellus.

The formative vitellus is now juxtaposed to the nutritive vitellus ; but when its cells have become greatly multiplied, it gradually envelopes the latter. The egg then reacquires precisely the appearance which it had before the commencement of evolution. We may distinguish in it, in fact, a central mass in the form of an emulsion, the nutritive vitellus, and a peripheral layer, physically and chemically different. From this period, however, this layer is cellular ; it is the blastoderm, or, if it be preferred, the external epithelium of the animal.

The mouth and intestinal canal soon make their appearance, in the form of a tubular invagination of the superficial epithelium. But, without following step by step the formation of each organ, we shall content ourselves with indicating two very remarkable histological circumstances relating to the formation of the otolithes and that of the tissue intermediate between the outer epithelium and the central mass.

The otolithes are formed in the embryonic nervous ganglion, which only presents from thirty to forty cells. Each of them (originally only one pair exists) appears as a little point in the interior of a cell by the side of the nucleus. When it has acquired a certain size, it slips out of the cell, this being the more easily effected because the latter has no enveloping membrane. The author appears to be inclined to believe that all the otolithes are successively produced by these two cells.

The formation of the intermediate tissue is very curious. It is effected by an actual secretion, with migration of cells. Between the external cellular layer and the central mass there accumulates a homogeneous, amorphous, and colourless substance. Stellate cells are soon seen to detach themselves from the external layer and penetrate into the interior of the homogeneous layer to constitute its cellular web. The migration of these cells takes place by means of their processes, which appear to act like the pseudopodia of the Rhizopoda.

M. Kowalewsky's memoir relates also to the development of *Cestum, Pleurobrachia, Cydippe,* and *Beroë.—Mém. Acad. Imp. de St. Pétersb.* tome x. 1866 ; *Bibl. Univ.* 1867, *Arch. Sci.* pp. 247–249.

Remarkable Instances of Crustacean Parasitism. By A. E. Verrill.

In a collection of about ninety specimens of a small sea-urchin (*Euryechinus imbecillis,* Verrill) from the coast of Peru, not one could be found in which the anal area and surrounding parts of the upperside of the shell were not more or less irregularly distorted or imperfect. An examination of the interior showed that in each specimen a crab (*Fabia chilensis,* Dana), allied to the common crab of the oyster (*Pinnotheres ostreæ*), had effected a lodgment in the upper part of the intestine, which had thereby been greatly distended in the form of a membranous cyst, attached to one side of the shell, and extending around to the lower surface near the mouth. The shell is usually swollen on the side over the cyst; and the anal area is depressed and distorted, with a large open orifice passing obliquely into the cyst, out of which the crab may thrust its legs at pleasure, but is apparently unable, when full-grown, to come entirely out. All the specimens examined in the cyst were females, carrying eggs; but a very small crab found clinging among the spines appears to be the male. The crab probably effects an entrance into the intestine through the anus while quite young, and, by its presence and growth in that position, causes the gradual distortion of the shell and formation of the cyst. In Prof. Dana's Report on the Crustacea of the U. S. Expl. Expedition this crab is described as from Valparaiso, from an *Echinus*; but no special notice of its mode of occurrence and remarkable frequency appears to have been published*.

Another peculiar mode of parasitism I have observed in a singular crustacean (*Hapalocarcinus marsupialis,* Stimpson†) from the Sandwich Islands. This creature lodges itself among the slender branches of a coral (*Pocillipora cæspitosa,* Dana) and causes, probably by its incessant motions, the branches to grow up and surround it on both sides by flat expansions of coral, terminating in digitations which often interlock above, leaving openings between them suitable for the uses of the parasite, but usually too small to allow of egress. Most specimens of the corals of this species sustain one or more, and often numerous, examples of these curious enlarged bulbs among the branches. The habits were unknown to Dr. Stimpson when he described his specimens, which had dropped from among recently collected corals.—*Silliman's American Journal,* July 1867.

On the Anatomy of Balanoglossus (*Delle Chiaje*). By A. Kowalewsky.

Under the name of *Balanoglossus,* Delle Chiaje described a vermiform animal of the Bay of Naples, known to the fishermen under the name of *lingua di bue.* It has since scarcely attracted any attention

* *Pinnaxodis hirtipes,* Heller, recently described from Ecuador and found in an *Echinus,* is probably the same species.

† Proceedings Boston Soc. Nat. Hist. vi. 412.

from naturalists; and the very incomplete investigation of it made in 1860 by M. Keferstein taught us nothing of importance about it.

The *Balanoglossi* nevertheless constitute one of the most curious of animal types, the position of which in the zoological scale is not easy to fix. This appears evidently from the fine work of M. Kowalewsky.

The body in the *Balanoglossi* (of which two species exist at Naples) is vermiform and composed of a series of successive regions. The foremost, separated by a constriction from the following one, has all the appearance of a head; but a careful examination shows that it possesses none of the characters which would justify that name. It is no doubt a tactile organ, to which M. Kowalewsky gives the name of trunk. It is followed by a sort of muscular collar bearing the mouth underneath. The succeeding region is much longer, and may be designated the branchial region. We shall recur immediately to its singular structure. Further back the body bears upon its back two rows of glands (the sexual glands), and then numerous papillæ, which Delle Chiaje took for respiratory organs, but which in reality contain blind processes of the intestinal canal: this, therefore, might be called the hepatic region. Lastly, the terminal or caudal region is smooth and finely annulated.

The most remarkable peculiarity of the *Balanoglossi* is the structure of the respiratory apparatus. The water which serves for the oxygenation of the blood penetrates by the mouth and issues upon the back of the animal by two series of apertures placed upon the sides of the branchial region. It traverses a very complex branchial apparatus, sustained by a chitinous skeleton. This skeleton is formed by two symmetrical series of vertical transverse plates, united in threes by small rods perpendicular to the direction of the plates. The whole therefore constitutes a double series of frames, upon which ramify the blood-vessels, covered by an epithelial layer. The openings of the frames are covered with vibratile cilia. The water, after penetrating by the mouth into the pharynx, gets entangled in the respiratory frames, and issues by the orifices which we have mentioned, the number of which is equal to that of the frames.

It is impossible, in our opinion, not to be struck by the great resemblance of this apparatus to the branchial apparatus of the Vertebrata. Certain anatomists have already attempted a comparison of the Ascidia with the Vertebrata, in consequence of their singular respiratory apparatus; but in this case the resemblance is very much greater.

No doubt, in other respects, the analogy with the Vermes is striking, especially as regards the facies of the animal and the central portions of the vascular system reduced to two principal trunks —a dorsal vessel driving the blood from behind forwards, and a ventral vessel conveying it in an opposite direction, &c. Nevertheless it appears to be impossible to ascribe to these animals, as M. Keferstein has done, a place among the Nemertida, or especially to approximate them to the Annelida, as M. Kowalewsky would do. For the present it is necessary to elevate the *Balanoglossi* into a separate class among the Vermes, through which the latter will as it it were hold out a hand to the Vertebrata, as already, by other types, to the Infusoria, Echinodermata, Mollusca, and Arthropoda. The group of Vermes is daily showing more and more the character of being the origin of all the animal kingdom.—*Mém. Acad. Imp. de St. Pétersb.* 1866; *Bibl. Univ.* 1867, *Arch. Sci.* pp. 249–251.

On the external characters of the Young of the Central American Tapir (Elasmognathus Bairdii, *Gill*). By A. E. Verrill.

This remarkable animal has hitherto been known only by its skull, and a skeleton, not entirely complete, belonging to the Smithsonian Institution. The Museum of Yale College has recently been so fortunate as to receive from J. H. Sternberg, Esq., a specimen of the young animal, preserved entire in alcohol. This individual is a female, and is supposed by Mr. Sternberg to have been about three months old in April. He states that its weight is not more than that of the head of the adult, one head that he formerly examined weighing 82 pounds.

Its entire length is 31 inches; nose to occiput 11; nose to eye 4·25; nose to incisor teeth 1·5; eye to ear 3·2; lower jaw 6·5; length of ear 3·5; breadth 2·5; tail from vent, not including hair, 2. The legs are short and stout; the tail small and inconspicuous. The head, viewed from the side, is elongated oval, from above elongated triangular, the sides nearly straight, the nose truncated. In advance of and above the eyes the sides of the nose are compressed and concave, with a slight depression on its ridge. Beyond this the snout is enlarged, and convex both on the sides and above; the tip papillose and slightly decurved, which gives it a truncated appearance. The nostrils are large, oval, placed obliquely at the end of the nose, about half an inch long, the inner angles separated about a quarter of an inch, the margins thickened. The nose itself is quite flexible and, apparently, capable of extension. The ears are large and prominent, broad oval, rounded at the end. The hair is rather fine and soft, about an inch long on the body, and half as long on the head, where it is not so thick.

The general colour is bright reddish brown, the head darker above. The lips and end of the nose, bordering the naked black tip, are white. Five interrupted narrow white stripes pass along each side of the nose, the upper one extending over and beyond the eye. The cheeks have several larger patches of whitish, one of which is under the eye; a larger white spot is on the throat. The ears are dark brown, lighter at the outer base, the tips and several unequal spots on the outside white. The back and sides are marked by longitudinal rows of yellowish-white patches, which partially blend into continuous stripes on the sides. There are in all about ten of these stripes. The underside of the body is uniform yellowish grey. The legs are darker brown than the body, and marked by numerous transverse bands and spots of white.—*Silliman's American Journal*, July 1867.

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[THIRD SERIES.]

No. 118. OCTOBER 1867.

XXIX.—*On the Classification of the Subdivisions of M'Coy's Genus* Athyris, *as determined by the laws of Zoological Nomenclature.* By E. Billings, Palæontologist of the Geological Survey of Canada*.

[Read before the Nat. Hist. Soc., Montreal, March 25, 1867†.]

Every naturalist who has studied the palæozoic Brachiopoda is aware that there exists a very great diversity of opinion with regard to the classification of the several sections into which the old genus *Athyris* has been divided. The arrangement which I and some others have adopted is, in substance, the same as that proposed by Mr. Davidson in the first edition of his 'General Introduction,' published in 1853‡. Although this has been

* From 'Silliman's American Journal,' July 1867.

† After the reading of this paper, the subject was discussed by some of the members of the Society. The following is from a short report published in the newspapers at Montreal:—"After the paper was read, Dr. P. P. Carpenter said that he thought that Mr. Billings had clearly established his point, and gave an account of the history of a committee appointed by the British Association to make laws to regulate scientific nomenclature, of which committee he was a member. Mr. Whiteaves stated that he was satisfied with the correctness of the view Mr. Billings had taken, and made some remarks about scientific nomenclature and upon some structural points in the shells of the genus in question. Principal Dawson deplored the confusion that has arisen through conflicting views on the question of nomenclature, and, agreeing with Mr. Billings in the conclusion he had come to, said that this communication was valuable inasmuch as it cleared up a question that had hitherto been obscure."

‡ Modified by separating *Merista*, thus:—

Genus.	Type.
Athyris, M'Coy, 1844	*A. tumida*, Dalman.
Spirigera, D'Orbigny, 1847	*S. concentrica*, Von Buch.
Merista, Suess, 1851	*M. Herculea*, Barrande.

The recent classification differs from the above as follows:—

Meristella, Hall, 1860	*A. tumida*.
Athyris or *Spirigera*	*S. concentrica*.
Merista	*M. Herculea*.

According to this, either *Athyris* or *Spirigera* must be suppressed, in order to make room for *Meristella*.

objected to by several distinguished palæontologists, and in consequence thereof abandoned by its author, yet I believe that, on a careful examination of all the circumstances, it will be found to be perfectly just toward the parties concerned, and in no respect inconsistent with the rules of zoological nomenclature. It was the first subdivision of the genus published, and should therefore take precedence over all others.

Previously to 1853 *Athyris* was only known as a single large genus of Brachiopoda, which included such forms as *Terebratula concentrica*, Von Buch, *T. tumida*, Dalman, and *T. Herculea*, Barrande. In that year Mr. Davidson divided it into two smaller genera, confining the name *Athyris* to that section for which it was most appropriate, with *tumida* or *Herculea* for the type, and adopting *Spirigera*, D'Orbigny, for the other type, *T. concentrica*. It was afterwards found that *Athyris*, as then redefined, included two genera; and in consequence it has been again divided by separating all those typified by *T. Herculea* under the name of *Merista*, a genus proposed but not clearly characterized by Prof. Suess in 1851. This is the classification which I believe to be the true one. While discussing it I shall, throughout this paper, when I may have occasion to refer to the species above named, designate them *Athyris tumida*, *Spirigera concentrica*, and *Merista Herculea*.

Those who are opposed to this arrangement contend that, as all the species which M'Coy placed in the genus at the time he first described it belong to the group typified by *S. concentrica*, the name *Athyris* must be retained for that group, and cannot now be transferred to the other section of which *A. tumida* is the type. This reasoning, according to my views, can only hold good in case it be first proved that M'Coy specially confined the genus to species having the generic characters of those in his original list, or pointed out one of them as the type, or drew up his diagnosis in such a manner as to exclude *A. tumida*. In this paper I shall endeavour to show—

1. That M'Coy did not limit his genus to the species first placed in it.

2. That, on the contrary, he and other naturalists understood it to include both *A. tumida* and *S. concentrica*.

3. That, according to the laws of zoological nomenclature, the subdivision made by Davidson in 1853 cannot be set aside.

4. That Davidson's classification has been adopted in several works, some of them of great influence and wide circulation.

In order to prove the above propositions, I shall give the more important facts of the history of the genus, with M'Coy's original figure, and shall quote some of the laws above mentioned in full. Much of this, of course, belongs to the common stock of knowledge of all palæontologists conversant with the fossils of the older rocks, and might be thought superfluous. But the question is somewhat complicated, and cannot well be decided unless in view of all the circumstances. Besides this, it is one upon which any good naturalist is perfectly competent to give an opinion although specially engaged in other departments. Few of these have access to works on palæozoic fossils; and therefore, for the convenience of such as may feel inclined to investigate the subject, it is desirable to bring all the facts together.

There is no dispute about the extent of the genera; and therefore the details of the internal characters need not be given. It is purely a question of natural-history ethics, if I may be permitted to use such a term.

1. *History and Extent of the original Genus.*

The original description was published in the 'Synopsis of the Carboniferous Fossils of Ireland,' in 1844. From this work I shall make some extracts, and shall introduce along with the original figure two others to further illustrate the subject.

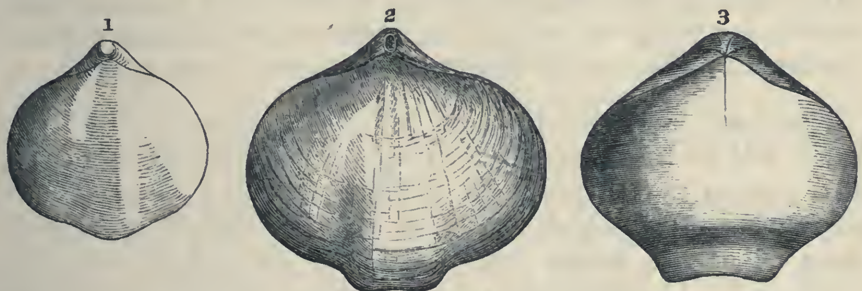

Fig. 1. Copy of the original figure given by M'Coy (without a specific name) to illustrate his idea of the general form of an *Athyris*.
Fig. 2. *Spirigera concentrica,* Von Buch. The form is copied from Davidson's Monograph of the British Devonian Brachiopoda, pl. 3. fig. 13, Pal. Soc. Mon. for 1862. The right-hand side is, in this copy, a little restored, and the aperture in the beak made larger than it is in the original figure.
Fig. 3. *Athyris tumida,* Dalman. Copied from Davidson's 'General Introduction,' pl. 6. fig. 73.

The following extracts are from M'Coy's work above referred to:—

"The family Delthyridæ appears to be divided into the five following genera:—1. *Spirifera,* Sow., composed of those longitudinally ribbed species in which the hinge-line is equal to, or exceeds, the width of the shell, the cardinal area with parallel sides, the cardinal teeth of the ventral valve [now called the dorsal valve] large, spirally rolled, and having a triangular foramen beneath the beak of the dorsal [ventral] valve. 2. *Martinia*, M'Coy, or the smooth Spirifers, in which the hinge-line is less than the width of the shell, and the cardinal area triangular. 3. *Athyris*, M'Coy, in which there is no vestige of either foramen, cardinal area, or hinge-line. This remarkable genus is frequently confounded with those shells usually named *Terebratula* in the older rocks, but is distinguished by the large spiral appendages, which are wanting in the other group. 4. *Brachythyris*, M'Coy, in which we find the longitudinally ribbed surface of *Spirifera* united with the short hinge-line of *Martinia*. 5. *Orthis*, Dal., in which there are no spiral appendages, the hinge-line and striæ frequently spinose (as in *Leptæna*), the cardinal area common to both valves, and its sides inclined towards each other at its angles; dorsal valve smallest."—*Op. cit.* p. 128.

On page 146 of the same work he thus concisely describes the genus:—

"*Gen. Char.*—Nearly orbicular, small; no cardinal area or hinge-line; spiral appendages very large, filling the greater part of the shell.

"This very interesting group possesses all the external characters of the Terebratulidæ united to the internal structure of the Spirifers, to which latter family it truly belongs. Prof. Phillips is the only author who has recognized the group: he forms of it his last division of the genus *Spirifera*, but gives no characters to distinguish it from *Terebratula*; the internal structure is, however, a sure guide."

The above is all that he wrote about the genus at that time; and it will be perceived that he does not point out any particular species as the type, and, further, that there is nothing in his remarks from which it can be inferred that he knew anything about the genera into which the group was afterwards subdivided. Consequently it is impossible that he could have intended to confine the genus to any one of them, as is now affirmed by some of the naturalists who are opposed to the classification advocated in this paper. Instead of excluding species with an imperforate beak such as *A. tumida*, the etymology of the word *Athyris* (without a door or opening), the expression "in which there is no vestige of either foramen, cardinal area, or hinge-line," and also his typical figure, all induce the belief that he had before him one or more forms with the beak entire. This is rendered certain by what he says on page 147. Speaking of what he calls *A. concentrica*, he says:—"This species is not uncommon; it is figured in the 'Bull. de la Soc. Géol. de France,' with a perforated beak as in *Terebratula*. I have, however, seen numerous specimens with the beak entire and imperforate, as in the other palæozoic species." It is highly probable from all this that he had in view such Silurian forms as *A. tumida*. This latter species is so common that it is almost certain that such a collection as he was then engaged upon would contain one or more specimens.

If we take the paragraph No. 3 as a part of the generic description, then *A. tumida* is included. If, on the other hand, we confine ourselves to the extract from page 146, it is not excluded, as there is no reference made there to the structure of the beak. This latter diagnosis is sufficiently comprehensive and general in its terms to include *Athyris, Spirigera,* and *Merista.* He did not place *A. tumida* in the genus, for the reason that his work was confined altogether to the Carboniferous fossils, among which it does not occur. But he did so afterwards, when he described Professor Sedgwick's Silurian fossils, as will be shown further on. He was wrong in supposing that all the species were imperforate—a matter of little consequence, as it was simply an error of observation, which does not vitiate. Had the genus turned out to be not capable of subdivision, all that could be done now with this error would be to strike it out. There was sufficient in his diagnosis to indicate what group of fossils was intended. He was also wrong in supposing *S. concentrica* to be a Carboniferous fossil: it is Devonian. It may be that he mistook some other species with an imperforate beak for that. It will be seen further on that Prof. King made a similar mistake with respect to this very species, having taken *T. scalprum,* Barrande, for it—an error which was detected by Mr. Davidson. Altogether he referred eleven species to the genus, several of which have been shown to be synonyms.

In the same work he proposed another genus, *Actinoconchus*; but as it was founded on error, he afterwards withdrew it, and added it to *Athyris* (Brit. Pal. Foss. p. 436). All scientific works abound more or less with such misconceptions.

That the genus was understood by other naturalists to include *A. tumida* is proved by the following facts. It is well known that the genus *Spirigera* was proposed by D'Orbigny, in 1847, simply as a substitute for *Athyris,* on the ground that this latter name implies the absence of a foramen, and is therefore not appropriate for species with a perforated beak. It is quite clear that D'Orbigny considered his genus to be precisely the same in extent as *Athyris.* All the species, therefore, which he placed in *Spirigera* he regarded as fairly within the group; and it is unquestionable that he would have referred them all to *Athyris* had not that name appeared to him objectionable. I have not seen his original description in the 'Annales des Sciences Naturelles,' referred to by Mr. Davidson in the extract given below; but in the 'Paléontologie Française,' vol. iv. p. 357, he says:—"This division has already two generic names which we cannot preserve, because they are in complete contradiction to zoological characters." The two genera referred to were *Athyris* and *Actinoconchus*.

He specially selected *T. concentrica** for the type of his genus; and therefore, if *Spirigera* be retained at all, it must be for that section. He refers to his 'Prodrome' for a list of the species; and we have thus only to examine this list in order to ascertain his idea of the extent of the genus. They are the following, taking them in the order in which they are published:—

"*S. Ceres, vultur, Circe, passer, Herculea, harpya, Hecate, tumida, concentrica, Helmerseni, Puschana, decussata, plebeia, Ferronesensis, Ezquerra, Hispanica, Toreno, subconcentrica, Pelapayensis, Campomanensis, Mayendorfi, Roissyi, serpentina, lamellosa, ambigua, Blodena, plano-sulcata, expansa, pentaëdra, pectinifera, trigonella, quinquecostata, quadricostata, tricostata,* and *cristigalli.*"

Several of the above species do not belong to the group. This list shows that D'Orbigny regarded the genus as including not only the types of *Athyris* and *Spirigera,* but also that of the genus *Merista* (*M. Herculea*), which I shall notice further on. I think it quite certain that, had D'Orbigny been aware that the genus was capable of subdivision, he would have retained *Athyris* for one of the groups which have the beak imperforate. Indeed, according to the laws of nomenclature, he could not have done otherwise with any probability of producing a permanent classification.

In a valuable paper, read before the Geological Society of France, in May 1848, on the Brachiopoda of the Upper Silurian rocks of England†, Mr. Davidson made the following observations on D'Orbigny's genus:—

"Vient ensuite le genre *Spirigera* que le même auteur établit pour les coquilles qui possèdent des spires internes placées de la même manière que les *Spirifer,* mais qui ont des appendices et des détails d'organisation essentiellement différents. Ces espèces, parmi lesquelles nous trouvons les *Terebratula, tumida, Circe, concentrica, subconcentrica, Roissyi, pectinifera, ambigua, Helmerseni, Pelapayensis, Campomanensis, Ferronesensis, Ezquerra, Hispanica,* ont déjà été distinguées par M. de Verneuil comme devant former une section à part, qu'il a nommée la section des *Concentricæ.* Je suis de l'opinion de M. d'Orbigny qu'elles doivent constituer un genre. L'étude minutieuse que M. Bouchard a faite de la *Terebratula concentrica* ne m'en laisse aucun doute; mais ce genre n'ayant pas encore été convenablement caractérisé, je m'abstiendrai de l'adopter

* "Le type est *T. concentrica,* De Buch. Toutes les espèces avec leur synonymie se trouvent dans notre 'Prodrome de Paléontologie stratigraphique.'"

† "Mémoire sur les Brachiopodes du Système Silurien supérieur d'Angleterre, par M. Th. Davidson," Bull. Soc. Géol. Fr. v. pp. 309–314.

dans ce petit mémoire qui n'est pour ainsi dire qu'un résumé d'un plus grand travail que je publie en ce moment dans le *London Geological Journal.*"

Upon the above I shall only remark that it is quite clear that Mr. Davidson then regarded *S. concentrica* and *A. tumida* as congeneric, and that whatever new genus might be established it would include both species.

In 1852, M'Coy, in the second fasciculus of the 'British Palæozoic Fossils,' page 196, redefined *Athyris* as follows:—

"*Gen. Char.*—Nearly orbicular or ovate, both valves convex; no cardinal area, foramen, or hinge-line; spiral appendages to beak of entering valve very large, nearly filling the shell; a strong mesial septum in the rostral part of entering valve; dental lamellæ moderate; tissue of shell apparently fibrous.

"One specimen [of *A. tumida*] shows the pallial and ovarian impressions to be thick, numerous, and dichotomizing frequently from beak to margin."

In the work cited and in the third fasciculus we find the following species:—*A. tumida, S. concentrica, ambigua, De Roissyi, expansa, globistriata, globularis, gregaria, paradoxa, pectinifera,* and *squamigera.* This shows clearly enough his views of the extent of the genus—that is to say, that, as it was then understood, it included both *A. tumida* and *A. concentrica.* In commenting on this, Prof. Hall says:—"The fact that M'Coy cited this as an *Athyris* no more renders it an *Athyris* than it was made *Atrypa* by being thus described by Dalman; and it was just as free for the foundation of a genus after the citation of M'Coy as before"*. This is true enough in part. It was free for the foundation of a genus until 1853, when Davidson used it for that purpose; but since 1853 it has never been free.

The above is quite sufficient to prove my first and second propositions.

I am not aware of anything else of much importance, with the exception of what relates to *Merista,* having been published up to 1853, when Davidson's excellent work, the 'Introduction to the Classification of the Brachiopoda,' made its appearance, in which the genus was first subdivided. But, before entering upon this, I shall notice the remarks of Prof. Suess on the genus *Merista.*

This genus was proposed by Prof. Suess in 1851; but he did not then sufficiently characterize it. The following is all that I can find relating to it that was published previously to 1853:—

"Mr. E. Suess communicated the results of the investigations on several Brachiopods, from the Bohemian transition rocks, which had

* Silliman's Journal, ser. 2. vol. xxxii. p. 131.

been made by him and Mr. Custos Dormitzer, of Prague. He showed that some of the forms heretofore referred to *Terebratula* had no opening in the beak for the passage of the muscle of adhesion, and also that the distribution of their inner organs points to an affinity with the non-attached genus *Pentamerus*. These inner organs are borne by six partitions in place of a single calcareous loop; the spiral arms are not unrollable.

"Through the separation of these forms (for which the name *Merista* is proposed) from the genus *Terebratula*, an apparent contradiction in the laws of palæontological distribution is solved, since those smooth forms will now be separated which have heretofore offered an apparent contradiction to the present views of these laws."

Lest I should not have expressed his views rightly in this free translation, I give the original in the note below*.

On page 160 of the same work there are some further remarks on the classification of the Brachiopoda, by Prof. Suess, in which he refers to the genus *Merista*. No generic description, however, is there given. It appears also that it was again noticed in Leonhard's 'Neues Jahrbuch,' 1854, p. 127. I have not at present access to that work, and do not know whether the genus is described there or not: at all events, at the time Mr. Davidson prepared the English edition of his 'General Introduction,' *Merista* was not understood.

Prof. King, in his 'Monograph of the Permian Fossils of England' (1850), proposed to restore the genus *Cleiothyris* of Phillips, apparently making it partly equal to *Athyris*, M'Coy. But the specimen on which this arrangement was founded was afterwards shown to Mr. Davidson, and by him identified with *T. scalprum*, Barrande (now *Merista scalprum*), while *Cleiothyris* was intended by its author as a substitute for *Atrypa*. (See Davidson's 'Introduction,' p. 85.)

* "Herr Eduard Suess theilte die Erfolge der Untersuchung einiger Brachiopoden aus dem böhmischen Uebergangsgebirge mit, die er gemeinschaftlich mit Herrn Custos Dormitzer in Prag angestellt hatte. Er zeigte, dass mehrere bisher zu den Terebrateln gezählte Formen an ihrer Spitze keine Oeffnung für den Anheftungsmuskel besitzen, und dass auch die Vertheilung ihrer inneren Organe auf eine Verwandtschaft mit der ebenfalls nicht angehefteten Gattung Pentamerus hinweist. Diese inneren Organe werden von 6 Wänden, statt von einer einfachen Kalkschleife getragen; die Spiralarme selbst sind nicht aufrollbar.

"Durch das Lostrennen dieser Formen, für welche der Name *Merista* vorgeschlagen wird, von der Gattung *Terebratula*, wird zugleich ein scheinbarer Widerspruch in den Gesetzen paläontologischer Verbreitung gehoben, da eben jene glatten Arten ausgeschieden werden, welche den bisherigen Ansichten über diese Gesetze am schroffsten entgegengestanden waren."—*Jahrbuch der k. k. geologischen Reichsanstalt, Vienna,* ii. pt. 4. pp. 150, 160: 1861.

2. *Subdivision of the Genus by Mr. Davidson in* 1854.

From all the facts above given it may be gleaned that in 1853, when Mr. Davidson was engaged in the preparation of his 'General Introduction,' this group of Brachiopoda was known as a single genus, but with two generic names—*Athyris*, M'Coy, 1844, *Spirigera*, D'Orbigny, 1847. Each of these was intended by its author to include the whole group. M'Coy was under the impression that all the species had the beak imperforate, while D'Orbigny maintained that they were all perforated. Both authors were partly wrong and partly right. The genus was capable of subdivision; but no one had as yet undertaken that task, unless, indeed, the observations of Prof. King and Suess can be so construed. With regard to the latter, as the genus *Merista* is now well understood and is different from *Athyris*, it does not affect the question. *Cleiothyris* may be regarded as obsolete.

Mr. Davidson, in his 'General Introduction,' in endeavouring to reconcile the conflicting nomenclatures of D'Orbigny and M'Coy, divided the genus, retaining the name *Athyris* for "forms with an apparently imperforate beak or closed foramen, variously disposed septa, and largely developed dental plates." He selected two species, "*A. tumida*, Dal., or *Herculea*, Barrande," and specially named them as the types.

He retained *Spirigera* for the group of which *S. concentrica* is the type. As to this latter group, by whatever name it may be hereafter known, its extent will most probably always be that assigned to it in the work in question.

The genus *Athyris*, however, as there defined, included *Merista* —a circumstance which, however, as I shall presently show, in no way vitiates the arrangement. In a note he states, "Before coming to the above conclusion, I submitted my views to Mr. Deshayes, Mr. Salter, and others, who seemed to consider that this mode of compromising the difficulty could not reasonably be objected to by the two authors principally concerned, nor by the generality of palæontologists" (*op. cit.* p. 86).

Afterwards this classification was strongly objected to by several naturalists, who maintained that M'Coy had "originally and positively" applied the name *Athyris* to the *S. concentrica* group, and therefore it could not be transferred to the other principal section. He, therefore, in the French edition of this introduction (1856), abandoned his first arrangement *, and

* "Mais ce moyen terme a été critiqué par plusieurs naturalistes qui ont insisté sur ce que le terme *Athyris* avait été originairement et positivement appliqué par son auteur à la *T. concentrica* et sur l'impropriété de l'autre dénomination pour désigner des coquilles telles que les *T. tumida*, *Herculea*, &c. M. Suess nous a informé (*Neues Jahrbuch*, p. 62, Janvier

substituted *Merista* and *Athyris*, at the same time transferring the latter to *Spirigera*, as in the extract given in the note below (*op. cit.* p. 101).

Upon a careful examination of all the circumstances, I think it will be found that, according to the laws of nomenclature, this change cannot be sustained. I shall therefore quote some of those laws, and endeavour to apply them to this case.

The first rule reads thus:—

"§ 1.—The name originally given by the founder of a group or the describer of a species should be permanently retained, to the exclusion of all subsequent synonyms."

It seems scarcely necessary to quote such a rule as this. I only do so in order to make the comment that it is the most important of all the laws of nomenclature, and that its operation cannot be prevented in any case by merely technical objections or by any error in the details of a generic or specific description. Provided the original diagnosis contains sufficient in substance to enable the scientific public to identify the group, trivial errors, from which the writings of no naturalist are free, will not have any effect. All that can be done is to rectify, not to destroy. One of the exceptions to this rule is thus expressed in No. 11:—"A name may be changed when it implies a false proposition which is likely to propagate important errors."

According to this exception, if the name *Athyris* should be applied to the *S. concentrica* group, there is a possibility of its falling into the list of synonyms; for, although no very important error would be superinduced, yet few naturalists can apply it to shells with a well-defined foramen without feeling that such an application is to some extent inconsistent with the purity of scientific nomenclature.

"§ 3.—A generic name, when once established, should never be cancelled in any subsequent subdivision of the group, but retained in a restricted sense for one of the constituent portions.

"§ 4. A generic name should always be retained for that portion of the original genus which was considered typical by the author."

This latter rule is preceded by some introductory observations which should be embodied in it, as they, in fact, form a

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1854) qu'il avait, en 1851, proposé le nom de *Merista* (Jahrb. k. k. geol. Reichsanstalt, ii. IV. 150, 1851. Mentionné encore dans *Leonhard's Neues Jahrbuch*, p. 127, 1854) pour le groupe renfermant ces dernières. J'abandonne donc la proposition que j'avais faite en 1853, et je conserve indifféremment l'*Athyris*, M'Coy, ou le *Spirigera*, d'Orb., pour le *T. concentrica*; et *Merista*, Suess, pour les *T. tumida*, *Herculea*, etc."

part of the rule itself. They are especially applicable to this case.

"When a genus is subdivided into other genera, the original name should be retained for that portion of it *as at first defined.* Authors frequently indicate this by selecting some one species as a fixed point of reference, which they term the 'type of the genus.' When they omit doing so, it may still in many cases be justly inferred that the *first* species mentioned on the list, *if found accurately to agree with their definition,* was regarded by them as the type. A specific name, or its synonyms, will also often serve to point out the particular species which by implication must be regarded as the original type of the genus. In such cases we are justified in restoring the name of the old genus to its typical signification, even when later authors have done otherwise."

Now this rule bears directly on the question, because many naturalists are under the impression that the first species placed on the list must *necessarily* be regarded as the type where the author is silent on that point. But, according to the above (and common sense), it is only so if found *accurately to agree with the definition. Spirigera concentrica* does not agree either with the name *Athyris,* or with M'Coy's generic description, or with his typical figure. Therefore it cannot be arbitrarily selected as the type, and the name *Athyris,* in consequence, retained for that group. Indeed in many instances it would be impossible that the first species placed in the genus should be the type; for the author might not have the true type in the collection under investigation.

In this instance, as before mentioned, M'Coy was preparing a work exclusively devoted to Carboniferous fossils, among which *A. tumida* does not occur. In preparing his description of the genus he may, however, have had that species before him, and its imperforate beak may have had some influence.

"§ 5. When the evidence as to the original type is not clear and indisputable, then the person who first subdivides the genus may affix the original name to any portion of it at his discretion; *and no later author has a right to transfer that name to any other part of the original genus.*"

This last paragraph applies as well to the author who first subdivided the genus as to others. Once a genus is established or subdivided, on sound principles, it becomes the property of science, and the author himself (either of the genus or the subdivision) can make no change. He may amend, by striking out the errors, if any there be, but all that is true must remain.

I think that, on a careful study of all the circumstances, it will be perceived that Mr. Davidson's first adjustment of this question was the most wise, the best for the interests of science, and the most just towards all the parties concerned that could be devised. It was not inconsistent with the laws of nomenclature, but in perfect accordance with them in every particular, and therefore should be retained.

In one respect, however, it has been modified. *Athyris*, as first defined by him, included *Merista* of Prof. Suess. This was, no doubt, due to the fact that the characters of this last-named genus were not then accurately known to the scientific public. This makes little difference. *Merista* has long since been separated, with its type *M. Herculea*, leaving the other and most important group for *Athyris*, with *A. tumida* for the type.

With regard to *Spirigera*, I think it can also be retained, notwithstanding the following rule:—

"§ When two authors define and name the same genus, *both making it exactly of the same extent*, the latter name should be cancelled *in toto*, and not retained in a modified sense."

If the name *Athyris* had been extremely objectionable, according to the 11th rule, *Spirigera* might have cancelled it altogether. But the true principle of interpreting these laws is, that where there is any possibility at all of saving the original name, it must be saved, even if the rules be strained to their utmost in that direction. The rules cannot be stretched to destroy, but they may be strongly bent in the other direction, to preserve. If a generic name should be appropriate for a large number of the species of the group to which it was originally applied, and *not very* objectionable as to a few only, I doubt whether it can be changed. Such was the case with *Athyris* when D'Orbigny objected to it. More than two-thirds of the species designated by him are imperforate, and he should have retained the name for these. Some naturalists were therefore in favour of rejecting *Spirigera* altogether, others of retaining it. It is not, therefore, a case clearly within the rule; and as there was much doubt, the best course to take, as soon as it was found possible to do so, was taken by Mr. Davidson. He decided in favour of preserving the name.

3. *Authors who have adopted the Classification.*

In 1856, Professors H. G. Bronn and F. Roemer, in the third edition of Bronn's 'Lethæa Geognostica,' adopted Davidson's classification, and copied his diagnosis of both genera in full. They cited *A. tumida* as the type of *Athyris*. "Die typische Art ist *Athyris tumida*, M'Coy (*Atrypa tumida*, Dalman). Andere Arten sind *A. Herculea* (*Terebratula Herculea*, Barrande), *A. pseudo-scalprum* (*Terebratula pseudo-scalprum,* Barrande), *A. scalprum* (*Terebratula scalprum,* Fried. Roemer)" (*op. cit.* p. 331).

They also recognized *S. concentrica* as the type of *Spirigera.* "Die typische Art ist *Sp. concentrica* (*Terebratula concentrica,* Bronn). Andere Arten sind *Sp. pectinifera* (*Atrypa pectinifera,* Sowerby), aus dem Zechstein, *Sp. Roissyi* (*Sp. de Roissyi,* Leveillé)," &c. (*op. cit.* p. 332).

In the same year Eichwald placed *A. tumida* in *Athyris,* and *S. concentrica* in *Spirigera**.

In 1860 he also introduced the same classification in his great work on the Palæontology of Russia. The Russian species are *A. tumida, didyma, ungula, cassidea, S. concentrica* and *ambigua*†.

In my studies of the Canadian Brachiopoda I had no occasion to describe any species of this group until 1859, when I commenced a series of papers on the Devonian Fossils of Canada West. At that time I had not fully investigated the subject, but understood, from a paper published by Mr. Davidson in the 'Geologist' (vol. i. p. 456), and also from Woodward's 'Manual of the Mollusca' (p. 223), that *A. tumida* and *S. concentrica* were thought to be inseparable‡. Not feeling perfectly satisfied that this was the correct classification, I prefaced my descriptions with the following remarks:—

"Genus Athyris, M'Coy.

"There is much difference of opinion as to the propriety of retaining this generic name. It implies that the shells have no foramen in the ventral valve; and yet many are placed in the genus which have the beak distinctly perforated. Some palæontologists are therefore in favour of using D'Orbigny's appellation *Spirigera* instead of *Athyris.* Nearly all of the Silurian species, and some of those from the Devonian rocks, have the beak so strongly incurved that no foramen can be seen. For such, at least, the name *Athyris* does not appear to be very inappropriate. Mr. Davidson still retains it, not only for those which have the foramen concealed, but also for those with it open. It appears probable that the genus will sooner or later be subdivided; and in that case *Athyris* might be retained for the species with closely incurved beak, and *Spirigera* for some of the others. I shall give some account of the generic characters of this group of shells in another article. The following species are placed in the genus provisionally."—*Canadian Journal,* ser. 2. vol. v. p. 273 (May 1860).

In that paper I described two species with closed beaks (*A.*

* "Beitrag zur geographischen Verbreitung der fossilen Thiere Russlands," Bull. Soc. Imp. Nat. Moscou, vol. xxix. pp. 419, 422.

† Lethæa Rossica, vol. ii. p. 731 (*Athyris*), p. 735 (*Spirigera*).

‡ In this work Mr. Woodward separates *Merista* (although with doubt) as a subgenus, and refers *A. tumida* to *Athyris.*

clara and *A. Maia*) which, no doubt, belong to the genus. The others with perforated beaks I marked doubtful, thus:—*A.* (?) *scitula* (Hall); *A.* (?) *Clusia*, n. sp.; *A.* (?) *unisulcata* (Conrad); *A.* (?) *rostrata* (Hall); *A.* (?) *Chloë*, n. sp.*

"I think it the same as the species called *Meristella Doris* by Prof. Hall (13th Reg. Rep. p. 84, 1860). I doubt that any of the others belong to either *Athyris* or *Spirigera*."

Afterwards Prof. Hall (13th Reg. Rep. p. 74) proposed to establish a new genus, *Meristella*, precisely identical with *Athyris* as redefined by M'Coy in 1852. His diagnosis reads thus:—

"Shells variable in form, oval, ovoid, orbicular, or transverse. Valves unequally convex, with or without a median fold and sinus; beak of the ventral valve apparently imperforate, incurved over the beak of the smaller valve; area none; valves articulating by teeth and sockets. Surface smooth, or with fine concentric lines of growth and fine obsolete radiating striæ, which are usually more conspicuous in the exfoliated shell. The interior of the dorsal valve is marked by the presence of the longitudinal septum, and the upper part of the ventral valve by a deep subtriangular muscular impression which unites with the rostral cavity."

Now I hold that, instead of proposing a new genus, he should have retained the original name *Athyris*, because his proposition amounts to a subdivision of the group: and, according to the laws of nomenclature, he should have applied the old name to that portion for which it is most appropriate, as had been done six years before by Davidson. As soon as this new arrangement was published, I reinvestigated the subject, and perceiving that it amounted to nothing more than a restoration of Davidson's former classification, but with a change of names, I declined to adopt it. In all the publications of our Survey in which species of this group are described or figured, *Athyris* is used instead of *Meristella*.

On the merits of this classification, a note in 'Silliman's

* I now think that *A. clara* is the same as Prof. Hall's *Meristella nasuta*, but am not quite sure that it is Conrad's species. *A.* (?) *scitula* was afterwards found to belong to a new genus described by me under the name of *Charionella* (*op. cit.* vol. vi. p. 148, March 1861). It is not *Atrypa scitula*, Hall, a point on which I was not certain at the time, as will be seen by the description, which reads thus:—

"The above figures represent different views of two specimens of a species which appears to me to be identical with that figured in the work above cited. It varies greatly in size. The length of the largest specimen that I have seen is 17 lines, the greatest width 14 lines, depth 8 lines. The smallest is about 2 lines in length; and many of intermediate sizes have been observed, to make out the series. It is not certain that this species belongs to the genus *Athyris*."—*Op. cit.* p. 30.

Journal,' ser. 2. vol. xxxiii. p. 130, expresses the views advocated herein. The following is an extract therefrom:—

"This is the classification which the writer of the criticism maintains should be sustained; and we cannot see any reasonable objection to it. It is perfectly just towards both M'Coy and D'Orbigny. It inflicts no injustice on any other author. It is not inconsistent with purity of zoological nomenclature, or in any way injurious to science. It does not require any modification in either of the original definitions. The typical species are central and dominant forms of two different groups of species which together form one larger general group. *Athyris*, under this arrangement, is the generic name of that group which has *A. tumida* for its type. *Spirigera* is a perfectly unexceptionable name for the other group, of which the typical form is *S. concentrica*. Prof. Hall's proposed genus *Meristella* is precisely identical with the genus *Athyris* in its restricted sense (as above explained), and cannot be admitted until some good reason is shown for setting aside Davidson's arrangement. It belongs to Prof. Hall to place this reason before the public in a clear and unsophisticated manner. If he succeed in maintaining his point, then he will establish a classification for this group of fossils far inferior to that proposed by Davidson. *Spirigera* must be suppressed, and *Athyris* must take its place, and thus stand as the generic appellation of a group of fossils for which it is not appropriate. We hold that this change is not necessary; and as it would, if adopted, be injurious to science by affecting the purity of zoological nomenclature, it cannot be maintained."

XXX.—*Fourth Report on Dredging among the Shetland Isles.* By J. Gwyn Jeffreys, F.R.S.*

In spite of the weather (which was worse than usual in this stormy region), some additional results of no slight interest were obtained. The three requisites of such enterprises (time, money, and experience) were not wanting; and the valuable cooperation of Mr. Norman, Mr. Waller, and Mr. Dodd, aided by a good yacht and crew, and by a large stock of apparatus, left nothing to desire except calmer seas. Dr. Edmonston and his family again did all in their power to promote our endeavours; and Mr. Cheyne of Edinburgh kindly placed his house at Tanwick at our disposal.

Discoveries in natural history are of several kinds, all of which are nearly equally important:—1. New species or forms. 2. Geographical distribution. 3. Habits of animals, including in the present case those supposed to be dependent on the depth of water. 4. Geological relations. 5. Extraneous incidents.

* Communicated by the author, having been read at the Meeting of the British Association at Dundee, 5th Sept., 1867.

All these I will now notice as regards the Mollusca. Other branches of the marine Invertebrata will be treated of by Mr. Norman, Mr. Waller, and Dr. M'Intosh; and Dr. Günther has kindly promised to report on a few small fishes caught in the dredge.

1. *New Species.*—The species I am about to enumerate are new to the British fauna, but not to science.

Terebratella Spitzbergensis, Davidson.

A fresh and perfect, although dead, specimen occurred in 80–90 fathoms off Unst. The only locality hitherto recorded for this shell in a living state is Spitzbergen. It was found by Hisinger and myself in a fossil state at Uddevalla, and last year by Messrs. Crosskey and Robertson in another raised sea-bed near Christiania. There is, of course, a possibility that the Shetland specimen also may be fossil; but it has all the appearance of being recent; and *Terebratula cranium* and *T. caput-serpentis* (both of which are likewise arctic species) live in the same place where this specimen of *Terebratella Spitzbergensis* was dredged.

Rhynchonella psittacea, Gmelin.

A specimen (unfortunately broken in dredging) was found with *Terebratella Spitzbergensis, Terebratula cranium*, and *T. caput-serpentis*. This was filled with soft mud, in which was a fresh, but dead, young specimen of *R. psittacea*. I had on a former occasion dredged a full-grown specimen and a young one (both quite perfect, although not living) off Unst. In 'British Conchology,' vol. ii. pp. 22 & 23, is an account of all the specimens said to have been taken by Capt. Laskey and others in the British seas; and I am still convinced that most of these reported discoveries were mistakes, and that some of the specimens are fossil. The present case is free from doubt, except on the latter ground. Single valves of *Pecten Islandicus, Tellina calcaria*, and *Mya truncata*, var. *Uddevallensis*, are not uncommon on the northern and eastern coasts of Shetland, and were procured with *T. Spitzbergensis* and *R. psittacea*; but the former had an unmistakeably fossilized or chalky aspect, and never were perfect or had the valves united. It seems to be an established rule that all marine invertebrate animals increase in bulk northwards; and thus the comparative size of living and dead specimens of arctic species found in the Shetland seas may serve as an additional test to distinguish which of the latter were recent and which fossil. The two Brachiopods in question must, I think, stand or fall together as British. Mr. Davidson (the great authority on this abnormal class of the Mollusca) says that, under the circumstances I have mentioned, "there appears to be a probability that these two species may occur somewhere in the neighbourhood—if not quaternary; but if this last, I hardly think they would have been so perfect and fresh as you describe them to be." Professor Lovén, who has examined my specimens, considers them recent. According to Professor Sars, *R. psittacea* inhabits the coast of Finmark, as far south as Tromsö (69° 40′ N. lat.), at depths of from 20 to 80 fathoms. Mr. M'Andrew dredged it off Drontheim and in Upper Norway, at depths of from 40 to 150 fathoms. Drontheim lies in 63° N. lat., Unst in about 61°.

Leda pernula, Müller.

A valve, apparently fossil, was dredged on the northern coast; and several valves in a fresh state (partly covered with a glossy epidermis) and a small perfect but dead specimen were dredged in St. Magnus Bay, on the west coast, at a depth of from 60 to 80 fathoms. As no glacial fossils of arctic kinds occurred on the west coast, I have no hesitation in regarding *L. pernula* as British. I had in former expeditions dredged small valves and a complete pair east of Shetland and in the Hebrides. This species inhabits the Scandinavian coasts, as far south as Kullen in Sweden, from 20 to 150 fathoms; and M'Andrew records a depth of 160 fathoms: it is widely diffused over the arctic seas of both continents, and it is also one of our post-tertiary or quaternary fossils.

The next two species are especially interesting, in respect both of novelty and of the classification of the Mollusca. They belong to the class Solenoconchia (Solenoconchæ, Sars, or Scaphopoda, Bronn), which is represented by the genus *Dentalium*. I have elsewhere so fully treated of this remarkable class that I will now offer merely a few remarks as to the genus *Siphonodentalium* of Sars, to which or an allied genus the species now about to be noticed must be referred. *Siphonodentalium* (perhaps the type of a separate family of Solenoconchia) is distinguished from *Dentalium* by having an extensile worm-like foot, the disk of which expands in the shape of a flower and is furnished with a spike, by the mouth or anterior orifice of the shell being obliquely truncated (in *Dentalium* it is circular), and by the posterior or smaller orifice having its margin serrated or slit on each side, instead of this orifice being furnished with a short pipe or having its margin slit on one side only. I am inclined to refer one of the species now discovered as British to the genus *Siphonodentalium*, and the other to the genus *Cadulus* of Professor Philippi *. In the latter genus (which Philippi

* Moll. Sic. ii. p. 209.

proposed for the reception of a small Sicilian fossil—his *Dentalium ovulum*) the shell is not cylindro-conical as in *Siphonodentalium*, but is tumid in the middle or anterior portion, sometimes awl-shaped; and the mouth is encircled by a narrow rim. In *Cadulus* the shell is quite smooth, transparent, and lustrous; in *Siphonodentalium* it is striated or exhibits the lines of growth, and is semitransparent. The long-lost *Dentalium gadus* of Montagu, an allied species (*D. clavatum* of Gould) from the China Sea, another species which I observed in the late Mr. Cuming's collection, from Mindanao (erroneously named *D. acuminatum*, Deshayes), and *D. coarctatum* of Lamarck (a tertiary fossil) apparently belong to *Cadulus*, and certainly not to *Ditrupa* (properly *Ditrypa*)—a genus of testaceous Annelids the shell of which is different in structure and composition from that of *Cadulus* or of *Siphonodentalium* (the mouth is contracted or pinched-in), and the animal is annulose and has a circular operculum. On the other hand, several kinds of shelly cases described as *Dentalia* really belong to *Ditrypa*. If *Cadulus* is not generically distinct from *Siphonodentalium*, the former of these names has priority; and we shall thus be able to expunge a more than sesquipedalian name from the terminology of the Mollusca. The diagram now exhibited is an enlarged representation of the figures of *S. Lofotense* and *S. subfusiformis*, in an admirable paper by Professor Sars, published in the Transactions of the Academy of Sciences at Christiania for 1864; and it will serve to explain the nature of these extraordinary mollusks. One of our species is

Siphonodentalium Lofotense, Sars

("Malacozoologische Jagttagelser," in Vid.-Selsk. Forh. 1864, p. 17, figs. 29–33), ranging from the Loffoden Isles to Christianiafiord, at depths of between 30 and 120 fathoms. It was rather plentiful among sandy mud in St. Magnus Bay, at the depth of from 60 to 80 fathoms; and I had found it in 1846 when dredging off Skye, in 1864 off Unst, and last year in the Minch. The shell may easily be passed over (as it was by me) for the young of *Dentalium entalis*; but it is more curved and cylindrical, the mouth and corresponding lines of growth slope backwards, and the margin of the posterior orifice is regularly jagged (having two slight notches on each side), and this extremity does not form a bulbous point in the fry. One of the characters given by Sars ("margine aperturæ posterioris integro") should be amended. My observation of the animal agreed with his, except that the foot is vermiform and has a fine point, the disk being expanded and assuming the shape of a flower only when the *Siphonodentalium* wishes to obtain a fulcrum and keep its place in the sand. The foot of *Nucula* and *Leda* is somewhat similar, its disk when expanded resembling the leaf of a palm. Another species of *Siphonodentalium* proper is *Dentalium quinquangulare* of Forbes, from the Ægean (80–230 fathoms), which M'Andrew afterwards dredged off the coasts of Portugal and Spain in 5–30 fathoms, and named (lapsu calami) *D. quadrangulare*; this species Sars lately procured from the Loffoden Isles and Christianiafiord in 50–300 fathoms, and described as *S. pentagonum*. The coincidence of the first and last of these specific names is curious. *D. bicarinatum* of Deshayes (a tertiary fossil) may also be referable to the genus *Siphonodentalium*. *D. bifissum* of Searles Wood, from the Coralline Crag, is possibly the type of another genus, for which I would suggest the name of *Dischides*. This species has been dredged in a living state off Gibraltar by Mr. M'Andrew. I suspected that *D. bifissum* might be the tube of a young *Teredo norvegica*, on account of its having a septal process within the posterior orifice: at all events my remark is justified by the affinity which exists between the *Teredinidæ* and the Solenoconchia.

The second species of this class is

Cadulus subfusiformis, Sars

(*Siphonodentalium subfusiforme*, l. c. p. 21, figs. 36–44), having a Norwegian distribution equally extensive with that of *S. Lofotense*, but attaining a greater depth, viz. from 50 to 300 fathoms. I noticed specimens among the fossils collected last year by Messrs. Crosskey and Robertson in a raised sea-bed at Barholmen, near Christiania. It occurred on the Unst ground, in 80–90 fathoms, and was apparently not rare. Mr. Peach detected a specimen in looking over some sand which I dredged there in 1864; this I at the time regarded as a *Ditrypa*. The margin of the posterior orifice has two slight indentations or notches, one on each side; and Sars's statement that the margin is entire was perhaps founded on imperfect specimens. *C. subfusiformis* may be known from *C. gadus* not only by its much smaller size, but also by having the greatest width or diameter in the middle (instead of in the upper or anterior part), and by the posterior or narrower part being abruptly curtailed. *C. gadus* is awl-shaped, and has a tapering extremity. *C. subfusiformis* is gibbous. Whether *C. gadus* inhabits our seas is questionable. Montagu says*, "This is a pelagic species, found in many parts of the British Channel, and is known to mariners by the name of 'hake's tooth,' who frequently find it within soundings, adhering to the log-line (as we are informed), but most likely to

* Test. Brit. i. p. 496.

the plumb-line." My specimens are from the collections of Dr. Turton and Mr. George Humphreys; the latter dealt almost exclusively in exotic shells. Rang placed *D. gadus* in his genus *Creseis*, among the Pteropoda; but Philippi rightly objected to such a classification, because the shells of all Pteropods are closed at the smaller end.

The sixth and last addition to our molluscan fauna is

Utriculus globosus, Lovén

(*Amphisphyra globosa*, Ind. Moll. Scand. p. 11). Two living specimens were dredged in St. Magnus Bay, with *Leda pernula* and *Siphonodentalium Lofotense*. Its original distribution extended from Finmark to Bohuslän in the south of Sweden; and through the kindness of the discoverer and Professor Lilljeborg I have been enabled to compare the Shetland specimens with those from the Scandinavian coasts. I mention this, because (before I was thus favoured, and when I had only Lovén's description to consult) I mistook this species for another, which I have lately described as *U. ventrosus*, from Skye.

2. *Geographical distribution*.—The accompanying list* of all the Mollusca hitherto observed in Shetland and the adjacent seas will serve to show the relations which exist between these and the Mollusca of the north and south of Europe. The number of Shetland species is 363, of which 315 inhabit the north and 245 the south of Europe. The total number of the British Mollusca, so far as I have yet worked out the subject, is 712. It may be remarked what a scanty proportion the land and freshwater Mollusca of Shetland bear to those of Great Britain, viz. 23 only out of 122. The marine species, however, are 338 out of 590—although the Zetlandic Nudibranchs and Cuttles have not been well examined, and, of the former, 28 only out of 110 have been as yet observed.

Some species are now for the first time recorded as Zetlandic, e. g. *Terebratella Spitzbergensis, Montacuta tumidula, Siphonodentalium Lofotense, Cadulus subfusiformis, Rissoa proxima, Odostomia clavula*, and *Utriculus globosus*. Other species, either rare or local, which I had previously dredged on the eastern and northern coasts, were found this year on the western coast also. Such are *Pecten Testæ, Lima Sarsii, L. elliptica, Leda pernula, Axinus ferruginosus, Isocardia cor, Tellina balaustina* (one living specimen being fully an inch in breadth), *Panopea plicata, Rissoa Jeffreysi, Aclis supranitida, A. Walleri, Odostomia minima, O. eximia, Eulima intermedia, Natica sordida, Aporrhaïs Macandreæ, Cerithiopsis costulata, Buccinum Humphreysianum, Colum-*

* This list will be published in the Reports of the British Association.

bella nuna, Pleurotoma brachystoma, Cylichna acuminata, Philine quadrata, and *P. nitida.*

3. *Habits of Animals.*—Species which were supposed to inhabit shallow water only were found living at considerable depths. In this category may be mentioned *Natica catena,* which was dredged alive in from 40 to 50 fathoms. Capt. Thomas informs me that he also dredged this species in the Orkneys living at the same depth. A dead specimen of *Stilifer Turtoni* was procured with *Natica catena.* Bathymetrical conditions are not of so much consequence to the Mollusca as a suitable habitation and a good feeding-ground. We had the good fortune of dredging in 170 fathoms—a greater depth than had been previously explored in the British seas. This was about forty miles N.N.W. of Unst. The ground was stony intermixed with patches of sand. The greatest depth recorded as having been dredged in our seas was 145 fathoms, by Admiral Beechey, off the Mull of Galloway. The following is a list of the Mollusca which I examined from our dredging in 170 fathoms :—

Living.—BRACHIOPODA : *Terebratula cranium,* young ; *T. caput-serpentis,* young ; *Crania anomala.* CONCHIFERA : *Anomia ephippium,* young ; *A. patelliformis,* var. *striata ; Lima subauriculata,* young ; *Leda pygmæa ; Montacuta substriata,* on *Spatangus meridionalis? ; Venus ovata ; Lucinopsis undata,* young ; *Saxicava rugosa.* SOLENOCONCHIA : *Dentalium entalis,* var. *anulata.* GASTROPODA : *Trochus occidentalis ; Eulima bilineata ; Natica Montacuti ; Trophon Barvicensis.*

Dead.—CONCHIFERA : *Pecten septemradiatus,* a fragment ; *P. tigrinus,* ditto ; *P. similis,* a single valve ; *Crenella decussata,* fragments ; *Nucula nucleus,* single valves ; *N. tenuis,* ditto ; *Leda minuta,* a single valve ; *Limopsis aurita,* small but fresh single valves; *Arca pectunculoïdes,* single valves ; *Lucina borealis,* perfect ; *Axinus Croulinensis,* single valves ; *Cardium fasciatum,* ditto ; *C. minimum,* ditto ; *Astarte sulcata,* ditto ; *Venus lincta,* ditto ; *Tellina balaustina,* a fragment ; *Psammobia Ferröensis,* ditto ; *Mactra solida,* var. *elliptica,* single valves ; *Scrobicularia prismatica,* a fragment ; *Thracia papyracea,* var. *villosiuscula,* young ; *Neæra cuspidata,* a fragment. GASTROPODA : *Tectura fulva,* var. *albula ; Propilidium ancyloïdes ; Emarginula fissura ; Trochus amabilis,* young ; *T. millegranus,* ditto ; *Turritella terebra,* var. *nivea ; Natica Alderi ; Trichotropis borealis ; Buccinopsis Dalei,* a fragment ; *Fusus gracilis,* young ; *F. propinquus,* ditto ; *Defrancia teres ; D. linearis,* var. *æqualis,* a fragment ; *Pleurotoma costata,* ditto ; *Cylichna alba,* ditto. PTEROPODA : *Spirialis retroversus ; Clio* or *Cleodora cuspidata,* a fragment.

Of these species sixteen were living, and thirty-eight dead—

in all, fifty-four. They comprised some rarities, viz. *Terebratula cranium, Limopsis aurita, Axinus Croulinensis, Trochus amabilis, Buccinopsis Dalei,* and *Cylichna alba.* The shells were of the usual colour; indeed this was brighter and darker in living specimens of *Venus ovata* and *Eulima bilineata* than in average examples of the same species taken in a few fathoms. The notion that colour is absent or fainter in shells from deep water seems to be quite unfounded.

4. *Geological Relations.*—Fossil shells (being relics of the glacial epoch) occurred in 170 fathoms and higher up to 80 fathoms. They were chiefly *Pecten Islandicus, Tellina calcaria, Mya truncata,* var. *Uddevallensis, Saxicava rugosa,* var. *Uddevallensis, Mölleria costulata,* and *Trochus cinereus.* All these species and varieties inhabit high northern latitudes, and none of them have been discovered living in our seas. No such fossils were detected on any part of the western coast of Shetland.

5. *Extraneous incidents.*—In the dredged stuff taken from a depth of about 85 fathoms, on a soft sandy bottom, twenty-five miles N.N.W. of Unst, I found the canine tooth of an animal of the weasel tribe; and Mr. Waller found the shoulder-blade of a much smaller quadruped. These occurred within a comparatively small space, although not together, and they were unaccompanied by any other land organisms. The socket of the tooth and the bone were corroded. It is possible that the tooth was that of a tame ferret, which was accidentally killed in 1862 and thrown into the sea at Balta, at a distance of about thirty-five miles from the place where the tooth was dredged. The tide sets with great rapidity in that direction; and when the carcase became distended by the gases evolved during putrefaction, it must have floated for some time. The bone is supposed by Mr. Boyd Dawkins to be that of a bat; this may have been eaten by a snowy owl, and disgorged or voided on its way back to the Faroe Isles or Iceland. I mention this curious circumstance to show that the bones of quadrupeds as well as of man may be preserved for a long time in "the slimy bottom of the deep," without being disturbed by the naturalist. When we consider the vast extent of the sea-bed, and the very trifling and unfrequent operations of the dredge (the one being measured by square nautical degrees, and the other by square yards), we ought not to be surprised that the remains of drowned mariners (at least their teeth) are not thus brought to light. Clarence's dream (the creation of a sublime poet) is never likely to be verified by modern research.

I have had much pleasure in presenting a collection of the rarer shells to our national Museum.

Subjoined are letters from Dr. Günther and Mr. Boyd Dawkins:—

"Dear Sir,

"The fishes collected by you by means of the dredge, at a depth of from 80 to 90 fathoms, at the Shetland Islands, belong to four species, all being new to the British fauna. Singularly enough, two belong to Mediterranean species—viz. a Dragonet, *Callionymus maculatus* (Bonap.) and a Sand-Launce, *Ammodytes siculus* (Swains.). The two others appear to be undescribed: one is a Rockling, distinguished by its very large eyes, for which I propose the name of *Motella macrophthalma*; the second a Goby, which I dedicate to its discoverer under the name of *Gobius Jeffreysi*. I will furnish you with descriptions of the two new species [see p. 290], and remain

"Yours very truly,

"*J. Gwyn Jeffreys, Esq., F.R.S.*" "A. Günther."

"Upminster, Romford, Essex.
"August 28, 1867.

"My dear Sir,

"I have carefully examined the remains found under such interesting circumstances. The tooth approaches nearer to the left lower canine of the ferret (*Putorius furo*) than to any other teeth in the Museum of the College of Surgeons. From so small a portion I can hardly infer the species of the animal; but if its possessor was not a Ferret, he was a Ferret's first cousin, one of the Mustelines, who died in the prime of life. The corrosion of the fang is very curious, and cannot be the result of the waste of the sea: it seems to be the result of the action of an acid, which has been prevented from attacking the crown by the crystalline structure of the enamel. Nearly all the gelatine has disappeared from the fang. Its age would be best arrived at by the character of the sea-bottom. If from a muddy deposit, probably it is of that age; if from a rocky bottom, its age is altogether uncertain. It is not more recent-looking than many of the Pleistocene bones I have dug out of caverns. The second fragment seems to be a portion of the scapula of a bat; but its condition does not allow of a very accurate determination. If the two were dredged up near each other, there is probably a deposit of bones at the spot whence they were obtained, similar to that of the east coast. Their discovery is of very great interest, and I am only sorry that I can add so little to their elucidation.

"I am, my dear Sir,

"Yours truly,

"*J. Gwyn Jeffreys, Esq.*
25 Devonshire Place." "W. Boyd Dawkins."

P.S. I may add that, before I left Shetland, Dr. Saxby kindly undertook, at my suggestion, to ascertain whether mammalian bones deposited in the sea would be corroded, and by what means.

XXXI.—*Notulæ Lichenologicæ.* No. XVII.

By the Rev. W. A. Leighton, B.A., F.L.S.

Dr. Nylander makes the following additions to the Lichens of Great Britain in the 'Flora,' April 26, July 17, and August 17, 1867:—

1. *Melaspilea amota,* Nyl.

Thallus macula albida indeterminata indicatus vel vix ullus distinctus; apothecia nigra, innata, rotundata vel rotundato-difformia (latit. 0·5 millim. vel parum amplius), margine proprio tenui inæquali; sporæ 4–8, incolores, 1-septatæ, medio constrictæ, longit. 0·016–0·022 millim., crassit. 0·007–0·010 millim.; paraphyses vix ullæ; thecæ confertæ; epithecium fuscescens vel fusco-luteum; hypothecium tenuiter et leviter vage obscuratum. Iodo gelatina hymenea vel thecæ dilute cærulescunt (qui color dein evanescit).

Killarney, Ireland (Mr. I. Carroll).

A *M. arthonioide* (*Sprengelii,* Ach.) mox paraphysibus deficientibus distat. Apothecia interdum epithecio fusco-rufescente in statu humido; sæpe circumscissa (h. e. fissura cincta).

2. *Arthonia ilicinella,* Nyl.

Similis *A. ilicinæ,* Tayl., sed sæpius minor, sporis sæpius minoribus (sed variant longitudine 0·021–0·036 millim., crassit. 0·008–0·012 millim.), et iodo gelatina hymenea vinose rubescente (nulla visibili cærulescentia).

Ad corticem *Ilicis* in Hibernia, Killarney, legit Carroll.

Sporæ 3–6-septatæ, plerumque bene evolutæ et majores 5-septatæ. Accedit versus *A. cinnabarinam.* In *A. ilicina* iodo gelatina hymenea cærulescit (cærulescentia persistente). Epithecium hydrate kalica sordide cærulescit.

3. *Verrucaria achroopora,* Nyl.

Thallus hypophlœodes, macula pallido-glaucescente indicatus; apothecia extus protuberantia thallode leviter convexiuscula (diam. 0·5 millim.) et ostiolo subincolore vel pallido punctiformi (diam. 0·05–0·07 millim.) non impresso indicata, conferta, perithecio immerso integre (sat tenuiter) nigro (diam. 0·4–0·5 millim.), sæpe depressiusculo; sporæ 8, fuscæ, 4-loculares, longit. 0·016–0·019 millim., crassit. 0·006–0·009 millim.

In Hibernia, Killarney, ad corticem legit Carroll.

Arcte accedit ad *Pyrenulam porinoidem,* Ach. Syn. p. 128, et vix est nisi ejus varietas ostiolis incoloribus vel pallidis (raro obscuris). Facies *Thelotrematis.*

4. *Verrucaria analeptoides*, Nyl.

Extus subsimilis *analeptæ*, sed revera forte sola varietas *V. antecellentis* Nyl. (in 'Flora' 1866, p. 86); sporis (1-septatis) longit. 0·036–0·050 millim., crassit. 0·009–0·010 millim. Variant sporæ septis (spuriis) 3–5. Paraphyses sæpe laxæ.

Hibernia, Killarney; legit Carroll, 1866.

5. *Verrucaria desistens*, Nyl.

Thallus vix ullus proprius; apothecia perithecio integro minuto (diam. 0·1 millim.), parte dimidia supera convexa prominula; sporæ 8, incolores, fusiformes, 3–5-septatæ, rectæ, longit. 0·011–0·016 millim., crassit. 0·003–0·004 millim.; paraphyses nullæ. Iodo gelatina hymenea vinose rubens.

In Hibernia, Killarney, ad corticem *Ilicis* legit Carroll (1866).

Prope *V. albissimam* locum habeat, sed recedit variis notis a stirpe *V. epidermidis*.

6. *Lecanora Hutchinsiæ*, Nyl.

Thallus pallido-cinerascens vel flavido-cinerascens tenuis, rimosus vel rimuloso-diffractus; apothecia rufo-testacea (latit. 0·5 millim.), convexa, biatorina; sporæ 8, incolores, fusiformes, 1-septatæ, longit. 0·010–0·012 millim., crassit. 0·0025–0·0035 millim., paraphyses crassulæ (crass. 0·0025–0·0035 millim.), nonnihil articulatæ, apice incrassato, incolore; hypothecium incolor. Iodo gelatina hymenea cærulescens (cum thecis, quæ apice intensius tinguntur).

Ad saxa in Hibernia (Miss Hutchins ex hb. Carroll.).

Facies *Lecideæ* cujusdam propinquæ *vernali*, sed theoretice *Lecanora*, nam spermogonia ut in stirpe *Lecanoræ subfuscæ*, ubi accedit ad *erysibem*. Sporæ tenues et paraphyses crassæ specimen distinguunt. Spermatia arcuata, longit. 0·020 millim., crassit. vix. 0·001 millim.

7. *Lecidea aphana*, Nyl.

Thallus griseus, tenuis, subverrucose vel subgranulose inæqualis, indeterminatus; apothecia nigra, parvula (latit. 0·2–0·4 millim.), convexula, immarginata, intus albicantia; sporæ 8, incolores, ellipsoideæ vel oblongæ, simplices, longit. 0·008–0·011 millim., crass. 0·0035–0·0045 millim., thalamium vage violaceo-fuscescens (epithecio vix obscuriore); paraphyses non discretæ; hypothecium incolor (vel interdum vage infra tenuiter violaceo-fuscescens). Iodo gelatina hymenea cærulescens.

In Hibernia, prope Kilkee com. Clare, ad saxa (Carroll, 1865).

Extus comparabilis cum *L. sylvicola,* a qua vero variis notis allatis differt.

8. *Lecidea mesotropa,* Nyl.

Thallus cinerascens, verrucoso areolatus, indeterminatus (mediocris crassitiei); apothecia fusco-nigra vel nigricantia, opaca, planiuscula, adnata (latit. 0·6–0·9 millim.), margine obtuso vel evanescente, intus albida; sporæ 8, ellipsoideæ, longit. 0·009–0·013 millim., crass. 0·005–0·006 millim.; paraphyses gracilescentes, vulgo non discretæ; epithecium fuscescens; hypothecium incolor.

In Scotia, Ben Lomond, ad saxa schistosa (Crombie).

Est quasi intermedia inter *L. lapicidam* et *lithophilam,* thallo fere illius, apotheciis fere hujus, nec forsan species propria. Apothecia sæpe faciei biatorinæ.

9. *Lecidea leiotea,* Nyl.

Thallus fuscus, tenuis, verniceus, lævis, determinatus, obsolete rimulosus; apothecia nigra, plana (diam. circiter 0·5 millim. vel minora), obtuse marginata vel margine non distincto, adnata; sporæ 8, incolores, ellipsoideæ, simplices, longit. 0·008–0·011 millim., crass. 0·006–0·007 millim.; paraphyses mediocres, apice fuscescente crassiores (et ibi vulgo aliquoties septato-articulatæ); hypothecium incolor. Iodo gelatina hymenea nonnihil cærulescens.

In Hibernia, Killarney, ad saxa basaltica (Carroll).

Forsan non sit status perfectissimus speciei, sed e loco pendens, thallo griseo-nigricante quasi "mucoso-gelatinoso," ut diceret Acharius.

Spermatia ellipsoideo-oblonga, longit. circiter 0·004 millim., crass. 0·0015 millim., sterigmatibus breviusculis simplicibus.

10. *Lecidea homalotropa,* Nyl.

Thallus albus, glaber, tenuissimus vel macula alba subdeterminata indicatus; apothecia nigra, fere mediocria (latit. circiter 0·5–0·6 millim.), plana, marginata; epithecio subrugoso; sporæ 8, incolores, cylindraceæ, multiseptatæ (septis plurimis et vulgo singulis inter se magis approximatis quam crassitie sporæ), long. 0·130–0·140 millim., crass. 0·0045–0·0050 millim.; paraphyses gracilescentes, nonnihil anastomosantes; epithecium obscuratum; hypothecium (sat tenue) nigricans. Iodo gelatina hymenea non tincta.

In Hibernia, inter Killarney et Kinmare, legit Dominus Carroll (Aprili 1867) ad corticem arboris.

Est species vicina *L. urceolatæ,* Ach., et differens præcipue apotheciis planis. Margo eorum sæpe inæqualis. Anne satius ambæ habeantur *Melaspileæ*?

11. *Verrucaria epigæoides*, Nyl.

Similis *V. epigææ*, sed minor et sporis 3-septatis (long. 0·018–0·027 millim., crass. 0·005–0·008 millim.).

In Hibernia, ad Moher comitatus Clare, supra terram (Carroll, 1865).

Macula thallina pallido-virescens. Perithecium immersum (latit. circiter 0·11 millim., altit. 0·25 millim.), supra nigrum, parte immersa fuscescente (in lamina tenui); paraphyses graciles. Vix sumi possit pro statu terrestri *V. chloroticæ*, nam obstant jam apothecia immersa et profunda perithecio alio.

12. *Verrucaria glabratula*, Nyl.

Subsimilis *V. achrooporæ*, sed lævior, ostiolis nigris, protuberantiis thalloideis minus distinctis, et interdum peritheciis supra subemersis. Sporæ long. 0·018–0·022 millim., crass. 0·006–0·008 millim.

Killarney, ad corticem (Carroll).

Forte status *V. glabratæ*, analoga ut *nitidella* est *nitidæ*; tum *achroopora*, Nyl. in 'Flora' 1867, p. 179, alium statum sistere possit *glabratæ*.

13. *Collema confertum* (Ach.).

Observetur *Collema turgidum*, var. *confertum*, Ach. L. U. p. 634, propriam sistere speciem.

Collema confertum (Ach.). Thallus nigricans, parvus, conferte turgide squamulosus, squamulis sæpe cyathoideis vel podetiiformibus, omnibus fere fertilibus; apothecia (singula in singulis squamulis vel lobulis thallinis superne urceolatis) subconcoloria, impressa, margine thallino tumido cincta; sporæ 8, ellipsoideæ vel fusiformi-ellipsoideæ, simplices, long. 0·017–0·023 millim., crass. 0·008–0·010 millim.; paraphyses gracilescentes. Iodo gelatina hymenea cærulescens (præsertimque thecæ ita tinctæ).

Supra terram in Anglia (Turner).

14. *Verrucaria capnodes*, Nyl.

Dici possit *V. rhyponta*, Borr., Leight., Mudd, fere ut species distinguenda a *V. rhyponta*, Ach.

15. *Verrucaria advenula*, Nyl.

Non differt a *V. rimosicola*, Leight. (quod nomen forte non est satis grammaticum).

16. *Lecidea Dufourei*, Ach.

Est nomen in herbariis variis obvium Lichenis, quem *Lecideam sabuletorum*, f. *simpliciorem*, dixi in Lich. Scand. p. 205. Nomen Acharianum restituendum.

Etiam in Gallia occurrit, in Vogesis (Mougeot); atque in Anglia (Leighton).

XXXII.—*On the* Menispermaceæ. By John Miers, F.R.S., F.L.S., &c.

[Concluded from p. 175.]

60. Desmonema.

This genus is proposed for a plant from Natal, with cordate, deltoidly orbicular, submembranaceous, glabrous, 5-nerved leaves, the nerves branching externally, the petiole being long and slender. It has an axillary inflorescence, with a somewhat slender rachis as long as, or longer than, the leaves, the whole plant so much resembling a species of *Tinospora* that it might easily be mistaken for one. The inflorescence is a simple raceme, its rachis being provided at short intervals with a subulate bracteole, half the length of the 1-flowered pedicel which emanates from the same point; the flower has six sepals, which are ovate, subacute, the three outer being alternate with and half the length of the three interior; six petals in two series, the outer ones subcuneately ovate, three-quarters of the length of the inner sepals, plane, the three inner ones a trifle shorter, linear, one-third their breadth, fuscous, subfleshy, longitudinally canaliculated; three monadelphous stamens as long as the outer petals, the filaments being united for three-quarters of their length into a central column, the upper extremities being free, nearly erect, supporting as many subglobular anthers, which are broader than them, 2-celled, the oval cells collateral, without intervening connective, each cell opening bivalvately by a somewhat lateral and subextrorse longitudinal furrow. *Desmonema*, in the feature of its three monadelphous stamens, resembles *Rhaptonema*, *Syrrhonema*, *Detandra*, and *Sarcopetalum*. It differs from the first in its subextrorse anthers, in the number and shape of its sepals, the kind of inflorescence, the form and venation of its leaves, and its very dissimilar habit. *Syrrhonema* differs from it in its introrse 4-lobed anthers, the want of petals, the greater number of its sepals, and in the character of its inflorescence. *Detandra* is distinct from it in its anther-cells, a far greater number of sepals, the character of its inflorescence, its peltate leaves, with another kind of venation. *Sarcopetalum* also differs in the number and form of its sepals, and in the globular shape of its larger fleshy petals.

DESMONEMA, nob.—*Flores* dioici. *Masc. Sepala* 6, biseriata, oblonga aut subovata, submembranacea, nervose picta, glabra, 3 interiora exterioribus 2-plo longiora et 3-plo latiora, æstivatione imbricata. *Petala* 6, biseriata, quorum 3 exteriora cuneato-ovata, submembranacea, plana aut subconcava, sepalis dimidio breviora, 3 interiora paululo breviora, 3-plo angustiora, linearia, erecta, fusco-carnosula, longitudinaliter canaliculata. *Stamina* 3, monadelpha, petalis æquilonga; *filamenta* longe ultra medium in columnam centralem coadunata, summo libera, complanata, suberecta; *antheræ* subglobosæ, conniventes, apicifixæ, 2-lobæ, lobis sulco laterali subextrorsum et bivalvatim dehiscentibus.

Frutex *scandens Africæ australis, habitu fere* Tinosporæ ; folia *deltoideo-orbicularia, cordata, obtusa, e basi* 5-*nervia, nervis extus ramosis, glabra, membranacea, longiuscule petiolata :* racemus ♂ *simplex, supra-axillaris, folio sublongior, glaber ;* rachis *gracilis, remotiuscule bracteolata ;* pedicellus *bracteola* 2-*plo longior,* 1-*florus ;* flos *parvus.*

The only species will be described in the third volume of the 'Contributions to Botany.'

Desmonema Caffra, nob.—In Africa australi: *v. s. in herb. Hook.* ♂, Natal (Gerard, 1976).

61. RHAPTONEMA.

The plant here described is a native of Madagascar, and the type of a new genus now proposed. It is a shrub of low growth, with straight, somewhat slender, tomentose branchlets, with oblong leaves having alternate nerves which anastomose everywhere with one another at short intervals, making thus a large areolar network of veins which gives them a very peculiar appearance; they are subpilose above, sulcate along the midrib, furnished beneath with a yellowish pubescence, the petiole being somewhat short and pubescent. The ♂ inflorescence is a racemelike panicle, which springs from the axils of the young upper leaves, and is therefore almost terminal; the somewhat slender rachis, which is covered with yellowish pubescence, is about half the length of the ordinary leaves, having rather distant, very short branches, with still shorter branchlets, which bear from one to three flowers at their apex; the flower is small, consisting of nine equal spathulately linear sepals, rounded at their apex, in three alternate series; six petals in two series, equal, rather more than half the length of the sepals, oblong, narrowing at each extremity, plane and glabrous; three stamens somewhat shorter than the petals, united for two-thirds of their length into a central column, leaving their extremities free, somewhat divaricated, broad, compressed, bearing two anther-cells at their apex inside, which are dorsally attached, collateral, separated by a narrow space, each opening introrsely by a longitudinal furrow.

The genus agrees with *Desmonema* in its three monadelphous stamens, but differs in their anthers being quite introrse, in having nine equal sepals, in its more compound raceme, in the very distinct character of its leaves, and a completely dissimilar habit. It differs also from other genera with three monadelphous stamens by the characters enumerated under *Desmonema*.

Rhaptonema, nob.—*Flores* dioici. *Masc. Sepala* 9, in ordine ternario alternatim disposita, spathulato-oblonga, æqualia, membranacea, extus pilosa, intus glabra, æstivatione imbricata, demum rotatim expansa. *Petala* 6, biseriata, oblonga, subacuta, sepalis fere tertio parte breviora, plana, submembranacea, glabra, nervo medio fusco signata. *Stamina* 3, monadelpha, petalorum longitudine; *filamenta* ultra medium in columnam centralem coalita, sursum libera, complanata, paulo divaricata; *antheræ* omnino introrsæ, dorso adnatæ, 2-lobæ, lobis ovatis, paulo dissitis, parallelis, sulco longitudinali dehiscentibus.

Suffrutex *Madagascariensis, subhumilis, ramosus;* ramuli *subtenues, tomentosi;* folia *oblonga, imo rotundata, apice obtusa, penninervia, nervis inter se ubique anastomosantibus, hinc grosse reticulatis, supra subpilosa, subtus pubescentia,* petiolo *tenui, subbrevi:* paniculis ♂ *racemosis, in axillis supremis solitariis, hinc fere terminalibus,* ramis *brevibus, alternatis,* flores 1–3 *brevissime pedicellatos gerentibus;* flos *parvus.*

The specific characters of this plant will be given in my 'Contributions to Botany.'

Rhaptonema cancellata, nob.—In Madagascar: *v.s. in herb. Hook. loc. cit.* (Gerard, 18).

62. Somphoxylon.

This genus was established by Dr. Eichler, in Martius's 'Flora Brasiliensis,' upon a scandent plant from Dutch Guiana; but its characters are not all fully known. One of its peculiarities, which suggested its generic name, is that its wood is extremely soft and spongiose. Its leaves are rather large, 6–9 inches long, 4–7½ inches broad, on a petiole 4 inches long, somewhat penninerved and glabrous. The ♂ inflorescence is a widely spreading panicle, 2 feet long, 1½ foot broad, with its branches horizontally patent and gradually decreasing upwards; these are again and again divided, by branchlets standing at right angles with each other, all elongated, the last series being very slender, 1–1½ inch long, furnished at close bracteolated intervals with three or four fasciculated minute flowers on very short pedicels. The habit of the plant is therefore very peculiar. The flower consists of six concave ovate sepals in two series, the outer being very briefly connate at base, the inner equal, alternate, and free; six fleshy petals somewhat shorter, obovate, in two series, the inner plane, the outer ones alternate, with their lateral margins inflected; three monadelphous stamens, whose filaments are united for three-quarters of their length into a central column, their apices free, each bearing two separated anther-lobes, adnate by their side and back to the filament, and bursting somewhat extrorsely by a longitudinal furrow. It will be seen that *Elissarrhena* and *Sciadotenia*, both from Guiana, have leaves similar in size and shape to those of *Somphoxylon*, and have also soft-wooded fistulose branches, thus offering a general resemblance; but the very expanded and peculiar inflorescence of the latter and the structure of its flower remove all further analogy. There is no evidence in the character of the plant that can indicate the tribe to which the genus belongs.

SOMPHOXYLON, Eichler;—*Flores* dioici. *Masc. Sepala* 6, biserialia, alterna, concava, glabra, quorum 3 exteriora ovato-lanceolata, dimidio breviora, inter se basi breviter connata, 3 interiora late obovata. *Petala* 6, biseriata, sepalis dimidio breviora, obovato-elliptica, carnosula, 3 interiora plana, 3 exteriora alterna, lateribus inflexis. *Stamina* 3, monadelpha; *filamenta* crassiuscula, pro majore parte in columnam centralem coalita; *antheræ* majusculæ, ad dorsum et latera filamenti adnatæ, 2-lobæ, lobis subglobosis, dissitis, singulis sulco longitudinali subextrorsum dehiscentibus.

Frutex *Guianæ Batavianæ glaberrimus,* ligno *mollissimo subspongioso;* folia *majuscula, oblonga, imo leviter vel subcordata, apice repente cuspidata, penninervia, concoloria, petiolata:* panicula ♂ *magna, late ramosa, bracteolata,* ramis *longis patentim divaricatis, sursum decrescentibus, iterum bis patentim expansis,* ramulis *tertiariis longiusculis, gracilibus, axillulis approximatis,* flores 3–4 *brevissime pedicellatos gerentibus;* flores *minimi, glabri.*

The characters of the only species will be given in the third volume of my 'Contributions.'

Somphoxylon Wellschlægelii, Eichl. in Mart. Fl. Bras. xxxviii.

p. 206, et quoad inflorescentiam in tab. 37. fig. 4.—In Surinamo, ad Paramaribo.

63. Disciphania.

This is another genus of Dr. Eichler's, described in Martius's 'Flora Brasiliensis,' the type being a plant from the river Amazonas, which bears a very strong resemblance to a *Jateorhiza*. It is a climbing plant, strigosely pilose in every part, with somewhat ovate leaves, deeply cordate, leaving a broad sinus between two rounded basal lobes, and divided at its summit into three almost parallel lanceolate-oblong segments; they are 5–7-nerved at base, on a petiole three-fourths of the length of the blade. It has one or two supra-axillary racemes with a slender rachis as long as the petiole, very pilose, spicated, with many alternate, approximated sessile flowers; each flower rises out of a small pilose bract, is glabrous, depressed-globose or subtrigonous in the bud; it has six equal sepals in two series, which are subequal, elliptic, and membranaceous; six equal petals, much shorter than the sepals, the three exterior twice the breadth of the three inner ones, all extremely thick and fleshy, closely compacted and depressed into a subtrigonoid form, leaving a hollow in the centre for the stamens, which thus appear sunk within a fleshy disk, nearly as in *Anomospermum*: in the centre are three free stamens, with almost obsolete filaments, each having a broad fleshy connective bearing two oval separated anther-cells dorsally adnate upon it, and each bursting introrsely by a longitudinal furrow. The position of the genus is yet quite uncertain. Dr. Eichler places it near *Tinospora*, probably on account of the resemblance of its leaves to those of *Jateorhiza*: it differs from it and all the genera of the *Heteroclineæ* in having only three stamens; in the monadelphous character of the stamens it resembles *Chasmanthera*, *Parabæna*, and *Odontocarya*, belonging to that tribe, which have six united filaments; while in its three monadelphous stamens it approaches *Sarcopetalum*, *Detandra*, *Syrrhonema*, *Rhaptonema*, *Desmonema*, and *Somphoxylon*.

Disciphania, Eichl.—*Flores* dioici. *Masc. Sepala* 6, biserialia, subæqualia, elliptica, membranacea, glabra. *Petala* 6, multo breviora, biseriata, 3 interiora paulo angustiora, omnia crassissime carnosa, valde depressa, compacta, et discum trigonoideum mentientia. *Stamina* 3, centralia, libera; *filamenta* brevissima, fere obsoleta, in connectivum latum carnosum expansa; *antheræ* 2-lobæ, lobis segregatis, ovatis, dorso semiimmersis, singulis rima longitudinali introrsum dehiscentibus. Frutex *Brasiliæ septentrionalis scandens, undique strigoso-pilosus;* folia *subovata, profunde cordata, apice inciso-trilobata, lobis* *lanceolato-oblongis, e basi 5-nervia, petiolo limbo breviore:* racemus ♂ *axillaris, valde hirsutus, petiolo longior;* flores *in axillulis bracteolatis approximatis, sessiles, pro ordine majusculi, glabri.*

The only species will be described in the third volume of the 'Contributions to Botany.'

Disciphania lobata, Eichl. *loc. cit.* p. 169, tab. 36. fig. 1;—Cocculus lobatus, *Mart. Obs. MSS.* n. 2803.—In Brasilia, prov. Amazonica.

63. Quinio.

This genus was proposed by Schlechtendal in the 'Linnæa' for 1853, for an Indian plant received from Hohenhacker, respecting which much doubt has existed; it was referred by the former botanist to the *Menispermaceæ;* but, as its floral parts are pentamerous, it has been rejected from the order by most authorities. Notwithstanding this decision, I entertain no doubt that it is a truly Menispermaceous plant; and, before explaining the reasons for this opinion, I will recapitulate its characters as recorded by Schlechtendal. It is entirely glabrous, its branches sulcately striated and black; its leaves alternate, transversely suborbicular, cordate at base, retuse and mucronated at the summit, 5-nerved, the nerves branching externally, glaucous beneath, 2 inches long, 2½ inches broad, on a petiole 4 inches long, which is swollen at base and articulated upon the stem, almost palately geniculated with the limb at the junction of the nerves. It has a very elongated racemose panicle, with a black rachis 10 or 12 inches long, with alternate spreading branches 2½ inches long, bearing at their summit several branchlets, often so much approximated as to appear almost umbelliform, each bearing from one to three flowers obsoletely pedicellated: the glabrous flower consists of five imbricated, obovate, concave sepals, which are maculated in interrupted longitudinal lines; it has five petals somewhat shorter and narrower than them, spathulately rhomboid, with their lateral margins lobulated and inflexed; five stamens opposite to and somewhat longer than them, and affixed to their claws, bearing on their apex two minute effete anther-cells, slightly divaricated at base; in the centre are three distinct ovaries, ovate, very gibbous, each containing a single ovule, and surmounted by a short style with a very thick dilated stigma.

It will readily be seen that all these minutely detailed characters agree precisely with those of *Diploclisia inclyta,* except the number of sepals, petals, and stamens, which here are five, instead of six. It may be inferred, therefore, that Schlectendal, when drawing up his diagnosis, was misled by examining a flower in which one of these organs, which are very caducous, had fallen away; and this seems clearly proved by the following circumstances. Schlectendal states that Hohenhacker's plant, on which he founded his genus, came from the province of Canara, on the south-western coast of the Indian peninsula. Now in the Hookerian herbarium I found a plant of Hohenhacker's from Mangalore, in Canara, which I carefully examined and ascertained that its flowers are hexamerous, agreeing in every character with other specimens of *Diploclisia inclyta*: it is also a ♀ plant, according with Schlectendal's description not only in the size and form of the leaves, but in the length of the inflorescence, the distance and length of its primary branches, its almost umbellate branchlets, the markings of the sepals, and the shape of the petals and sterile stamens. It appears to me that there is not the slightest doubt of their absolute identity; and I therefore think that the genus should be suppressed, and that *Quinio cocculus*, Schl., should stand as a synonym of *Diploclisia inclyta*.

XXXIII.—*Revision of the Group of Lepidopterous Insects hitherto included in the Genus* Pronophila *of Westwood.* By A. G. Butler, F.Z.S.

I have recently had occasion to rearrange the species of butterflies included in *Pronophila*; and, being struck with their great variety of form and different style of colouring, I have made a careful examination of all their structural details: the result of my investigations has been to reveal great differences of form in the cell of the front wings, and of position with regard to the emission of the subcostal and discoidal nerves; the palpi also differ slightly in form, length, and position.

The type of the genus *Pronophila* is *P. Thelebe* of Westwood and Hewitson. This group, represented by only five species, one of which is as yet undescribed, may now stand as follows:—

Genus 1. Pronophila, Westwood (part.), 1851.

Typical Species, *Pronophila Thelebe.*

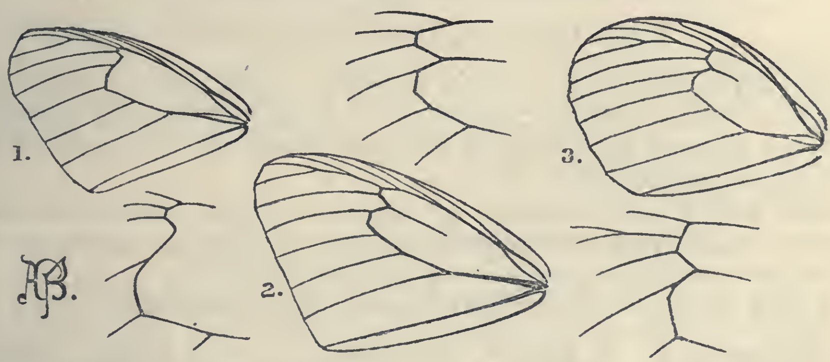
Gen. Alis magnis, repandis: anticis subintegris, margine externo paulum undato: posticis margine undulato.

Alis anticis cella obtuse bifurcata, furca inferiore subquadrata, longiore; furca superiore conica, venas secundam et tertiam subcostales et primam discoidalem ferente; venis his omnibus ad origines confertim approximantibus.

Caput palpis mediocribus præporrectis.

Species:—1. *P. Thelebe,* Westwood & Hewitson; 2. *P. Orcus,* Latreille; 3. *P. Porsenna,* Hewits.; 4. Sp. nov. (Venezuela); 5. *P. Cordillera,* Westw.

These species all agree in structure, stature, form, and general coloration: they are closely allied to the genus *Corades.*



1. Neuration of *Pedaliodes.* 2. Neuration of *Oxeoschistus.*
3. „ *Gyrocheilus.*

Genus 2. PEDALIODES (πηδαλιώδης), gen. nov.

Typical species, *Pedaliodes Poesia.*

Gen. Alis mediocribus: anticis plus minusve irregularibus, apice plerumque subfalcato: posticis margine sinuato.

Alis anticis cella ad apicem claviformi-undulata; venarum tertia solum subcostali et prima discoidali ad origines approximantibus.

Caput palpis brevioribus angulariter undatis.

Species:—1. *P. Poesia,* Hewitson; 2. *P. Proerna,* Hewits.; 3. *P. Pisonia,* Hewits.; 4. *P.? dejecta,* Bates; 5. *P. Perperna,* Hewits.; 6. *P. Phanias,* Hewits.; 7. *P. Paneis,* Hewits.; 8. *P. Polusca,* Hewits.; 9. *P. Pausia,* Hewits.; 10. *P. Piletha,* Hewits.; 11. *P. Prytanis,* Hewits.; 12. *P. phœnissa,* Hewits.; 13. *P. Physcoa,* Hewits.; 14. *P. porina,* Hewits.; 15. *P. Peucestas,* Hewits.; 16. *P. Pallantis,* Hewits.; 17. *P. Pylas,* Hewits.; 18. *P. Plotina,* Hewits.; 19. *P. Parepa,* Hewits.; 20. *P. Phila,* Hewits.; 21. *P. phæa,* Hewits.; 22. *P. peruda,* Hewits.; 23. *P. Panyasis,* Hewits.; 24. *P. Napæa,* Bates.

Genus 3. GYROCHEILUS (γυρὸς χεῖλος), gen. nov.

Typical species, *Gyrocheilus Patrobas.*

Gen. Alis mediocribus: anticis subpiriformibus, apice rotundato, margine externo subintegro: posticis margine externo dentato.

Alis anticis cella breviore, alarum medium solum attingente; venis regularibus bene separatis, discocellularibus angulariter positis, furcas duas formantibus; furca superiore breviore venas secundam et tertiam subcostales primamque discoidalem ferente.

Caput oculis subnudis, palpis elongatis cirratis subrectis.

Species:—1. *G. Patrobas,* Hewitson.

Genus 4. Oxeoschistus (ὀξέως σχιστὸς), gen. nov.

Typical Species, *Oxeoschistus Puerta.*

Gen. Alis majoribus: anticis elongatis, subfalcatis; costa subrecta, margine externo plus minusve undato et minime sinuato: posticis margine externo bene undulato, rarius ad venam secundam medianam subproducto.

Alis anticis cella elongata, ad apicem bifurcata; furca inferiore majore, angularibus tribus arcuata; furca superiore acuminata venas secundam subcostalem et primam discoidalem ferente.

Caput oculis cirratis, palpis elongatis undatis porrectis.

Species:—1. *O. Puerta,* Hewitson; 2. *O.? hilara,* Bates; 3. *O. protogenia,* Hewits.; 4. *O. pronax,* Hewits.; 5. *O. propylea,* Hewits.; 6. *O. Prochyta,* Hewits.; 7. *O. irmina,* Hewits. & Westw.; 8. *O.? tauropolis,* Hewits. & Westw.

Genus 5. Lasiophila, Felder (1859).

Typical species, *Lasiophila Zapatoza.*

This genus has already been characterized: it is chiefly remarkable for the long palpi and tailed hind wings of all the species; there are also differences in the character of the markings upon the wings.

Species:—1. *L. Cirta,* Felder; 2. *L. Præneste,* Hewits.*; 3. *L. Zapatoza,* Westw.; 4. *L. Circe,* Feld.; 5. Sp. nov. (Bolivia); 6. *L. Prosymna,* ♀, Hewits.

Genus 6. Dædalma (part.), Hewitson (1858).

Typical species, *Dædalma Dinias.*

Section 2. Alis posticis costa integra, rarius caudatis.

Species:—1. *D. Phoronea,* Hewits.; 2. *D. Phaselis,* Hewits.

The *Dædalma drymæa* of Hewitson may, very likely, come into this section.

* Our specimens of *Cirta* and *Præneste* are all males.

XXXIV.—*On two new Birds from Eastern Australia.* By JOHN GOULD, F.R.S.

To the Editors of the Annals and Magazine of Natural History.

26 Charlotte Street, Bedford Square, W.C.
Sept. 13, 1867.

GENTLEMEN,

Will you do me the favour to insert in your next Number the following descriptions of two birds from Eastern Australia, which I believe to be new to science, and oblige

Yours very faithfully,
JOHN GOULD.

Cuculus (*Cacomantis*) *castaneiventris.*

Chin, ear-coverts, crown, and upper surface deep purplish grey; all the under surface, including the under tail-coverts, bright chestnut-red; wings brown, glossed with olive; upper tail-coverts and tail deep greyish purple; all the feathers tipped and the lateral ones toothed on their inner web with white, which assumes on the two outer ones the appearance of interrupted bars; bill purplish black; legs and feet orange; nails black.

Total length $9\frac{1}{2}$ inches; bill $\frac{7}{8}$, wing $4\frac{1}{4}$, tail 5, tarsi $\frac{3}{4}$.

Hab. The Cape-York district of Queensland, Eastern Australia.

Remark. This bird is much smaller than *Cacomantis flabelliformis*, and, moreover, has much shorter wings, but assimilates very closely to that species in form and contour; it differs, however, not only from that and every other Australian cuckoo, but from all others I have yet seen from the islands to the northward; it is closely allied to a species inhabiting the Philippine Islands which I take to be the *Cacomantis sepulchralis* of Bonaparte, and more distantly to the *Cacomantis bronzina* of G. R. Gray.

Ptilotis notata.

Crown and all the upper surface greenish olive; lores, a line beneath the eye, and the anterior portion of the ear-coverts brownish black; from the angle of the mouth a pale-yellow stripe; posterior part of the ear-coverts pale yellow, assuming the form of a nearly round spot; under surface pale greyish olive, obscurely streaked with pale grey down the throat and breast; bill black, with a thick fleshy yellow gape; legs bluish.

Total length $6\frac{1}{4}$ inches; bill $1\frac{1}{16}$, wing $3\frac{3}{8}$, tail $2\frac{7}{8}$, tarsi $\frac{7}{8}$.

Habitat. The Cape-York district of Queensland, Eastern Australia.

Remark. This species is allied, on the one hand, to the large *Ptilotis chrysotis*, and, on the other, to the small *P. gracilis*; its most remarkable feature, when compared with those birds, is its long and stout bill, which is both longer and stouter than that of the former species; in all its other admeasurements it is considerably smaller, while they much exceed those of the *P. gracilis*. It is also closely allied to, but quite distinct from, the *P. similis* of the Aru Islands. Gilbert collected this bird at Brown's Lagoon, on the 20th of December, 1844, when travelling with Leichardt from Moreton Bay to Port Essington; and I have lately received specimens through Mr. Jardine from the Cape-York district of Queensland.

XXXV.—*Synopsis of the Asiatic Squirrels* (Sciuridæ) *in the Collection of the British Museum, describing one new Genus and some new Species.* By Dr. J. E. Gray, F.R.S., V.P.Z.S., &c.

The Squirrels form a very natural group. The species are very difficult to distinguish, on account of the general similarity that exists between them, and the variation that the specimens of the same kind present. The species appear to have a comparatively limited range, and therefore are most easily divided into geographical series.

The North-American species have been well studied and described by Dr. Spencer Baird, in his work on the North-American Mammalia.

The species of Asia and, especially, of South and Tropical America are very imperfectly known.

I have been studying the Asiatic specimens in the British Museum, many of which are the types of the species described by Horsfield, Hodgson, Blyth, Kelaart, Sykes, Elliot, Solomon Müller, and myself; and I have attempted to arrange them into groups, so as to bring together the species most nearly allied, and to enable the student easily to distinguish them. A synopsis of the species of Africa and America will follow. In these synopses I have confined myself to the study of specimens in the Museum Collection, which have been most carefully compared together.

The section Sciurinæ of Sciuridæ is separated from the Arctomyinæ by the small size of the upper front molar, or by its absence (for it is often early deciduous), and by the broad rounded form of the inner edge of the grinders. It may be thus divided:—

I. *Without any cheek-pouches. Fur soft, consisting of fusiform hairs and a soft under-fur. Ears ovate.* Arboreal. Tree-Squirrels.

A. *The limbs free, without any parachute.*

i. *The front edge of the cutting-teeth broad, rounded, closely longitudinally grooved.*

1. RHEITHROSCIURUS. Ears large, long, pencilled; head large, short; tail broad, clavate.

ii. *The front edge of the cutting-teeth narrow, compressed, smooth.*

2. SCIURUS. Ears ovate, pencilled or tufted externally; nose rounded; tail longer than the body.

3. MACROXUS. Ears ovate, covered with short adpressed hairs; nose short, blunt; cheek-pouch none; tail longer than the body.

4. RHINOSCIURUS. Ears ovate, covered with short adpressed hairs; nose acute, produced; cheek-pouch none; tail longer than the body.

B. *The limbs enclosed in skin, forming a parachute; tail short, broad, pennate; front edge of cutting-teeth smooth.*

5. SCIUROPTERUS. Ears ovate, covered with short adpressed hairs. Europe, Asia, and America.

II. *Without any cheek-pouches. Fur short, rigid, with flat channelled spines, without any under-fur. Ears rounded, scarcely raised.* Terrestrial. Ground-Squirrels.

6. XERUS. Ears narrow, short, mostly raised above the head; face short, blunt; cheek-pouches none; fur short, rigid. Africa.

III. *With distinct cheek-pouches. Fur soft, consisting of fusiform hairs and a soft under-fur. Ears ovate.* Fossorial. Burrowing Squirrels.

7. TAMIAS. Ears ovate, covered with short adpressed hairs; face short, rounded; cheek-pouches distinct. Europe, North Asia, and America.

I. *Without any cheek-pouches. Fur soft, consisting of fusiform hairs and a soft under-fur. Ears ovate.* Arboreal. Tree-Squirrels.

A. *The limbs free, without any parachute.*

i. *The front edge of the cutting-teeth broad, rounded, closely longitudinally grooved.*

1. RHEITHROSCIURUS, nov. gen.

Head large, compressed, short; ears large, with a pencil of elongated hairs at the tip; cutting-teeth broad, rounded in front and closely longitudinally grooved. The limbs free; feet large, strong. Tail as long as the body and head, very thick, clavate, covered with long flaccid hairs.

The grooving of the teeth is a peculiarity not observed in any other Sciuridæ.

Rheithrosciurus macrotis.

Sciurus macrotis, Gray, P. Z. S. 1856, p. 341, t. 46.

Brown, very minutely punctulated; throat and beneath white; lateral streaks broad, yellowish; front of thighs bay. Tail blackish, whitish-washed.

Hab. Sarawak (Wallace). Type in B.M.

II. *The front edge of the cutting-teeth narrow, compressed, smooth.*

2. Sciurus.

Head moderate, short, rounded; ears ovate, covered externally with elongated hairs forming a tuft or pencil; front edge of the cutting-teeth narrow, compressed, smooth. Limbs free. Tail as long as or longer than the body, covered with long hair spreading on the sides.

I. *The ears with a tuft of elongated rigid hairs forming a transverse pencil.* No. 1.
II. *The ears with rather rigid hairs forming a fringe and slight pencil.* Nos. 2–4.
III. *The ears with a puff or tuft of soft hairs on the outer surface.* Nos. 5–9.

I. *Ears with a tuft of long hairs forming a pencil; tail broad, as long as the body; medium-sized.*

1. *Sciurus calotus.*

Mustela? calotus, or *Chuakhal*, Hodgson, Calcutta J. N. H. ii. 221, t. 9.
Mustela calotis, Hodgson.
Sciurus europæus, var. Gray, List. Hodgs. Coll. 23.

Fur very soft, black-grey, beneath white; tuft of ears and tail darker.

Hab. North China, Thibet (Mr. Hodgson's type), Siberia. B.M.

This may be the same as the Grey Squirrel of Northern Europe; but it is smaller and the fur softer than any *S. vulgaris* I have seen.

II. *The ears covered externally with elongated hairs forming a fringe and slight pencil; medium-sized.*

2. *Sciurus leucomus*, Sol. Müller, Verh. N. B. 10.

Dark grey, grizzled with black and white; beneath reddish grey, white half collar on the back of the neck. Tail as long as the body, hairs with two or three broad black and yellow rings; end of the nose yellowish.

Hab. Celebes. B.M.

3. *Sciurus leucocephalus.*

Dark blackish grey, varied with white tips to the hairs; head, ears, throat, underside of body, outer and inner sides of limbs, and underside of the tail white or yellowish white. Tail as long as the body and head, with black, largely white-tipped hairs; ears fringed with elongate hairs.

Hab. Asia? B.M. (a male).

See also *Sciurus erythræus,* Pallas, not Swinhoe, which is a *Macroxus.*

4. *Sciurus historicus.*

Sciurus syriacus, Verreaux, Cat., not Ehrenb.

Fur elongate, soft, full, blackish grey, closely and minutely punctulated with white; head, neck, and shoulders with a reddish tint; chin, throat, underside of the body, fore legs, and fore feet rufous. Tail as long as the body, blackish, reddish-grey-varied, with broad reddish edges and tip, hairs rufous, with a broad subterminal black band and reddish tip; ears with longish rigid hairs, forming a fringe and slight pencil.

Hab. Syria (Verreaux). B.M.

Differs from *Sciurus syriacus* of Ehrenberg and Tristram in the pencilled ears, the darkness and length of the fur, the dark colour of the shoulders, and the red being confined to the sides of the belly and not extending up the sides of the body.

III. *Ears with a puff of soft hairs on the outer surface.*

* *Tail elongate, longer than the body and head; large-sized.* Ratufa.

5. *Sciurus indicus.*

Sciurus maximus, Schreb. Säugeth. t. 217; Horsf. Zool. Java, t. = *Great Squirrel,* Shaw.
Sc. indicus, Erxl., 1777.
Sc. bombayus, Bodd.=*Bombay Squirrel,* Penn., 1785.
Sc. purpureus, Zimm.

Fur red brown; thighs, loins, rump, and tail black; cheeks and occipital band fulvous.

Hab. India, Malabar. B.M.

Var. *Elphinstonii.*

Sc. Elphinstonii, Sykes, P. Z. S. 1831, p. 103.

Hab. Dukhun (Sykes). B.M.

Varies greatly in the intensity of the colour.

*** Tail moderate, as long as the body and head; fur grizzled; middle-sized.*

6. *Sciurus lokrioides.*

Sciurus lokrioides, Hodgson, J. A. S. B. 1836, p. 223; Horsf. P. Z. S. 1839, p. 152.

Sciurus assamensis, M'Clelland, MS.; Gray, List Mamm. B. M. p. 143 (1842).

Fur pale grey, closely and minutely punctulated with yellow; chin, throat and beneath pale grey; front of thighs like back. Tail coloured like back, upper end with indistinct annulations, tip blackish; hairs pale, with three black bands and a pale tip.

Hab. India, Assam (Gray): type in B.M. Darjeeling (Hodgson): type in B.M.

The hair of the ears soft.

7. *Sciurus modestus.*

S. modestus, S. Müller, Verh. Mam. t. 14.

Blackish olive, very closely and minutely punctulated with yellow; head and sides of neck rather more rufous; chin, throat, belly, and inside of limbs pale reddish. Tail black and and yellow, punctulated, obscurely ringed; hairs yellow, with broad black subterminal ring, and with a well-marked yellow tip.

Hab. Sumatra (Müller's type in B.M.).

**** Tail moderate, as long as the body and head; face with a longitudinal streak; small-sized.*

8. *Sciurus Macclellandii,* Gray, P. Z. S. 1839, p. 152.

Sciurus trilineatus, Gray, B.M. 1828 (not Waterhouse).

Sciurus Barleei, Blyth, J. A. S. B. xvi. 878, t. 36. f. 3 (1847).

Fur soft, yellowish grey, with a black vertebral streak; orbit, streak from end of nose, under the eye and ear, along the side of the back, yellowish; a small tuft of soft hair behind the ear white; chin and underside of body pale reddish grey.

Hab. Bhotan: type in B.M. Nepal (Hodgson, n. 33): B.M. Formosa (Swinhoe): B.M.

9. *Sciurus melanotis.*

Sciurus melanotis, S. Müller, Verh. t. 15. f. 4, 5, 6.

S. nanus, Wallace, B.M.

S. soricinus, Waterh. Cat. Zool. Soc. Mus. Suppl. ed. 2. no. 448.

Fur pale grey, soft; chin, middle of throat, chest, belly, and inside of limbs reddish; streak from nose, under the eye to side of neck pale reddish, edged above with black; ears covered with soft black hairs. Tail dark grey, washed with whitish; hairs yellow, with a broad subterminal band and white tip. A very small species.

Hab. Borneo (Müller's type in B.M.). Sarawak (Wallace's type in B.M.) New Guinea: B.M.

3. Macroxus.

Head moderate, short; nose rounded; ears ovate, covered with short adpressed hairs; front edge of the cutting-teeth compressed, smooth. Limbs free. Tail as long as or longer than the body and head, covered with long spreading hair.

M. F. Cuvier, in the 'Dents de Mammifères' and in his paper on the skulls of Sciuridæ in the Memoirs of the Museum, proposed a genus under the name of *Macroxus* for *Sciurus vittatus* of Asia and *Sciurus æstuans* of Tropical America. It is very indistinctly characterized; and Lesson has referred to the genus sundry species having little relation to each other. As it is desirable to separate the squirrels with simple ears, I have adopted the name, and defined it as above. It is a natural group, containing many Asiatic, African, and American species.

The Asiatic *Macroxi* may be thus divided:—

I. *Large size. Tail much longer than the body and head.* Nos. 1–3.
II. *Medium size. Back with black longitudinal stripes.* No. 4.
III. *Medium size. Sides of the body with a black longitudinal streak.* No. 5.
IV. *Medium size. Sides of the body with a pale or white longitudinal streak.* Nos. 6–13.
V. *Medium size. Sides of the back with two pale streaks; lower broad, diffuse.* No. 14.
VI. *Small size. Back with three or five white or pale longitudinal stripes.* Nos. 15–18.
VII. *Medium or small size. Back grizzled, without either dorsal or lateral stripes.* Nos. 19–38.

I. *Large size. Tail much longer than body and head.* Rukaia.

1. *Macroxus macrourus.*

Sciurus zeylanicus, Rai. Syn. Quad. 265.
S. macrourus, Forster in Pennant, Ind. Zool. t. 1.
S. macrurus, Fischer.
S. ceylonensis, Bodd.
?*S. madagascariensis*, Shaw, Fischer.

Fur harsh; black, more or less grizzled with white; face, fore and hind legs, and spots on nape white; tail sometimes apparently imperfectly annulated.

Hab. Ceylon. B.M.

Var. End of tail white. *Sciurus macrourus*, Blyth, J.A.S.B. xvi. t. 36. f. 2. Ceylon.

Var. larger? *Sciurus Tennantii*, Kelaart, J. A. S. B. xviii. 600; Blyth, J. A. S. B. xvi. 13 (1851).
Hab. Ceylon, in the mountains.

2. *Macroxus bicolor.*

Sciurus bicolor, Sparrm.; Horsf. Java, t.; Kuhl.
Sc. javensis, Schreb. t. 216; Shaw.
Sc. macrouroides, Hodgson.
Sc. giganteus, M'Clelland.
?*Sc. abessinicus*, Gmelin.

Black; belly yellow or white; legs black, front of legs whitish. Fur harsh.

Var. *a*. Pale; belly white.

Sc. albiceps, Geoff., Desm.
Sc. Leschenaultii, Desm.
Sc. Desmarestii, Fischer.
Sc. hypoleucus, Horsf.
Sc. humeralis, Coulson.
?*Sc. affinis*, Raffles.
Sc. ochraceus, Temm.

Var. *b*. Fur white; belly pale yellow.

Sc. aureiventer, I. Geoff. Mag. Zool. 1832, t. 5; Gervais, Mag. Zool. 1842, t. 4. f. 1–4.

Hab. India, Nepal (Hodgson): B.M. Java, Sumatra: B.M. Malay peninsula: B.M.

Fur rather harsh; hairs generally of one colour, of the nape and tail sometimes pale-tipped. Black; chin, under surface and inside of limbs yellow or white, varying from black to blackish brown or grey brown and whitish grey. The legs and feet in the black specimens are black, with more or less of white hairs on their front. The head of one dark specimen is whitish.

3. *Macroxus ephippium.*

Sciurus ephippium, S. Müller, Verh. t.

Fur rather short, soft, very variable in colour, from black minutely grizzled to pale reddish brown; the throat, cheeks, and feet red or yellow.

Hab. Borneo: B.M. Celebes (Verreaux): B.M.

II. *Medium size. Back with three black longitudinal streaks; fur grizzled olive and yellow; chin and beneath yellowish; tail as long as the body.* Laria.

4. *Macroxus insignis.*

Sciurus insignis, Horsf. Z. Java, t.; Gervais, Mag. Zool. 1842, t. 32. f. 5 (skull).
Sc. trivirgatus, Franks.

Sides reddish; tail dark, whitish-washed; hairs of three colours—yellow, black, and grey at the tip.

Hab. Sumatra: B.M. Java.

III. *Medium size. Lower part of the sides of the body with a black* *longitudinal stripe; tail elongate, end black; fur grizzled; chin and beneath red.*

5. *Macroxus Phayrei.*

Sciurus Phayrei, Blyth, J. A. S. B. 1858, p. 476; Peters, P. Z. S. 1866, p. 429.

Fur olive, minutely and closely punctulated with yellow; chin and beneath red or reddish yellow, the two colours separated by a black lateral streak; tail annulated, with a black tip; feet white or yellow.

Var. Shoulders and fore legs darker.

Hab. Malabar (Blyth, type in B.M.). India. Borneo.

IV. *Medium size. Sides of the body with a pale or white longitudinal stripe.*

a. *The lateral stripe broad, produced over the shoulders and thighs; fur black or blackish, minutely punctulated; tail black, rather longer than body and head; chin, inside of limbs, and beneath dark red bay.* Callosciurus.

6. *Macroxus Rafflesii.*

Sciurus Rafflesii, Vigors & Horsfield, Zool. Journ. t.
Sc. Prevostii, Lesson (tail discoloured), Schlegel, Nederl. Tijdsch. i. t. 1. f. 1.

Black; beneath red bay; cheeks, shoulders, sides, and fringe of the thighs white.

Hab. Malay Islands. B.M., type.

Var. *Bangkanus.* Cheeks and shoulders iron-grey.

Sc. Prevostii Bangkanus, Schlegel, *l. c.* t. 1. f. 2.

Hab. Malay Islands. B.M.

See also *Sc. borneonensis*, Schlegel, *l. c.* t. 1. f. 3. Like the former, but the cheeks black, sides of the body and outside of the thighs dark iron-grey. Borneo. Mus. Leyden.

7. *Macroxus sarawakensis.*

Black; lower part of cheek, sides of neck, shoulders, fore and hind legs bright rufous, like the under parts of the body; narrow lateral streak and outer side of thighs yellowish white; black on back narrow between the shoulders and haunches; tail black, slightly greyish-washed.

Hab. Sarawak (Wallace). B.M.

8. *Macroxus rufogularis.*

Sciurus rufogularis, Gray, Ann. & Mag. Nat. Hist. 1842, x. 363.

Lateral streak and thighs white; tail black; throat, shoulders, and feet red; face black.

Hab. China. Type in B.M.

Var. *redimitus.*

Sc. redimitus, Boon Mesch.?, Blyth.

Shoulders red; outer side of thighs iron-grey; tail white-washed.

Hab. Borneo.

b. *The pale lateral streak on side of body with a black streak beneath it; fur black, blackish, or olive; beneath red; tail as long as body and head.*

9. *Macroxus rufoniger.*

Sciurus rufoniger, Gray, Ann. & Mag. Nat. Hist. 1842.

Cheeks, shoulders, legs, feet, and tail black; beneath red; lateral streak narrow, interrupted; thighs grey, mottled externally.

Hab. ——. B.M.

10. *Macroxus atrocapillus.*

Sciurus atrocapilla, Schlegel, *l. c.* t. 2. f. 1.
Sc. Schwaneri, B.M.

Back iron-grey, minutely punctulated with white; crown of head, lower lateral streak, feet, and tail black; throat, chest, belly, and inner side of limbs red; upper lateral line white, well marked.

Hab. Borneo. B.M.

See also *Sc. Schlegelii* (with cheeks red), *Sc. erythrogenys,* Schlegel, *l. c.* t. 2. f. 3 (1863), not Waterhouse.

11. *Macroxus vittatus.*

Sciurus vittatus, Raffles.
Sc. bivittatus, Desm., Horsf. Z. J. t.
Macroxus toupai, Lesson.
Sc. pygerythrus, I. Geoff. Voy. Belanger.
Sc. flavimanus, I. Geoff. Mag. Zool. 1832.
Macroxus bivittatus, F. Cuv. D. M.

Fur olive, black-and-yellow-punctulated; sides with a pale-yellow and black lateral streak; chest and beneath red.

Hab. Ceylon: B.M. Java: B.M. Cochin China: B.M. Malacca: B.M.

12. *Macroxus nigrovittatus.*

Sciurus nigrovittatus, Horsf. Z. Java.
Sc. griseiventer, I. Geoff. Mag. Zool. 1832; Coulson, Mém. Neufch. i. t. 10.

Fur olive, minutely black-and-yellow-punctulated; sides with a linear pale and a broad black streak beneath; chin and underside dark black grey; sides of face and throat and front of shoulders rufous; tail black, obscurely ringed, with a black tip.

Hab. Malacca: B.M. Java: B.M.

c. *The pale lateral streak with a streak of the same colour as the back beneath it; fur olive, punctulated; tail elongate, as long as the body and head; hairs pale-ringed.* Baginia.

13. *Macroxus platani.*

Sciurus platani, Lingb., Desm., Horsf. Z. J. t.
Sc. notatus, Bodd.
Sc. bilineatus, Geoff.
Macroxus bivittatus, Lesson.

Hab. India? Java, Sumatra. B.M.

V. *Medium size. Back with two white or pale longitudinal streaks on each side; fur grizzled olive and yellow; tail as long as the body, hair yellow, with a black sublinear ring.*

14. *Macroxus Berdmorii.*

Sciurus Berdmorii, Blyth, J. A. S. B. 1832, p. 334.
Sc. Mouhotii, Gray, P. Z. S. 1861, p. 137.

Fur grizzled; sides blackish; the lower streak broad, indistinctly marked, upper one narrow, distinct; chin and underside of body white; tail blackish, base of hairs yellow. The first upper grinder nearly as large as the second one.

Hab. Cambogia (Mouhot): B.M. Tenasserim (Blyth): B.M.

VI. *Medium or small size. Back with three (or five) pale longitudinal streaks; fur grizzled, punctulated; tail as long as the body.* Palmista.

Palmiste, F. Cuv. Mém. Mus. x. 121, t. 10. f. 2.
Farunculus, Lesson, Ill. Zool.
Tamias, sp., Gervais, Mag. Zool. 1842.

15. *Macroxus palmarum.*

Sciurus palmarum, Horsf. Z. J.; Waterh. P. Z. S. 1834, p. 118.
Palmiste, Buff. H. N. x. t. 26.

Sides and beneath whitish grey; back blackish olive, minutely punctulated, with three elongated, distinct, pale longitudinal streaks, the side ones wider in the centre, central one linear elongate.

Hab. India: B.M. Ceylon (Kelaart): B.M.

Var. *a. Kelaartii.* Fur uniform, shining; the stripe and undersurface in the adult male are reddish white.

"*S. Kelaartii*, Layard, Ceylon" (Kelaart, in B.M.).

16. *Macroxus penicillatus.*

Sciurus penicillatus, Leach, Zool. Misc. vi. t. 1.
Sc. tristriatus, Waterh. P. Z. S.; Mag. N. H. 1837, p. 496; 1839, p. 114.
Sc. trilineatus, Kelaart, P. Z. S. 1850, p. 157.
Sc. palmarum, Elliot, Madras Journ. 1839, p. 218.
Sc. Brodiei, Layard, Ann. & Mag. N. H. 1852, ix. 335. "Blyth," Kelaart, B.M.

Back and sides dark olive, minutely punctulated; chin, chest, and belly white; head reddish-washed; middle of the back often black, with three narrow linear pale stripes; lateral stripes widest, linear. Larger and darker, with narrower stripes than the former.

Hab. Madras (Leach & Elliot, type in B.M.). India, Ceylon (Lord Walden, Kelaart).

17. *Macroxus Layardii.*

Sciurus Layardii, Kelaart, in B.M.

Fur blackish, very minutely punctulated with white; middle of the back black, with three longitudinal linear streaks; the vertebral one the widest, orange-red; the side ones very narrow, linear, white; chin, chest, and underside red; tail black, obscurely annulated with white, and with a black tip.

Hab. Ceylon (Lord Walden). B.M.

Sent from Ceylon as *Sc. Barleei*; but the lateral streak is not continued under the eyes.

18. *Macroxus sublineatus.*

Sciurus sublineatus, Waterh. P. Z. S. 1838, p. 19.
Sc. Delessertii, Gervais, Mag. Zool. 1842, t. i. f. 1–3 (t. 2. f. 1, 4, skull).

Dark olive, very minutely punctulated; back blackish, with three indistinct narrow, linear, white streaks; chin and beneath reddish grey; tail blackish, slightly yellow-varied.

Hab. India, Nilgherries. Ceylon (Lord Walden). Waterhouse and Delessert's type in B.M.

VII. *Medium size or small. Back grizzled, without any dorsal or lateral longitudinal stripes.*

a. *Chest and belly grey or white.* Nos. 19–24.

b. *Chest grey; belly red.* Nos. 25, 26.

c. *Chest and belly dark red brown.*
  Tail black (rarely red). Nos. 27–30.
  Tail indistinctly ringed, with black tip. No. 31.
  Tail dark grizzled, end white. No. 32.

d. *Chest and belly reddish yellow.*
  Tail not annulated, end black. No. 33.
  Tail blackish, punctulated, whitish-washed. No. 34.
  Tail reddish, short. No. 35.

e. *Fur above and below red brown.* Nos. 36, 37.
f. *Fur above and below white.* No. 38.

a. *Chest and belly grey or white; fur grey, punctulated; tail as long as body and head, annulated. Middle size or small.*

19. *Macroxus caniceps.*

Sc. caniceps, Gray, Ann. & Mag. N. H. 1842, p. 212.

Sc. chrysonotus, Blyth, J. A. S. B. 1847, p. 873, 1855, p. 474; Peters, P. Z. S. 1866, p. 429.

Fur olive-grey, very minutely punctulated; back varied with red; inner side of limbs, nose, throat, and beneath pale, nearly uniform whitish grey; feet pale grey; tail as long as the body and head, grey-and-black varied, with a black tip; hairs of tail yellowish, with three equal black bands. Middle size.

Hab. Bhotan: B.M. India (Beavan): B.M.

Var. 1. Back and nape yellow brown; loins grey. (*Sc. caniceps*, Gray; type, *S. chrysonotus*, Blyth, J. A. S. B. t. 37. f. 2.)

Var. 2. Back and loins red brown. India (Beavan). B.M.

Var. 3. Fur grey, grizzled with a few roundish, irregularly placed reddish spots on the middle of the back. India (Bevan). B.M.

20. *Macroxus similis.*

Sciurus lokrioides (part.), Hodgson's Collection.

Fur blackish grey, very closely and minutely punctulated; outer side of thighs reddish-washed; chin, chest, belly, and inner side of limbs greyish white; the front edge of the thighs pale rufous; tail blackish, indistinctly black-ringed, end black; hairs yellow, with two black rings and a long black tip.

Hab. Nepal (Hodgson). B.M.

Very like *Sciurus lokrioides*, but darker, and the front of the thighs pale rufous, their outer side washed with rufous, and the hair on the hinder part of the belly sometimes also has a rufous tinge, and the ears are covered with short hairs.

21. *Macroxus philippinensis.*

Sciurus philippinensis, Waterhouse, Proc. Zool. Soc. 1839, p. 117.

Fur blackish brown, minutely punctulated with yellow; hair elongate; chin, chest, underside of body, and inner side of limbs white; tail blackish, slightly yellow-varied, end black; hairs with two black and four yellow bands.

Hab. Philippine Islands (Cuming; Waterhouse, type, from spirit, bad state). B.M.

22. *Macroxus tenuis.*

Sciurus tenuis, Horsf. Zool. Java, t.

Fur olive, very minutely black-and-yellow punctulated; chin, inner side of legs, and beneath white or greyish; tail black, yellow-varied, black at the tip; hairs of tail yellow, with an indistinct subbasal and very broad subapical black band. Small size.

Hab. Java (Horsfield): B.M., type. Sarawak (Wallace): B.M. Singapore: B.M.

23. *Macroxus chinensis.*

Sciurus chinensis, Gray, L. M. B. M. 144.

Fur dark olive, minutely punctulated with yellow; chin, throat, belly, and inner side of limbs greyish white; tail elongate, black, with long white tips to the hairs; tip blackish; hairs pale brown at the lower half, with a broad black band and a grey tip.

Hab. China (John Reeves). B.M., type.

Var. Head and shoulders paler yellow; tail dull brown, with grey tips to the hairs. China. B.M.

See also *Sciurus exilis,* S. Müller, Verh. t. 15. f. 4, 5, 6. Sumatra, Borneo.

24. *Macroxus inornatus.*

Fur olive-grey, very closely and minutely punctulated with reddish yellow; throat, inner side of limbs, and beneath pale bluish grey, washed with whitish; feet like back; tail longer than the body and head, coloured like the back, with elongated white-tipped black hairs at the tip; hairs of the tail yellow, with three black bands. Middle size.

Hab. Loo Mountains (Mouhot). B.M.

b. *Chest grey, punctulated like the back; belly reddish yellow; tail indistinctly white-ringed.*

25. *Macroxus griseopectus.*

Sciurus griseopectus, Blyth, J. A. S. B. xxvi. 873, t. 36.
Sc. Fortuni, Parzudaki, MS.

Fur dark olive grey, closely and minutely yellow-punctulated; throat and chest grey, like back, but paler; belly, inner side of limbs, and front of thighs pale red brown; face black; tail like back, obscurely white-ringed, end black; hairs pale, with black rings and a grey tip.

Hab. China (Cuming). Type in B.M.

26. *Macroxus leucopus.*

Fur olive grey, minutely punctulated with yellow; lower side of neck like back; hinder part of throat and belly, front of thighs and hind legs reddish grey; feet white; tail elongate, coloured like the back, grey, and black-ringed at the tip; hairs grey, with several subequal broad black rings. Middle size.

Hab. Cambogia (Mouhot). B.M., male adult.

See also *Sciurus persicus,* Gmelin, Reise, iii. 379, t. 45. *Sc. vulgaris persicus,* Erxl., Gilan, in Persia. ? *Sc. anomalus,* Güldenst. in Schreb. Säugeth. 781, t. 215 c. *Sc. caucasicus,* Schm. *Sc. erythræus,* Penn., Georgia (not Kuhl). *Hab.* Caucasus.

c. *Chest and belly dark red brown. Middle-size Squirrels.*

† *Tail black, rarely red.*

27. *Macroxus Pluto.*

Fur, feet, and tail deep black; chest, belly, and a narrow well-defined line down the inner side of the legs bright red bay.

Hab. Borneo, Sarawak. B.M.

See *S. erythromelas,* Schlegel, *l. c.* t. 2. f. 2, but with the edges of the fore legs and the hind feet red; and *S. piceus,* Peters, P. Z. S. 1866, p. 429.

28. *Macroxus rufogaster.*

Sciurus rufogaster, Gray, Mag. Nat. Hist. 1842.

Fur minutely punctulated; back yellow-washed; head, shoulders, and thighs iron-grey (grizzled).

Hab. Malacca. B.M., type.

Var. *Borneensis.*

S. hippuris, I. Geoff. Mag. Zool. t.

Nape, back, rump, and hinder edge of fore legs bright red chestnut, like underside.

Hab. Borneo (Blyth). B.M.

29. *Macroxus punctatissimus.*

Fur soft, black, very minutely and closely punctulated with grey; tail and feet black; throat, chest, belly, and inner side of limbs bright red chestnut.

Hab. India. B.M.

30. *Macroxus erythrogaster.*

Sciurus erythrogaster, Blyth, J. A. S. B. xii. 972, xxiv. 473.
Sc. erythræus, Gray, List M. B. M.; Swinhoe, P. Z. S. 1862, p. 357 (not Pallas).

Fur dark olive, minutely punctulated with yellow; back yellowish-washed; throat, chest, belly, and inner side of limbs red chestnut; tail like back; hairs indistinctly pale-ringed.

Hab. Bhotan. B.M., type.

Var. 1. Tail yellow-washed. Formosa (Swinhoe, type). B.M.
Var. 2. Tail, hinder half, red bay, like belly. Assam. B.M.

See also *Sciurus rubriventer,* Müller, Verh. 10.

†† *Tail dark, indistinctly white-ringed; end blackish.*

31. *Macroxus castaneoventris.*

Sciurus castaneoventris, Gray, Ann. & Mag. Nat. Hist. 1842.

Fur dark olive grey, minutely punctulated; chest, throat, and belly red-brown; tail broad, coloured like back, indistinctly white-ringed, end black; hairs black, with one or two narrow yellow basal rings and grey tips.

Hab. China (Reeves). B.M.

††† *Tail dark-grizzled; end white.*

32. *Macroxus atrodorsalis.*

Sciurus atrodorsalis, Gray, Ann. & Mag. N. H. 1842, p. 213; Blyth, J. A. S. B. t. 37. f. 2; Peters, P. Z. S. 1866, p. 428.
Sc. hyperythrus, Blyth.

Fur grey, minutely punctulated; back with a large black patch; tail coloured like back at the base, hinder half whitish, with black rings; hairs black, with long grey tips; face reddish; throat, chest, belly, and inner side of limbs dark chestnut-red.

Var. Throat more or less grey. India, Benares. B.M.

Hab. India (Blyth). Type in B.M.

d. *Chest and belly reddish yellow.*

* *Tail elongate, as long as the body and head, with numerous narrow black rings and a black tip.*

33. *Macroxus Blanfordii.*

Sciurus Blanfordii, Blyth, J. A. S. B. 1862, p. 333.

Fur olive grey, punctulated with black and grey; throat, inner side of limbs, and feet rufous; tail with numerous narrow black rings and a well-marked black tip.

Hab. India, Pegu and Upper Burmah (Blanford, Blyth). Types in B.M.

** *Tail as long as the body, varied, whitish-washed; end blackish.*

34. *Macroxus lokriah.*

Sciurus lokriah, Hodgson, J. A. S. B. 1836, p. 223; Horsf. P. Z. S. 1841.
Sc. subflaviventer, M'Clelland, MS.; Gray, List Mam. B. M. 144 (1842).
Sc. anomalus, Kuhl, Beitr. 69? not Güldenst.

Fur dark olive, grizzled, closely and minutely yellow-punctulated; chin, throat, middle of chest, and abdomen pale red yellow; tail black, washed with whitish, and with a bluish tip; hairs yellow, with an evident lower and a broader subapical band and a grey tip; the underside of the tail with an orange central streak from the orange base of the hairs, and a couple of bluish marginal bands when expanded.

The extent of the red beneath varies; in some it occupies the whole under surface, in others only the centre of the chest and belly.

Hab. India, Nepal (Hodgson). Type in B.M.

See *Sciurus pygerythrus*, I. Geoff. Mag. Zool. 1832, with underside of body and vent and the base of the tail red. It may be the same as the former, if the second account of the *outer* side of the limbs is a slip of the pen for the *inner* side.

*** *Tail short, only as long as the body, reddish.*

35. *Macroxus syriacus.*

Sciurus syriacus, Ehrenb. & Hemp. S. P. t. 8 ; Tristram, P. Z. S.
Sc. russata, Wagner, *fide* Verreaux : Schreb. S. iii. 155.

Fur pale iron-grey (black, very closely varied with white) ; sides of the head and neck, the shoulders, fore legs, sides of the body, front edge of the thighs, and the fore feet red ; chin, throat, chest, belly, and inner side of the limbs pale reddish yellow ; tail rufous, slightly grey-varied, with a greyish edge ; hairs rufous, with a more or less wide subterminal black band, and grey tips.

Hab. Syria, Lebanon, under the cedars (Tristram) : B.M. Brussa (Verreaux) : B.M.

Var. *pallescens.* Paler iron-grey ; sides of head, shoulders, fore legs, and the fore feet pale yellowish ; chin and underside of body and inner side of limbs white.

Sciurus syriacus, Verreaux.

Hab. Asiatic Turkey ("Asie Turque," Verreaux).

This animal, according to Ehrenberg and Hemprich, changes its colour according to the season, being ashy in summer and foxy in winter. The animal, by the shortness of its tail and in general appearance, much resembles a *Spermophilus* ; but the skull has the broad teeth and the high erect zygomatic arch of the squirrel. The skull is also without the first upper grinder. They are tree-squirrels, and abundant in the forests of Brussa and on the cedars of Lebanon.

e. *Fur uniform red brown, or red punctulated with black and white. Tail elongate, longer than the body and head, rather slender, red. Middle size.* Erythrosciurus.

36. *Macroxus ferrugineus.*

Sciurus ferrugineus, F. Cuv. Mam. Lith. ; Blyth, 1847, 1862.
Sc. splendidus, Gray, P. Z. S. 1861, p. 137.
Sc. ruberrimus, Blyth, M. Z. Soc.

Fur uniform, red bay, varying from dark chestnut to yellowish, sometimes paler on the sides and beneath.

Hab. Cambogia (Mouhot) : B.M. Arakan and Pegu (Blyth).

Var. *Keraudrenii.* Very dark bay; tail-end white.

Sc. Keraudreni, Reyn., Lesson, Cent. Zool. t. 3.
Sc. Kerodreni, Schinz.

37. *Macroxus siamensis.*

Sciurus siamensis, Gray, P. Z. S. 1859, p. 478; 1861, p. 137 (Blyth).

Small. Fur reddish bay, minutely punctulated with black; chest, belly, and beneath uniform red bay; tail elongated, longer than the body and head, slender, tapering, grizzled black and orange, apical half bright red bay.

Hab. Siam (Mouhot). B.M., type.

This may be an undeveloped state of the former.

f. *Fur white, uniform above and below; tail slender, elongate.*

38. *Macroxus Finlaysonii.*

Sciurus Finlaysonii, Horsf. Zool. Java, t.
Fair Squirrell, Pennant, Syn. 285.

Fur white, whiskers and a few hairs on the tail black.

Hab. Sichung Island (Horsfield): type in B.M. Guzerat (Penn).

4. Rhinosciurus, Gray, List Mamm. B. M. 195 (1843).

Head moderately elongate; nose produced, acute. Ears ovate, covered with short close-pressed hairs. Cutting-teeth compressed, smooth in front. Cheek-pouches none. Limbs free. Tail as long as the body, pennate; hair rather long, expanded. Skull, jaws much produced, narrow, compressed, lower cutting-teeth very long.

Rhinosciurus tupaoides, Gray, *l. c.* 195.

Sciurus tupaoides, Blyth, J. A. S. B. 1855, xxiv. 477.

Dark olive-grey, minutely punctulated; tail blackish, punctulated.

Hab. Singapore. Type in B.M.

See also *Rh. laticaudatus* (*Sciurus laticaudatus,* S. Müller, Verh. t. 15. f. 1, 2, 3). Borneo.

XXXVI.—*On a new Genus of Phalanger.* By FREDERICK M'COY, Professor of Natural Science in the Melbourne University, and Director of the National Museum of Victoria.

[Plate VI.]

GYMNOBELIDEUS (M'Coy), nov. gen.

Teeth and general form of *Belideus*, but destitute of the lateral cloak-like parachute or flank-membrane, and having on the fore feet the inner finger or thumb shortest, the second longer, the third longer than the second, the fourth longest, the fifth or outer toe shorter than the third, but longer than the second. On the hind feet the inner toe or thumb is succeeded by two of nearly equal size, more slender and shorter than the others, and united together as far as the base of the last joint. The thumbs of the hind feet are without nails, and the claws of all the other toes are small, and exceeded in length by the prominent wrinkled pads on the underside. The ears are large, semielliptical, and nearly naked towards the tips. Dental formula:—incisors $\frac{3}{1}$, canines $\frac{1}{0}$, premolars $\frac{3}{4}$, molars $\frac{4}{4}=40$.

In general appearance this curious animal is intermediate between *Belideus* and *Phascogale*; but its nearest affinity is with the former, from which the absence of the flank-membrane and the different form of the feet distinguish it. There is only one species known, which occurs in the scrub on the banks of the Bass River, in Victoria. I name it after the skilful taxidermist of our Public Museum, in which specimens of both sexes are preserved.

Gymnobelideus Leadbeateri (M'Coy).

Upper surface brownish grey, with a blackish dusky streak from the top of the head along the back to the sacrum; there is a dark patch under the base of the ear, and a fainter one before and behind the eye. Under surface dull yellowish; tail rather lighter than the back, and lightest at the tip. Head like that of *Belideus breviceps*, but with a slightly sharper snout. The tail has the fur no longer on the basal half than on the back, the apical third of the length being gradually more bushy, from the greater length of the hair. Ears brown. The fur of the body is soft and dense, the hairs grey at the base, and blackish and tipped with brownish white at the end; the fur of the tail is brownish throughout. Teeth: anterior incisor above more than twice the length of the others, and rather broader near the edge than at the base; second incisor shorter than the third, which is triangular; space between third incisor and canine equal to length of second incisor; canine conical, shorter than the first, but longer than the third incisor; space between canine and next premolar one-third the width of the canine; second premolar half the length of the canine, first a little longer, both triangular and single-rooted; third premolar as long as the canine, or one-third longer than the next molar, double-rooted, and triangular. First three molars quadrate, with two blunt tubercles on outer and two on inner edge; fourth or last molar smallest, triangular, with one tubercle behind and two in front. The molars and second and third premolars are in continuous contact. Lower jaw: all the teeth in continuous series without interval; incisors long, nearly horizontal, sharp-pointed; first three premolars small, short, and obtuse, the antero-posterior extent of the first greatest, third least, but all of one height; fourth premolar twice the height of the others, triangular, with a slight lobe at back of base; first molar with anterior half forming a conical lobe nearly twice the height of the last premolar and of the rest of the molars; posterior half bitubercular, and only as high as the others, which are all quadritubercular, except the small hind one, which is tritubercular.

	inches.	lines.
Length of head	1	8
" from snout to base of tail	5	4
" of tail	6	5
" of ear	0	9
" of fore foot	0	9
" of hind foot	1	0½
" of nasal bones	0	6½
" of frontal bones	0	7

EXPLANATION OF PLATE VI.

Fig. 1 represents the male, half the natural size.
Figs. 2, Fore foot, and 3, hind foot, twice the natural size.
Figs. 4, Upper, and 5, lower jaw, three times the natural size.

XXXVII.—*Additions to the British Fauna.* By Dr. Albert Günther, F.R.S.

[Plate V.]

Although we are very well acquainted with the marine fishes inhabiting the shores of Great Britain and Ireland, our knowledge of the pelagic and deep-sea forms is extremely scanty. Of the Dealfish (*Trachypterus arcticus*), a fish by no means uncommon in the northern and eastern seas of Scotland, I have never seen a British example in a good state of preservation. Now and then, after the gales of the vernal equinox, a mutilated specimen of the Ribbonfish (*Regalecus Banksii*) is drifted ashore, rarely to fall into the hands of a naturalist, generally to be cut up as bait for the lobster-pot. The British species of *Leptocephalus* is not better known than the allied forms from the Mediterranean and tropical seas. Others, like *Centrolophus*, are known from single examples only. Their development, as well as that of many of the more common forms which spawn in the open or deep sea, is perfectly unknown.

In seeking information concerning this part of the British fauna, we are not hunting after a shadow: there is evidence enough to show that the depths of the British seas are inhabited by a fish-fauna very different from that of the coasts, and that this fauna is composed of two elements—first, of those which may be regarded as indigenous, and, secondly, of such forms as are frequently, perhaps constantly, carried by currents from more southern parts of the Atlantic northwards, even to the coasts of Norway (*Antennarius, Batrachus, Beryx*)—not to mention those fishes which by their strong power of swimming are enabled to reach our shores in their migrations, as *Ausonia*.

The causes of our incomplete knowledge of these fishes are evident: zoologists were either not aware of the existence of such a fauna, or satisfied with the stray specimens thrown in their way by accident; while the difficulties surrounding the examination of the deep-sea fishes are so great as to render all progress in attaining to a knowledge of them extremely slow. Still it may be hoped that, after the attention of naturalists has been directed to the subject, no opportunity will be lost of advancing it.

Such an opportunity occurred to Mr. J. Gwyn Jeffreys, who, during his exploration of the marine invertebrate fauna of the Hebrides, preserved the specimens of fishes which were brought up in the dredge from a depth of from 80 to 90 fathoms. Small as the number of specimens is, the result of their examination proved to be most interesting and satisfactory, inasmuch as they belong to four species new to the British fauna, two being new to science, viz. *Ammodytes siculus* (Swains.), *Motella macrophthalma* (sp. n.), *Callionymus maculatus* (Bonap.), and *Gobius Jeffreysii* (sp. n.). On former occasions I have pointed out that the geographical range of deep-sea fishes appears to be extended in proportion to the vertical depth inhabited by them, and that they are either distinguished by an increased size of the eye to collect as many rays of light as possible, or by a rudimentary condition of that organ, as is the case in fishes inhabiting caves. This is in some measure verified by the species collected by Mr. Jeffreys, which, however, it must be remembered, inhabit a much less depth than *Regalecus, Plagyodus*, &c. Two of them (*Callionymus maculatus* and *Ammodytes siculus*) were previously known as occurring in the Mediterranean; and the eyes of three of them are conspicuously larger than in their congeners (*Ammodytes lancea, Callionymus lyra,* and *Motella tricirrata*).

1. *Ammodytes siculus* (Swains.).

(Smooth Sand-Launce.)

This species was hitherto known from Sicily only. For description see Günth. Fish. iv. p. 386.

2. *Motella macrophthalma.* Pl. V. fig. B.

(Large-eyed Rockling.)

This species has three barbels, one at each of the anterior nostrils and one at the chin. It is distinguished from specimens of the same size of the other three-bearded species by its large eye, the diameter of which, in the specimen obtained, is as long as the snout, one-fourth of the length of the head, and much longer than the width of the interorbital space. The teeth of the mandible are very unequal in size, some being canine-like. The anterior ray of the rudimentary first dorsal fin is about as long as the eye. D. 55. A. 55. Back with narrow brownish cross bars.

Three inches long.

The figure represents the specimen of the natural size. For the sake of comparison the figure of the head of *Motella tricirrata* (B′) has been added.

3. *Callionymus maculatus,* Bonap. Pl. V. fig. A.

(The Southern Dragonet.)

This species is common in the Mediterranean; but it has been also observed on the coast of Norway. It is easily recognized by the shortness of the snout relatively to the diameter of the eye.

4. *Gobius Jeffreysii.* Pl. V. fig. C.

D. 6 | 10. A. 9. L. lat. 30.

Body as deep as broad anteriorly, its greatest depth being one-half of the length of the head, which is two-sevenths of the total (without caudal). Head depressed, broader than high, its greatest width being two-thirds of its length. Snout of moderate extent, though shorter than the eye; lower jaw projecting beyond the upper. Eyes very close together, large, their diameter being two-sevenths of the length of the head. Dorsal fins higher than the body; the second dorsal spine more or less prolonged. The pectoral and ventral fins reach equally far backwards, to the vent. A series of five rounded blackish spots along the lateral line, the last being on the root of the caudal fin. Dorsal fins with series of black spots; outer half of the anal blackish. A blackish bar below the eye.

Three specimens, two inches long.

The only British species with which this Goby might be confounded, and to which it is evidently allied, is *Gobius rhodopterus* (Gthr.); however, this latter species is said to have the interorbital space broader, its width being equal to one-half of the diameter of the eye (Cuv. & Val. xii. p. 50); and M'Coy, who examined two Irish examples, describes the snout as "very short, tumid, and convex," which character cannot be applied to *G. Jeffreysii.*

XXXVIII.—*On the Systematic Value of Rhynchophorous Coleoptera.* By John L. Leconte, M.D.*

In the empirical arrangement of the families of Coleoptera, which has resulted from the adoption of the tarsal system of division, the families contained in the great natural group of Heteromera are followed by the Curculionidæ and Scolytidæ, which, more or less subdivided into smaller families, have been supposed to establish a linear relation between the rostrated Heteromera (*Salpingus, Rhinosimus,* &c.) and the Cerambycidæ and Chrysomelidæ, the great types of the Pseudotetramera or Subpentamera of various authors.

It is the object of the present investigation to determine the limits and the relations of the first-mentioned of these types, the Rhynchophora.

The inferiority of this type is manifested not only in the larval condition by the limited number or absence of visual lenses, the want of locomotive appendages, the feeble development or entire want of antennæ, and the unchitinized epidermis, but also by the combination in the imago of characters belonging to a perfectly developed organism with others pertaining to an inferior grade in the scale of Coleoptera.

Thus, for instance, while we perceive, in the other series of beetles, that the lower forms retain certain larval characters (as evidenced by the extension of the coxæ, the imperfection of the anterior coxal cavities, the softness of the integuments, and the want of centralization in the abdomen), all such degradational characters are absent in the Rhynchophora.

Other characters representing low grades in their respective series do not appear in the Rhynchophora—such as vegetative growth of the organs of sense, indicated by pectinate or flabellate antennæ, or excessive length of palpi.

On the contrary, we find in the Rhynchophora that the in-

* From 'Silliman's Journal' for July 1867, being an abstract of a memoir read before the National Academy of Sciences at Washington, Jan. 24, 1867.

teguments are perfectly chitinized, the elytra never abbreviated or wanting; the anterior coxæ are always completely enclosed; the ventral segments, usually five, never exceed six in number.

The plan of degradation, in passing from the higher to the lower forms, is by the extension of the longitudinal axis of the body, in its anterior half; this is usually most strongly manifested in the head, and exhibited not only by the length of the beak, but by the conformation of the lower floor of the mouth.

Commencing with those Curculionidæ (Adelognathi, *Lacordaire*) in which the mentum fills the gular emargination, as in the higher Tenebrionidæ, we find a gradual lessening in size of the mentum, itself becoming supported upon a broad, short, gular peduncle, permitting the maxillæ to become visible (Phanerognathi, Cohort I., *Lacordaire*); next, the gular peduncle becomes elongated and bilobed, receiving the mentum, now reduced to very small size, between its lobes (Phanerognathi, Cohort II. and also Brenthidæ and Anthribidæ).

Having, in the continuance of my work on the Classification of the Coleoptera of North America, recently commenced a critical study of our Rhynchophora, I became aware of the impossibility of intercalating them between the Heteromera and Subpentamera, and am now convinced that they represent a special type, which must be isolated from all other types of Coleoptera, possessing a systematic value equal to all the others combined.

In seeking for the characters which should define this type, I observed a remarkable difference in the arrangement of the pieces of the under surface of the prothorax, heretofore overlooked, and, so far as I know, confined to this particular type.

In other Coleoptera the prosternum is either extended behind the anterior coxæ, so as to form part of the hind margin of the segment, thus coming in contact with the mesosternum, or it is cut off between the coxæ, and in this case (as in many others) the coxal cavities are open behind: in the few exceptions (*Derodontus*, *Dacoderus*) in which the coxæ are contiguous and the cavities closed behind, the prosternum still extends behind the coxæ to the hind margin of the segment, as is shown by the short sutures separating the epimera from the medial piece of the prosternum.

I have represented these modifications of form in the adjoining woodcuts. Fig. 1, under surface of prothorax of a Carabide (*Pasimachus*); the coxal cavities are closed, and the epimera and episterna well defined. Fig. 2, ditto of a Scarabæide (*Lachnosterna*); the coxæ are transverse, the cavities closed, the side pieces not distinct. Fig. 3, ditto of *Cucujus*; coxal cavities open behind, side pieces not distinct. Fig. 4, ditto of *Telephorus*; coxal cavities confluent, and open behind.

In Rhynchophora the prothoracic sutures are obliterated; there is no separation between the prosternum and episterna, and very rarely between the latter and the pronotum; the coxal cavities, frequently confluent, are always closed behind, *by the epimera*, which become connate on the median line, enclosing the hind part of the prosternum, thus cutting it off completely from the mesothoracic segment.

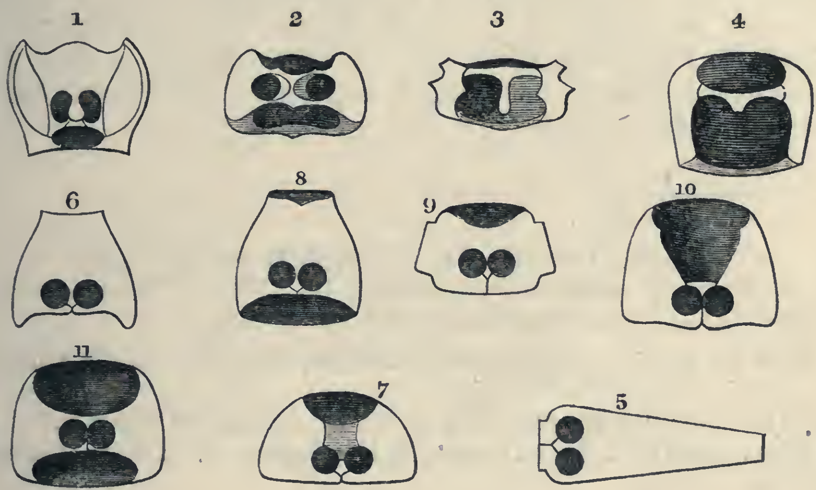


Fig. 5 represents this arrangement of parts in a Brenthide, in which family the extreme limit of degradation by linear extension is reached. Fig. 6, under surface of prothorax of a Calandride (*Rhynchophorus*). Fig. 7, ditto of *Cryptorhynchus*. Fig. 8, ditto of *Balaninus*. Fig. 9, ditto, *Ophryastes*. Fig. 10, ditto, *Thecesternus*. Fig. 11, ditto, *Dendroctonus*.

When the coxæ are contiguous, the point of the prosternum is visible behind them, but is none the less perfectly enclosed by the growth of the side pieces to the median line.

Another evidence of the inferiority of type of the Rhynchophora, which has not been mentioned, is seen in the functions performed by the beak, which in the lower groups, especially in the female, becomes greatly elongated. The occurrence of corneous exserted ovipositors in other orders of insects is not rare; a few species of Coleoptera (certain *Valgus*, for example) have the last abdominal segment prolonged, simulating such an organ; but it was reserved for the Rhynchophora to exhibit a degradation of type by which a function, peculiarly appropriate to the posterior extremity of the body, is performed by the head—the elongated beak becoming, in fact, the ovipositor.

Thus the inferiority of grade, evidenced in other series of Coleoptera by the softness of the integuments or by the permanence of larval forms, chiefly in the abdomen and coxæ, is in the Rhynchophora manifested by the transfer of a function from the posterior to the anterior part of the body, and the linear extension of the latter, in accordance with this "change of base."

The principles of classification of Rhynchophora, and their division into families, will be discussed in a subsequent memoir. It is, however, proper to observe that the peculiar construction of prothorax above described as characteristic of the Rhynchophora is not exhibited in the Bruchidæ, which family, as observed by Lacordaire (Gen. Col. vii. 600) should be viewed as closely related to, if not actually a portion of, the great family Chrysomelidæ.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 20, 1867.—Lieut.-General Sabine, President, in the Chair.

"On some Elementary Principles in Animal Mechanics." By the Rev. Samuel Haughton, M.D., Fellow of Trinity College, Dublin.

There are some elementary principles in animal mechanics which are so natural that they may be assumed as probable, and as such, have not received from observers the attention they really deserve.

Among these principles I select for illustration the two following:—

i. *The force of a muscle is proportional to the area of its cross section.*

ii. *The force of a muscle is proportional to the cross section of the tendon that conveys its influence to a distant point.*

i. In order to test the first of these statements, I made a careful examination of the cross sections of the muscles that bend the forearm and leg, in a very finely developed male subject, with the following results:—

Neglecting the slight effect of the *supinator radii longus* in flexing the forearm, I found the cross sections of the *biceps humeri* and *brachiæus* to be as follows:—

	Cross section.
1. *Biceps humeri*	1·914 sq. in.
2. *Brachiæus*	1·276 „
	3·190

The cross sections of the muscles that bend the leg were found to be in the same subject:—

1. *Biceps femoris* (long head)	. . .	2·59 sq. in.
,, (short head)	. . .	1·14 ,,
2. *Semitendinosus*	. . . .	1·87 ,,
3. *Semimembranosus*	. . . .	2·25 ,,
4. *Gracilis*	. . . .	0·89 ,,
5. *Sartorius*	. . . .	0·59 ,,
		9·33

When the arm was held vertically, and the forearm horizontally with the fist shut and in supination, I found that 39 lbs. was the limit of the weight that could be lifted when suspended at $12\frac{1}{4}$ inches from the axis of the elbow-joint, and that the perpendiculars let fall upon the directions of the muscles from the same axis were:—

1. *Biceps humeri*	. . . . . .	2·06 inches.
2. *Brachiæus*	. . . .	1·07 ,,

Hence if K denote the force of the muscle, per square inch of cross section, we have, adding 2 lbs. for the weight of the forearm at $12\frac{1}{4}$ inches from the axis of the joint,

$$41 \text{ lbs.} \times 12\tfrac{1}{4} \text{ inches} = \text{K} \times \left\{ \begin{array}{c} 1{\cdot}91 \times 2{\cdot}06 \\ +1{\cdot}28 \times 1{\cdot}07 \end{array} \right\}$$

$$502\tfrac{1}{4} = \text{K} \times \left\{ \begin{array}{c} 3{\cdot}935 \\ +1{\cdot}369 \end{array} \right\}$$

$$= \text{K} \times 5{\cdot}304$$

and finally $\text{K} = 94{\cdot}7 \text{ lbs.}$

This represents the force per square inch of cross section that the muscles flexing the forearm are capable of exerting.

In order to measure the force of the muscles flexing the leg, I placed the observer lying upon his face upon a table, with the legs extended over its edge, and having fastened down the thighs, I observed the maximum weights, suspended from the heel that could be conveniently lifted, and found that 34 lbs. was the limit; to this must be added 3 lbs. for the weight of the leg, supposed suspended at the heel, which was measured as $16\frac{1}{2}$ inches from the axis of rotation of the knee-joint. The perpendiculars let fall upon the directions of the several muscles flexing the leg were then measured:—

		Perpendicular.
1. *Biceps femoris* (long head)	. . . .	0·95 in.
,, (short head)	. . . .	0·56 ,,
2. *Semitendinosus*	. . . .	0·40 ,,
3. *Semimembranosus*	. . . .	0·65 ,,
4. *Gracilis*	. . . .	0·25 ,,
5. *Sartorius*	. . . .	0·00 ,,

Hence we find, for the determination of K (the coefficient of muscular contraction per square inch of cross section),

$$37 \times 16\tfrac{1}{2} = K \times \left\{ \begin{array}{l} 0{\cdot}95 \times 2{\cdot}59 \\ +0{\cdot}56 \times 1{\cdot}14 \\ +0{\cdot}40 \times 1{\cdot}87 \\ +0{\cdot}65 \times 2{\cdot}25 \\ +0{\cdot}25 \times 0{\cdot}89 \\ +0{\cdot}00 \times 0{\cdot}59 \end{array} \right.$$

or,

$$610{\cdot}5 = K \times \left\{ \begin{array}{l} 2{\cdot}460 \\ +0{\cdot}638 \\ +0{\cdot}748 \\ +1{\cdot}462 \\ +0{\cdot}222 \\ +0{\cdot}000 \\ \hline 5{\cdot}530 \end{array} \right.$$

and, finally,

$$K = \frac{610{\cdot}5}{5{\cdot}53} = 110{\cdot}4 \text{ lbs.}$$

It appears from the foregoing considerations that the force of contraction of the muscles, per square inch, is in

The arm	94·7 lbs.
The leg	110·4 „

These numbers are, perhaps, as near to each other as this class of observations admits of; but I believe that they do not differ so much really as they appear to do, for the following reason:—

As it was not convenient to procure a good subject destroyed by a violent death, I made use of a powerful man who had died of cholera * and who had been a blacksmith by profession. Now it is natural to suppose that the muscles of the arm of a blacksmith are more developed than those of his leg; so that their cross section would be relatively too great, and the coefficient derived from that cross section, therefore, too small. I therefore compared the sections of the *biceps humeri* and *brachiæus*, found by me, with the only other measurements with which I am acquainted, for the knowledge of which I am indebted to Dr. W. Moore of Dublin, who translated the results for me, from the Dutch, of Messrs. Donders and Mansfelt † of Utrecht.

Cross Sections of *Biceps humeri* and *Brachiæus*.

	millims.	sq. in.
1. *Biceps humeri* (long head)	530	0·821
„ „ (short head)	452	0·701
2. *Brachiæus*	614	0·952
	1596	2·474

* It is well known that after death by *cholera*, life continues in the muscles, and manifests itself for some hours by movements, and by the existence of the muscular *susurrus*. This latter fact, the first notice of which belongs to Dr. Collongues, of Paris, I have repeatedly verified, as also the continuance of the *susurrus* in cases of death by *tetanus*. It appeared to me, therefore, that such a subject as I selected was one well suited to the purpose of my observations.

† Over de Elasticiteit der Spieren. Utrecht, 1863.

If this estimate of the cross section of the muscles be assumed instead of my own, the coefficient found by me should be increased in the proportion of 3190 to 2474; or

Coefficient of muscles of forearm . . $94{\cdot}7 \times \frac{3190}{2474} = 122$ lbs.

The mean of the coefficients found from my own measurement of the muscles of the arm, and that of Professor Donders, is 108·4 lbs., which agrees nearly with that obtained from the muscles of the leg, viz. 110·4 lbs., and the mean of all the observations on arm and leg would be **109·4 lbs.,** a result which I consider to be not far from the truth.

The cross sections of the muscles were found by cutting them across with a sharp scalpel, and marking out their section on cardboard, and afterwards weighing the marked portions, the weights of which were then compared with the weight of a known number of square inches of the same cardboard, and so the cross sections in square inches calculated.

I give here, for the purpose of illustration, the actual sections of the muscles of the leg. (Figs. 1–6.)

The perpendiculars let fall upon the directions of the muscles were measured by stretching strings from the origin to the insertion of the muscles, and measuring, by means of a compass, the perpendiculars let fall upon these strings from the axis of the joint.

The weights of the muscles themselves were as follows:—

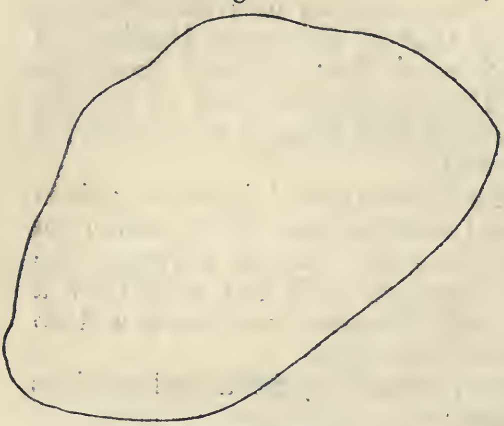
	oz.		oz.
1. *Biceps humeri* . .	4·22	5. *Semimembranosus* .	7·25
2. *Brachiæus*	5·04	6. *Gracilis*	2·98
3. *Biceps femoris* . .	10·74	7. *Sartorius*	5·66
4. *Semitendinosus* . .	5·17		

ii. The principle of economy of force or of material in nature would lead necessarily to the principle that each tendon conveying the effect of a force to a distant point should have the exact strength required, and neither more nor less; for, according to the doctrine of *final causes*, it was originally contrived by a perfect architect, and according to Lamarckian views it must have perfectly accommodated itself to the uses to which it is applied. According, therefore, to either view, if the tendon be too strong, it will become *atrophied* down to the proper limit; and if too weak, it must either break or be nourished up to the requisite degree of strength. It seemed to me desirable to prove this fundamental proposition in animal mechanics by direct observation; and I selected for this purpose the tendons in the leg of several of the large running birds (*Struthionidæ*),—and always with the same result, viz. that *the cross sections of any two muscles tending to produce a similar effect are directly proportional to the cross sections of their tendons.*

I shall select as an example the case of the *flexor hallucis longus* and *flexor digitorum communis perforans* of the Rhea, whose tendons unite into a common tendon halfway down the posterior side of the *canneon* bone of the bird.

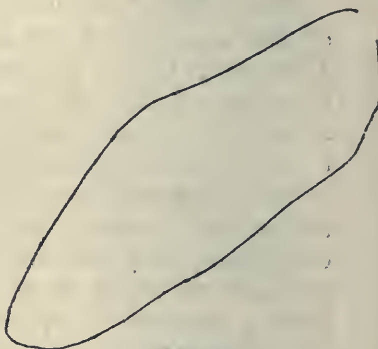
The cross sections of these two muscles are shown in the annexed figures, taken as in the human subject (figs. 7 and 8).

Fig. 1.



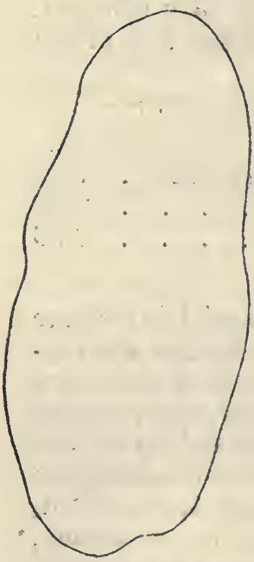
Biceps (long head).

Fig. 2.



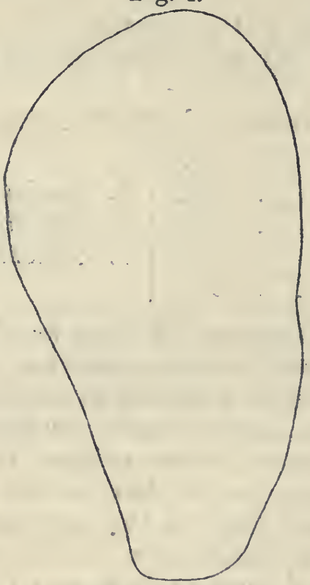
Biceps (short head).

Fig. 3.



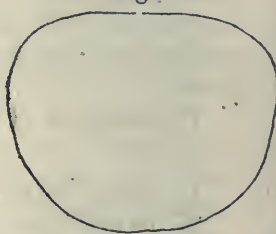
Semitendinosus.

Fig. 4.



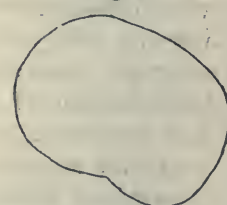
Semimembranosus.

Fig. 7.



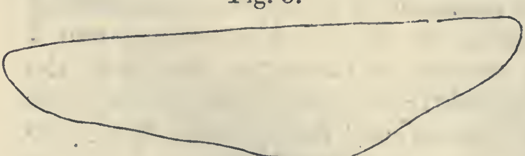
Flexor perforans. (Rhea.)

Fig. 8.



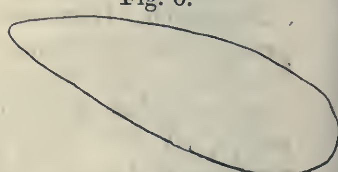
Flexor hallucis. (Rhea.)

Fig. 5.



Gracilis.

Fig. 6.



Sartorius.

The areas of these cross sections were found to be as 245 to 160; or the less was 65 per cent. of the greater.

Two equal lengths of the dried tendons were then weighed and found to be in the proportion of 845 to 495, which was assumed to be the proportion of their cross sections. The smaller of these numbers is 59 per cent. of the greater—a result that seems to be as near to the former result derived from the muscles as can be expected in this class of experiments.

"On the Anatomy of *Balænoptera rostrata,* Fab." By ALEXANDER CARTE, M.A., M.D., &c., and ALEXANDER MACALISTER, M.D. &c.

In this paper the authors give an account of the dissection of a young female of the Lesser Fin or Piked Whale, which was captured off Clougher Head, co. Louth, Ireland, on the 8th of May 1863.

After describing its external form, and giving accurate measurements of its various parts, the authors point out some differences between the relative sizes and positions of the organs of the animal as contrasted with similar parts of those of the same species which have been recorded by previous writers, especially as regards the position of the dorsal fin, which appendage seems to vary in situation in different individuals, and show that consequently no value, as indicative of species, ought to be attached to its relative position.

This is followed by a description of the osteology of the animal; and attention is drawn to the fact that the body of the axis vertebra is composed, in part, by the displaced body of the atlas, showing that what at present forms the upper half of the centrum of the axis is in reality the centrum of the atlas.

The myology of the different regions of the animal has been closely investigated, especially the rudimentary muscles of the paddle, which latter the authors have minutely examined.

The anatomy of the mouth, pharynx, and blowholes is described, and the mechanism by which the functions of respiration and deglutition are performed. In connexion with the larynx, a remarkable muscular pouch is mentioned as existing, which appendage is supposed by the authors to be accessory to the act of expiration, serving a somewhat similar office to that of the air-reservoir in a double-action bellows. Directly in front of the glottis there existed a peculiar hood-like fold of mucous membrane arranged in such a way as to allow of its being drawn over the orifice, and so prevent the entrance of all foreign substances into the respiratory tract during the act of deglutition.

The tongue was found fixed, as far as its tip, by a thick frænum. The lateral walls of the submaxillary cavity were thrown into folds, thereby admitting of considerable distention, this arrangement being peculiarly adapted to the feeding-requirements of the animal. The number of baleen plates found in the specimen was 280 on each side.

The muscles for acting on the blowholes were arranged in three strata, the superficial and deepest layers being used in opening, and the intermediate one for closing the nasal canals.

The anatomy of the eye and ear is fully described in the original paper, together with that of the digestive, nervous, and vascular systems; in connexion with this last, remarkable vascular retia were found, situated in the axillary, submaxillary, and cervical regions.

MISCELLANEOUS.

Notice of a new Species of Spider Monkey (Ateles Bartlettii) *in the British Museum.* By Dr. J. E. Gray.

Mr. Edward Bartlett, who is collecting specimens on the banks of the Amazons, has sent home a new and beautiful species of spider monkey, which I propose to call *Ateles Bartlettii*, in honour of the father and sons. Every one acquainted with the father knows him as a most careful and accurate observer and most obliging person; and I believe his sons are following in his footsteps.

Ateles Bartlettii may be thus distinguished:—

Fur abundant, long, and soft. Black; the cheeks white, a band across the forehead over the orbits bright reddish yellow; the chest, belly, inner side and front and back of the limbs, and the sides and under surface of the tail yellow.

Hab. Brazil, the upper part of the Amazons (Bartlett). In Brit. Mus.

Note on a Species of Planarian Worm hitherto apparently not described. By the Rev. W. Houghton, M.A., F.L.S.

To the Editors of the Annals of Natural History.

Gentlemen,—I have recently met with a form of Planarian worm which I am unable to identify with any described species, either in Diesing's 'Systema Helminthum' or in Johnston's 'Catalogue of non-parasitic Worms in the British Museum.' It belongs to the family of Dalyellidæ, and is a species of the genus *Typhloplana*, Hemp. & Ehrenb. Diesing (Syst. Helminth. vol. i. p. 231) enumerates four freshwater species of this genus; and Dr. Johnston admits two into the British fauna, viz. *T. fœcunda* and *T. prasina*, the first of which is white, the second of a beautiful grass-green colour. My specimens are almost entirely black, except at the margins near the head. I find them within the stems of *Sparganium* in a weedy reedy pond where other Planariæ (such as *Polycelis nigra* and *P. brunnea*, *Planaria lactea* and *P. torva*) are common. The species, which I believe to be new, occurs sparingly. Diesing's definition of the genus is as follows:—

"*Corpus* oblongum, teretiusculum. *Caput* corpori continuum. Os centrale v. subcentrale. *Ocelli* nulli. *Aperturæ* genitales.... Aquarum dulcium, rarissime maris incolæ."

The species, which I propose to call *Typhloplana nigra*, may be thus described:—

Body rounded anteriorly, tapering to a point behind; colour deep black, except near the head, where the margin is white when viewed under a lens. Length about 2 lines. Motion active.

From the bodies of some individuals I have pressed about twenty round, reddish-brown, capsulated ova. It will be seen, by a reference to Dr. Johnston's 'Catalogue' (p. 16), that this species bears a great resemblance to the *T.* (*Planaria*) *prasina* of Sir John Dalyell, and differs almost solely in colour. I remain, Gentlemen,

Your obedient Servant,
W. HOUGHTON.

Megaceros hibernicus *in the Cambridgeshire Fens.*

To the Editors of the Annals and Magazine of Natural History.

GENTLEMEN,—In reply to Mr. H. G. Seeley's letter in the 'Annals' for August 1867, on the Irish Elk, I beg to remark that I was acquainted with the passage in Prof. Owen's 'British Fossil Mammals' to which Mr. Seeley alludes; but, as the bone to which my note referred was found in *Cambridgeshire*, and as *Megaceros hibernicus* is not common in the Fens, I supposed that its occurrence was worth recording. I am, Gentlemen,

Your obedient Servant,
Dublin, Aug. 26, 1867. NORMAN MOORE.

Note on Ursus lasiotus, *a hairy-eared Bear from North China.* By Dr. J. E. GRAY, F.R.S. &c.

The Zoological Society has recently received a bear from North China. It belongs to the same group as the European bear (*Ursus arctos*), the Grisly Bear (*U. ferox*), and the Japanese bear, having a broad head rounded above behind, a moderate broad nose, and prominent ears.

It differs from these species in having the ears covered externally and, especially, internally with long soft hairs, those on the inside forming a tuft that nearly fills up and projects beyond the cavity of the ear. The fur is longer than in the European and Japanese bear at the same seasons; and there is a large tuft of longer hair on the back part of the throat, which is bent forwards at the tips. It is nearly as black as the Japanese bear; but it has a brownish nose and no indications of the angular mark on the chest usually found in that species, and it is of a larger size.

These peculiarities induce me to believe that the Chinese hairy-eared bear is a distinct species, for which I propose the name of *Ursus lasiotus*. When we have an opportunity of examining the skin and bones more particularly, I expect that more important specific characters will be observed. It is very distinct from the Syrian or Isabella bear of the mountains of Asia, which has a long narrow head.

Mr. Bartlett believed that it was a distinct species as soon as he saw it on board the ship. It is probably the bear that the Chinese lead about and teach to tumble, as shown in Chinese pictures, and as the "bear-leaders" in my childhood's days used to exhibit in London the European brown bear.

On the Anatomy and Physiology of Amphioxus. By M. P. Bert.

The existence of *Amphioxus* has been ascertained, during the month of March of this year, in the muddy sands of the basin of Arcachon, by MM. Fillioux and Lafont. This is the first time, to my knowledge, that any one has found it on the oceanic shores of France.

From March to May all the individuals have the generative organs filled with eggs or with spermatozoids in different degrees of development. After this period these organs are empty and atrophied. Like all fishes, the *Amphioxi* are fit for reproduction before they have attained their full size. No difference can be ascertained between the male and female, even when the generative sacs are filled with their products, except with the aid of magnifying-instruments. The number of these pouches is, in both sexes, from twenty-two to twenty-six; that of the muscular masses is sixty-one pairs; but that of the branchial spaces varies considerably with the size, as has long been known (an individual of the length of 20 millimetres has 93 spaces, one of 30 millimetres 153). This augmentation takes place at the two extremities of the branchial apparatus; of this we may easily be assured by taking for point of reference the anterior extremity of the liver, which always corresponds to the sixteenth muscular mass. Beyond the abdominal pore the coats of the body do not closely embrace the intestine, as M. de Quatrefages says. I have, on the contrary, verified the assertion of J. Müller, who describes a prolongation of the peritoneal cavity going to the anus. It is true that the particles which have traversed the branchial network never get into this passage, which is sometimes obliterated by the contractions of the coats of the body. On the other hand, I cannot admit the existence of the lateral canal (prolongation of the general cavity) which according to some anatomists opens at the side of the mouth.

Each of the ovarian sacs consists of a thin wall furnished with pavement-epithelium, of which the very pale cells measure about 0·01 millim. Within, separated from the sac by an interval full of a transparent liquid, is the ovigerous sac, which is extremely thin and without epithelium when the eggs are developed; but when these first make their appearance, it possesses epithelial cells 0·010–0·014 millim. These cells group themselves round the young eggs, which appear to originate only in contact with the wall. The smallest that I have seen were 0·038 millim., their germinal vesicle 0·009 millim., and their germinal spot 0·004 millim. I have found them in the same sac from that size to 0·24 millim., which is that of the mature egg (vesicle 0·09, spot 0·026 millim.). The vitellus becomes opaque when the egg attains 0·085 millim. I have seen at the same time in the sac some isolated corpuscles which had all the characteristics of the germinal vesicle. When the eggs are mature, they lose their spot and vesicle, and, being compressed in the sac, form at its surface an elegant mosaic. They then emerge by the bursting of the sac and pouch: in the wall of the former some pigment-granules are developed; it then contracts and becomes invisible.

I have not been able to trace from its commencement the appearance of the spermatozoids; I have, however, once seen them united by the head, in great numbers, in their mother cells (male ovules); the latter then burst, and the spermatozoids group themselves in a single bundle in a large sac with thin walls without epithelium. Between this sac and the testicular pouch float a number of corpuscles measuring 0·0045 millim., the nature of which is unknown to me.

I cannot regard the dorsal cord as formed of cells (Quatrefages) or of disks (J. Müller &c.). Longitudinal sections showed a more regular structure, namely lamellæ composed of semisolid amorphous material. But these lamellæ towards the centre of the dorsal cord are forked in proportion as they recede from that centre, giving origin to secondary lamellæ in gradually increasing numbers, which do not reach the whole surface of the dorsal cord. Hence arise those parallel lines which have led to the belief in juxtaposed disks, and which, occupying a part of the circumference, have been regarded by M. de Quatrefages as limiting large flattened cells. Nor can I share the opinion of M. Marcusen, according to which the large bodies contained in the cells of the fin on the one hand, and in the swelled extremity of the spinal marrow on the other, are composed of capillaries. In the first place, the large bodies are translucid and homogeneous, whilst the swollen extremity (so well described by M. de Quatrefages) is filled with corpuscles perfectly similar to those which strike us at the first glance in the spinal marrow. Secondly, in some fragments of *Amphioxus* which had been cut for several days, and were still living, these parts preserved their dimensions, which would not have been the case if they had been composed of capillaries full of blood. The spinal marrow contains, both in the swollen and contracted parts, some cells which are very difficult to see clearly. They did not appear to me to be round, as is generally stated, but angular or polar. I have seen from an angle on one of them, which was tripolar and measured 0·015 millim., a fibre originate and soon become bifurcated.

The manifest contradiction between the description of M. de Quatrefages and that of M. Marcusen with regard to the termination of the cutaneous nerves appears to me to be founded on a premature generalization. If we examine the cutaneous nerves in the middle and posterior regions of the body, we find them ramifying more and more, losing their proper envelope, and at last becoming so fine that their extremities cannot be distinguished. I have reason to believe that they present anastomoses in their course. But the nerves which proceed from the facial trunks (second, third, fourth, and fifth pairs of Quatrefages) behave differently; after a short course, they arrive at some oval cellular bodies, measuring from 0·012 to 0·015 millim., filled with granules, with one or two nuclei of 0·004 millim. These cells, pointed out by Quatrefages, are the very terminations of the nervous filaments; but they only exist for the facial filaments, in which they undoubtedly indicate some particular function.

The anterior termination of the spinal marrow of *Amphioxus*, although not inflated, nevertheless plays the part of an encephalon;

if it be cut away, the animal, when once at rest, remains immoveable upon the sand, without any indication of voluntary determination. But it is still extremely sensitive, and regularly executes the movements of the muscles of the belly which aid in respiration. I have seen the general reflex movements persist for more than a week in a decapitated *Amphioxus*.

The immersion of an *Amphioxus* in sea-water charged with blue litmus (Vulpian's method) furnished no evidence of an acid secretion in its intestinal tube, unless perhaps in the buccal cavity. As to the large greenish appendage which is usually denominated the liver, I have been unable to perceive, under the microscope, the production of violascent spots by the action of acidulated tincture of iodine; hot nitric acid gives it a rather bright bottle-green colour.

Neither in the liver and excrements, nor in those singular bodies, differing in different animals in number, size, and position, which J. Müller regards as the kidneys, could I detect the presence of uric acid by the microscopic reaction of murexide.

I believe I am the first to have witnessed the ejection of the semen; it issues by the abdominal pore in a continuous jet, reinforced by pulsations due to the abdominal muscles; the spermatozoids, which are free and active, retain their movements for about twenty-four hours in sea-water (at 59° F.). They then measured:—head 0·003; tail 0·040–0·048 millim., but generally 0·045 millim. The detection of this spontaneous emission of the semen is important, as it compels us to regard the *Amphioxus* as an adult and definitive form.

If the extremity of the body of an *Amphioxus* be cut off, the wound does not cicatrize; on the contrary, the tissues become gradually disintegrated. I have seen animals, with only the tail mutilated, become gradually eaten away up to the middle of the branchial region, and live thus without intestines, without abdominal walls, and without branchiæ for several days. In this destruction the disks of the dorsal cord become detached, and the muscular fibres become dissociated, lose their striæ, and disappear: the wound acquires a rosy colour.

Immersion for two minutes in water at 106° F. kills the *Amphioxi*; but although incapable of spontaneous movements, they are still locally contractile. Fresh water kills them with convulsions in two or three minutes; they then become opaque and rigid, and their muscles no longer contract, even under the influence of induced currents insupportable by the dry fingers. If, then, the animal be again placed in sea-water, contractility is seen to return in a few hours, and then sensibility. If the cessation of the movement of the vibratile cilia has been waited for, it reappears in sea-water, but contractility and sensibility are finally lost.

The presence in water of a very small quantity of strychnine kills the *Amphioxi* with tetanic convulsions; morphine stupefies them (even when the cephalic extremity has been removed), leaving them, however, when in small quantity, their sensibility; lastly, curari renders them immobile without affecting their contractility, and this even when their integuments are uninjured.—*Comptes Rendus*, August 26, 1867, pp. 364–367.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 119. NOVEMBER 1867.

XXXIX.—*On a new form of Mudfish from New Zealand.* By Dr. Albert Günther, F.R.S.

[Plate VII.]

The family of Galaxidæ was formed by the late Johannes Müller for a single genus, *Galaxias*—scaleless freshwater fishes from the temperate zone of the southern hemisphere, which, with regard to the development and position of their fins, remind us of the Pikes of the northern hemisphere, but in other respects (as, for instance, in their dentition and open ovaria) resemble the Salmonoids, to which they have been compared by Müller. Also the settlers of at least some parts of New Zealand have dignified the larger kinds with the name of "trout" or "rock-trout." However, they cannot be regarded as the southern representatives of the Salmonoids, inasmuch as recent researches have shown that this latter family is represented in the southern hemisphere by other, much more closely allied genera*. If we look for the representatives of the Galaxidæ in other zones, perhaps the African Mormyridæ and the Arctic Esocidæ are those which may be mentioned with the greatest propriety.

Up to the present time only twelve species of *Galaxias* are known, which I have described in the 'Catal. of Fish.' vol. vi. pp. 208–213. Their geographical distribution is a point to which the greatest interest attaches. We find the genus most developed in New Zealand, where five species occur, and these are the largest of the whole group. Westwards it extends to New South Wales, with three, and to Van Diemen's Land, with two species. Another is said to be an inhabitant of the creeks of Queensland; but this is doubtful. Eastwards the same genus is met with again in the southernmost parts of America (Falkland Islands, Patagonia, Terra del Fuego), whence

* *Haplochiton* and *Prototroctes*: see Günth. Fish. v. p. 381.

three species are known; and, finally, a minute form is said to occur in Chile. The occurrence of the same natural genus of freshwater fishes in Australia, New Zealand, and South America would appear to be significant enough, and must be the more so when we find that even one and the same *species* (*Galaxias attenuatus*) inhabits the fresh waters of countries separated at present by the South Pacific Ocean. Nor does this fact stand alone, inasmuch as another family of freshwater fishes, that of *Haplochitonidæ*, offers a very similar instance of geographical distribution—one of the two genera of which it is composed being found in Terra del Fuego and the Falkland Islands (*Haplochiton*), the other in Southern Australia (*Prototroctes*). These instances seem to be confirmatory of an observation made in Proc. Zool. Soc. 1858, p. 390, where the Batrachian fauna of South America was shown to be most closely allied to that of Australia.

By the last New Zealand mail I received a highly interesting example belonging to this family of Galaxidæ, differing generically, however, from *Galaxias* in *being devoid of ventral fins.* It is the type of a new genus, which may be characterized thus:—

Neochanna.

General characters those of *Galaxias*. Ventral fins none. Each jaw with a single series of very small, compressed (incisor-like) teeth of equal size; palate toothless. A series of hook-like teeth on each side of the tongue. Pyloric appendage single. Gill-rakers very short, conical, widely set.

Neochanna apoda. Pl. VII.

B. 7. D. 16. A. 17.

Body subcylindrical, compressed behind, rather elongate, its depth being contained seven times and a half in the total length (without caudal). Head broad and depressed, its greatest width being much more than its depth, and at least two-thirds of its length, which is a little less than one-fifth of the total (without caudal). Snout broad, obtusely rounded. Lips broad. Cleft of the mouth of moderate width, the maxillary extending to below the *eye, which is very small.* Anterior nostril prolonged into a minute tube; several wide pores on the upper part of the head. A rather deep groove runs from the head along the middle of the back and abdomen. The dorsal and anal fins are about as high as the tail between them, and both are continuous at the base with the rudimentary rays of the caudal fin. Caudal fin rounded, as long as the head (without snout); pectoral somewhat shorter.

Brown, with irregular blackish transverse spots.

Total length $5\frac{1}{2}$ inches.

The peculiar circumstances under which the specimen was obtained are best explained in the following letter, by which it was accompanied:—

"Geological Survey Office and Colonial Museum,
"Wellington, 27th July, 1867.

"Dear Sir,

"At the request of His Excellency Sir George Grey, I forward a specimen of a fish which is found under peculiar circumstances near Hokitika, on the west coast of the province of Canterbury, with a request that, if it proves to be a subject of interest, you will describe it and deposit it in the British Museum. I also enclose a pencil-sketch of the same specimen, which was found at a depth of 4 feet from the surface, in a stiff clay imbedding roots of trees. The locality is 37 feet above the level of the Hokitika River, and three miles from the sea, and has at one time been a backwater of the river during floods. The gold-fields township of Kaneiri is now built upon it; but little more than two years ago it was a swamp covered with dense forest. The surface of stiff clay rests on a deep deposit of gravel, which has been pierced in all directions by the gold-miners; so that, during the above period, no surface- or river-water could have collected, and the original swamp has disappeared.

"Mr. Schaw, the warden of the district, to whom I am indebted for my information, has examined seven or eight specimens of this fish, and assures me that they occur enclosed in hollows in the clay; and that, although when first extracted they moved freely, if placed in water they get sluggish and soon die. The specimens seen vary from 3 to 7 inches in length.

"That a fish should survive when imbedded in clay for months or even years, is a matter of familiar experience; and it is not difficult to conceive how these fish might, on the desiccation of the swamps, get into the position in which they are found, by following crevices among the roots of trees; and I believe that the early settlers in New Zealand were frequently much astonished by digging up fish along with the potatoes they had planted in the rich swampy land—a natural bounty which they were not prepared for.

"I am sorry I cannot send you specimens of the fish from the neighbouring waters for comparison; but I believe you will find it to be only an abnormal form of some commonly recognized species.

"I remain,
"Yours faithfully,
"James Hector."

"*Dr. Günther, F.R.S.,*
"*British Museum.*"

The last surmise of Dr. Hector is natural enough, and would occur to any one who had not the opportunity of comparing this fish with the allied forms. I have frequently seen individuals of carp, Anabas, &c., taken under similar circumstances, the appearance of which was so much altered that they could not be readily identified. However, the fish sent by H.E. Sir George Grey is not merely such an abnormal individual, although it may be regarded as a degraded form of the more highly developed type of *Galaxias*. Even if it did not generically differ by its peculiar dentition and absence of ventrals, still we should be obliged to distinguish it specifically on account of the large number of fin-rays and the small size of its eye. By the latter character *Neochanna* is distinguished in a remarkable manner from the true *Galaxias*, which appear to inhabit more open and clear waters (those from Terra del Fuego are found in "alpine lakes") and have the eyes fully developed; while the almost rudimentary eyes of *Neochanna* indicate clearly that it lives habitually in mud or swampy places; and I have no doubt that Dr. Hector is correct in thinking that it will be found in such localities in the neighbourhood of Hokitika. It is not surprising that the specimens obtained were killed by the sudden immersion in clear water; perhaps they might have survived if the change had been made in a more gradual manner.

All *Galaxias* are extremely fat, so that it is impossible to handle them, even for a very short time, without the fat penetrating through the skin, and soiling everything which comes into contact with them. I was much surprised to find this also to be the case in our specimen of *Neochanna* (which I should have supposed to have undergone a protracted trial of fasting), —and still more so when the stomach proved to be distended with food, which appeared to consist of the semidigested remains of the larvæ of a small dipterous insect.

In conclusion I would draw attention to the remarkable fact that in numerous groups of fishes which live in mud, or are even enabled to pass a longer or shorter time in soil periodically dried and hardened during the hot season, forms occur entirely devoid of or with only rudimentary ventral fins. Thus in the family of Labyrinthici two genera, *Osphromenus* and *Trichogaster*, have the ventral fins reduced to a thin filament. I have also seen specimens of *Anabas* abnormally devoid of ventral fins, though the pubic bones were present. Among the Ophiocephalidæ *Channa* is entirely destitute of these organs. There are several ventral-finless Siluroid and Cyprinodont genera; but, unfortunately, we are acquainted with their habits only in a very general manner. *Gymnarchus* is nothing but a *Mormyrus* without any of the lower fins. The chief function of these fins is to balance the body of the fish whilst swimming; and it is evident that, in fishes moving during a great part of their life over swampy ground, or through more or less consistent mud, this function of the ventral fins ceases, and that nature can readily dispense with these organs altogether.

XL.—*Remarks upon Oceanic Forms of* Hydrozoa *observed at Sea.* By Cuthbert Collingwood, M.A., F.L.S. &c.

The following observations were made during a prolonged sea-voyage, extending over a year and a half, and embracing the Indian Ocean north and south of the Line, the China Seas, and the North and South Atlantic Oceans. During this voyage, of course, many interesting observations were made relating to other animals; but the present paper will be confined to the oceanic Hydrozoa of the orders Physophoridæ and Lucernaridæ.

The appearance of these animals is by no means a constant occurrence even in calm seas, and seems in fact to be somewhat capricious and regulated by conditions which are not well ascertained and would require the collation of a lengthened series of observations for their determination. On some days floating Hydrozoa occur in vast numbers; but when they do so, they usually appear to be all of the same species; nor are such days of frequent occurrence. The small gymnophthalmatous Medusidæ (naked-eyed Medusæ) are so transparent that it is impossible to see them from the ship, although they may be tolerably abundant; and it is only when they are captured in the towing-net that their presence is detected; and that must be, of course, in calm weather, when the ship is not sailing too fast. But the towing-net is seldom put down without securing various forms of such transparent Medusæ, as well as Beroës and similar oceanic Actinozoa, also small gelatinous masses usually more or less torn by contact with the net. The pelagic species of the order Physophoridæ, such as *Velella, Physalia,* and *Porpita,* occur perhaps more frequently than any others, and usually in company with one another, the two former especially seldom occurring one without the other, and having the appearance from a distance of large bubbles of water drifting by, though their persistence at once attracts the attention of the observant. Next to them, perhaps, are *Porpitæ,* looking like beautiful blue gun-wads, with delicate radiating markings, and surrounded with a fringe of deep-blue tentacles. The number of these Hydrozoa must be enormous, and their range very remarkable. I have found them extending over 55° of latitude, and I have no reason to believe this to be the limit.

It is not to be wondered at that these light bodies, which present more or less sail to the wind, should be blown ashore in a gale. Thus I have found a *Velella* on the Lancashire coast; and abroad, as, for example, on Bush Island, at the mouth of Kelung Harbour, Formosa, after windy weather, I have seen thousands of the first two genera lying high and dry upon the rocks.

But the most magnificent specimens of these richly coloured animals (*Physaliæ*) occurred in the Atlantic Ocean, near the equator. On the 19th of June, in lat. 13′ S. and long. 22° W., wind S.S.E., therm. 77°, bar. 30°·1, the sea was moderately calm, and from time to time during the day splendid individuals of *Physalia pelagica* sailed by, attracting attention, even when far off, by their large size and brilliant colours. They had the appearance of beautiful prismatic shells standing upright upon rich blue cushions, the shell being radiated from the base or cushion to the circumference, which was fringed with a rich and bright rose-colour. They were not in great abundance, but one would float by every five minutes or so.

The largest *Physalia* which I examined measured as follows:—

Extreme length of bladder	8 inches.
Greatest vertical circumference	$10\frac{1}{4}$,,
Height of bladder above water	$2\frac{3}{4}$,,

But this was considerably reduced from the natural height; for the rose-coloured crest had collapsed, which would have added at least $\frac{3}{4}$ inch to it, making a total of $3\frac{1}{2}$ inches in height above the water. I had judged them to be about 8 inches long, before I captured one, by the expedient of throwing into the water a piece of wood of ascertained length, which I carefully compared with the animal as it floated near it. No one on board the ship had ever seen such magnificent *Physaliæ*, although they had been at sea many years. Some thought at first that they had seen them as large in the West Indies, but they were fain to confess at last that the large one I measured exceeded the largest they had ever seen. I saw these large *Physaliæ* subsequently on more than one occasion, the last being in lat. 26° N., though higher than this somewhat smaller specimens occurred.

The stinging-propensities of these Hydrozoa were not generally known, but were destined to make themselves evident at the expense of one unfortunate man. A boat happened to be lowered early in the day; and one of the crew, seeing a large *Physalia* float within reach, took it up with his naked hand. The threads clung to his hand and arm, penetrating to the axilla and down the side, causing the man to yell with agony. He was quickly brought on board, and, as soon as he reached the deck, ran about like a frantic maniac, so that it took several men to catch him, and, when secured and the proper remedies applied, he rolled about for a considerable time, groaning with pain. His arm was red, inflamed, and swollen, and remained so for some hours after the occurrence.

One circumstance in relation to these large *Physaliæ* struck me as being very remarkable. Each one as it floated by had beneath it what at first I took to be its mass of tentacles and polypites; but on more close observation I found that the appearance was due to a shoal of small fishes accompanying the hydrozoon under protection of its appendages. The fishes were of various sizes, from 2 to 6 inches long, transversely banded, and looking in the water precisely like the pilot-fish (*Naucrates ductor*). There were perhaps a dozen of these accompanying fish clustered together beneath the bladder of each *Physalia*. Every *Physalia* had its cluster; but this peculiarity was observable—viz. that under small *Physaliæ* the fishes were small, while under large specimens they were correspondingly large, being, in fact, always proportioned to the size of the man-of-war which they accompanied. Unfortunately I did not discover this curious fact till late in the day; and when the boat was down in the morning I was unaware of it, or I should have made a point of attempting to secure a specimen of so interesting a fish.

What the relation is which exists between the fish and the Hydrozoon I cannot say; but this correspondence between the sizes of the two animals seems to indicate that the fishes do not capriciously select their protecting Hydrozoon. It is known that certain fishes harbour in the threads of some of the large Lucernaridæ; but I believe they have not before been noticed accompanying *Physaliæ*.

The presence of these fishes also accounted for a remarkable thing I had observed earlier in the day. One of the large albicores made a sudden dash at a *Physalia* (apparently), but did not take it; returning, however, presently to the charge, he made a clean sweep, no trace of the *Physalia* being left. Doubtless it was the small fishes which accompanied it, rather than the *Physalia* itself, which stimulated the albicore's attack.

Before I quit the subject of the Physophoridæ, I must not omit to mention a circumstance which occurred only once during the whole time I was at sea—viz. the remarkable influx of Stephanomiadæ, accompanied by other kinds of animals, into Kelung Harbour, Formosa, on the 18th of June. The beautiful organisms I there observed were of the genus *Stephanomia*, and closely resembled the *S. triangularis* of Quoy and Gaimard. They were wonderfully sculptured and carved masses of solid jelly, either perfectly transparent or tinged with pink. They would bear being taken up carefully in a hand-net and placed in a basin of sea-water, but, when there, became absolutely invisible from their transparency and delicacy, and, when touched, would break asunder into transparent, gelatinous, star-like bodies; so that I was of despair at getting even a sketch of their complicated forms, for they soon melted away into shapeless masses. I endeavoured to preserve some in glycerine, but without success, for they immediately fell to pieces and dissolved. These bodies were solid to the touch, about 3 inches long, and appeared to be formed by the union of gelatinous bodies (swimming-bells) of very complex form, and dissimilar at different parts of their length, so that the diameter of one-third was greater than that of the other two-thirds. I was much disappointed at my unsuccessful attempts to keep some record of them; but their invisibility, their fragility, and the approach of evening rendered all my attempts at that time futile; and although I might have succeeded better if I had had another opportunity, I never saw anything like them again.

But the circumstance to be especially remarked is that during all the time these curious animals were floating by, it was raining pretty hard—a condition which, *à priori*, would have been supposed the most unfavourable for them; for the destructiveness of fresh water to delicate marine animals is well known. Whence, too, could they have come in such profusion? And if the surface of the sea is their natural habitat, why are they not more frequently seen?

With regard to the Hydrozoa of the order Lucernaridæ (the covered-eyed Medusæ of Forbes), on the comparatively few occasions when they appear upon the surface, they are usually in great abundance, and not in great variety. Thus in the upper part of the Red Sea, on the 10th of March, a species of *Aurelia* appeared in great numbers; and two days after, we passed through a shoal of Rhizostomas. Four days later, in the Gulf of Aden, we again encountered shoals of *Aurelia*, apparently identical with those of the Red Sea, the two shoals being separated by about 1400 miles. Again, in October we passed, on the west coast of Borneo, off Cape Santubon, through a number of magnificent Pulmogrades. The upper part of the umbrella was pilose, with long papillæ; the periphery was fringed with long tentacles, and the pedicels gave rise to magnificent grape-like masses, the whole being of a delicate white colour, and fully 18 inches in diameter. In the following month, in the strait which separates the island of Singapore from the Malay peninsula, I observed a great number of the same beautiful Pelagian, and accompanying it some specimens of a small and elegant, brown, turquoise-studded species, similar to one I had already obtained in Victoria Harbour, Labuan, and of which, it may be here mentioned, I found a small crab within the umbrella, beneath which it appeared to reside.

To show the vast numbers of these animals which swim freely in the ocean, I will mention that, in the Atlantic, in lat. $3\frac{1}{2}°$ S. and long. 17° W., we encountered a shoal of these animals, all of the same species, the individuals of which were among the most beautiful in form and colouring that I have ever met with. Just before sunset we passed through them for a space of two hours, during which time we had traversed ten miles. Supposing that this shoal were at least as broad as long, it was easy to calculate roughly that there could not be less than thirty millions of individuals constituting it, an estimate probably far below the truth. I procured one, and made a careful drawing of it while still living.

The only exception I met with to the rule I have mentioned (namely, that when Hydrozoa floated they appeared in considerable shoals of one species only) occurred in the great calms which I encountered in the North Atlantic Ocean, in the first fortnight of July, and which extended more or less over upwards of a thousand miles, during which, on two or three occasions, I saw several species of Hydrozoa mingled with vast numbers of compound Ascidians. Some of them were new and strange forms, such as I have nowhere seen figured, some abundant, others but few in number, only appearing occasionally, and therefore very difficult to capture from a moving ship. One of these I did succeed in taking; but there were at least three or four species besides the *Physaliæ* and *Velellæ*.

It occasionally happened that the observation of a shoal of Hydrozoa pointed out some curious facts from which interesting deductions might be made. Thus, while passing through the Indian Ocean, in lat. 13° N., during an entire day (March 17), we ran through shoals of *Aurelia*, meeting from time to time patches in which they were too numerous to be counted, and in each of which there were many hundreds. A noticeable fact I remarked with regard to them, viz. that, without any exception that I could discover, these *Aureliæ* were, during the whole day, swimming in the same direction, or *with* the wind. We were steaming nearly due east, and a breeze was blowing a little south of east; and the umbrellas were all inclined one way, and pointing in the direction towards which the wind was blowing.

On another occasion, in a dead calm, on a beautiful day, off the river Min, I observed great numbers of a large white species. The edges of the umbrella were frilled, and numerous long and delicate threads stretched out straight and parallel; but what struck me as singular was, that these threads did not all float in the same direction, as though drifted from the animal by wind or tide, but, although they were several feet long, they formed three or four distinct bundles, which stretched straight out in different, and often opposite, directions from the body of the animal, from which it appeared that they were propelled by a voluntary effort.

In passing through Banka Strait, owing to the number of rivers (Palembang and others) which flow out of the island of Sumatra, the water had only seven-tenths of the saltness of the ocean; but notwithstanding this comparative freshness, I observed a number of large white Rhizostomas floating just below the surface, apparently unaffected by this peculiar condition.

XLI.—*List of Coleoptera received from Old Calabar, on the West Coast of Africa.* By Andrew Murray, F.L.S.

[Continued from p. 95.]

Lymexylonidæ.

Atractocerus, Palis. Beauv.

Atractocerus africanus, Boh. Ins. Caffr. i. 520.

A single specimen.

I have not seen any typical specimen of Boheman's *A. africanus*; but mine agrees perfectly with his description, and differs from the well-known *A. necydaloides* of Latreille in the particulars which Boheman points out. "At first sight," says he, "very similar to *A. necydaloides,* but is well distinguished from it by the head being ovate, the thorax longer, narrower, oblong-quadrate, and without a reflexed margin behind."

It would appear to range across Africa, and also into Madagascar; for I have seen specimens (probably *A. madagascariensis* of Castelnau) from that country which did not differ from this Old-Calabar species.

Melittomma*, nov. gen. (See fig. 1, p. 316.)

Hylocœto similis, sed magnis oculis sine ocellis et thorace elongato.

Habit and facies similar to those of *Hylocœtus*; the antennæ imbricated strongly in the male, subserrated in the female; the palpi as in *Atractocerus*; the head with very large eyes, as in *Atractocerus,* covering the whole sides of the head and nearly

* From μέλιττα, *a bee,* and ὄμμα, *an eye,—bee-eyed.*

meeting in front, reminding one of the eyes of a bee, in this respect differing entirely from the typical *Hylocœtus,* which has small, black, round eyes placed on the sides of the head and occupying a very small part of it. There is no ocellus on the front of the head. The epistome or front of the head differs in having a projection in the middle and one on each side, above the insertion of the antennæ; in *Hylocœtus* the front margin is quite straight. The back of the head is narrowed into a neck, which commences immediately behind the eyes. The thorax is longer than broad, and subparallel, instead of being broader than long. The first article of the tarsi is longer than in *Hylocœtus,* being about as long as all the rest. Number of abdominal segments five; in the male there is a depression in the middle of the last segment, but none in the female. Coxæ very long, conical, and projecting, those of the anterior legs being nearly as long as the thighs. It has the head of an *Atractocerus,* and the body and elytra of *Hylocœtus,* but appears to me to have more affinity with the former than with the latter.

The type of this genus is the *Hylocœtus brasiliensis* of Castelnau. Lacordaire has already indicated that it must be separated from *Hylocœtus.* Speaking of it and of *H. cylindricus* of Dejean (Cat. ed. 3. p. 128), he says:—"Both having the enormous and strongly granulated eyes of the *Atractoceri* (they are contiguous on the front in the males, a little separated in the females), combined with the elongated thorax of *Lymexylon,* cannot remain among the *Hylocœti.* They manifestly form a genus intermediate between the latter and the *Atractoceri.*" (Lacord. Gen. Col. iv. 503.)

Although the facies is different from *Lymexylon,* the majority of the characters are the same. The most important difference is in the antennæ, which in *Lymexylon* are filiform, while in the present genus they are imbricated.

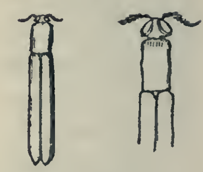
I entirely agree with those who object to the multiplication of genera, and prefer, wherever it is possible, to make the necessary subdivisions in the form of subgenera, which may serve the purpose of the student of the particular family without overburdening the general nomenclature. In this case, however, it would lead to a wrong appreciation of affinities were we to do so. Were we, on the strength of its facies, to make this form a subgenus of *Hylocœtus* or *Lymexylon,* it would imply that it was nearer them than *Atractocerus,* and that the northern type of the family extended into Africa south of the Sahara, which, so far as we yet know, it does not; and to make it a subgenus of *Atractocerus* would be to treat with too little regard the abortive elytra of the latter.

Melittomma castaneum. Fig. 1.

Castaneum, elytris dilutioribus, opacum, levissime punctatum, sericeo pubescens; thorace elongato, fere parallelo, lateribus medio parum angulatis; elytris $3\frac{1}{4}$ thoracis longitudine.

Long. 9 lin., lat. $1\frac{1}{3}$ lin.

1



Very close to *Hylocœtus brasiliensis* of Castelnau, almost the only distinction being that it is a very little smaller, darker in colour, and that the posterior lateral margins of the thorax are sinuate, while in *brasiliensis* they are straight and form a slightly obtuse basal angle. It is a good deal like *Hylocœtus dermestoides*, but longer and of firmer texture, chestnut-coloured, the elytra paler than the head and thorax, very finely punctate and fulvo-sericeo-pubescent. The eyes are subtriangular in shape; the granulations interspersed with a short, fulvous, silky pubescence. The thorax is a little longer than broad; the sides are slightly angled in the middle, where it is widest, and slightly sinuate both before and behind the middle; the anterior angles obtusely rounded, posterior angles rectangular; the surface is finely granulosely and very closely punctate, dull, with sericeous reflexion from the pubescence; there is a slight depression on each side behind the middle, and before it towards the anterior angles, and also before the middle on each side of the disk; the sides are very finely margined, most so posteriorly; the anterior margin is nearly straight, slightly emarginate in the middle; the basal margin slightly bisinuate. Scutellum nearly oblong, angles of the apex rounded. Elytra more than three times the length of the thorax, rather more finely granulosely punctate than the thorax, most so towards the base and shoulders, which are very slightly shining; there are four slightly raised costæ, besides a slightly raised sutural line and outer margin; the two innermost costæ are united together near the apex, and from the point of union a single line continues obliquely outwards and backwards a short distance, when it is united to the next costa; this last is very faint, and is least distinct towards the base; the outer costa is near the margin, and scarcely visible when viewed from above. Each elytron terminates at the apex in a peak, the termination of which is rounded. There is a slightly raised sutural line; but the space between it and the innermost costa falls towards the suture. The underside is sericeous and granulosely punctate, like the upper. The legs are very like those of the Heteromerous genera *Serropalpus*, *Phloiotroia*, and the neighbouring groups, as indeed are those of the whole family of Lymexylonidæ.

Only a female specimen received. The above description therefore applies only to the female; but, as it is almost identical with *M. brasiliense,* I have taken the characters of the male specified in the characters of the genus from one of that species.

This is another example of a Brazilian form occurring at Old Calabar.

I may take this occasion to say that I think the family to which this species belongs (the Lymexylonidæ) is not here in its right place. Although actually pentamerous, it appears to me that the species composing it are Heteromera in disguise, and that their place is next the genera I have above mentioned. On the same principle that botanists disregard the rules of the Linnæan system when they run counter to natural affinity, entomologists ought, I think, more frequently than they do, to disregard the tarsal characters when inconsistent with other indications of affinity. Westwood (with his admirable *flair entomologique,* that instinct for affinity which so rarely errs) acknowledged this relationship between the Lymexylonidæ and Melandryadæ in his 'Modern Classification of Insects;' and Lacordaire, in alluding to his remarks, also admits the analogy. Both, too, in placing the family in or near its present position, admit that it is not placed satisfactorily. It comes awkwardly in between *Ptinus* and *Clerus* (where Lacordaire has placed it), and not much better between *Ptinus* and *Bostrichus* (where Westwood has put it). But if it is to come among the Pentamera, there is no better place for it. They have bent to that artificial test; but in doing so they have removed it from a group of insects like it in facies and habit, of similar structure, and endowed with some of the exceptional peculiarities which are to be found in this family. That group is a cluster of Heteromerous genera belonging to the Melandryadæ. All of them have the underside of the body and legs and tarsi (except in the number of articles) constructed on the same principle, and that a principle deviating considerably from that of the Pentamera. Some of them, too, as *Serropalpus,* have a similarity in outward appearance to the Lymexylonidæ. In species of that genus and others of the Heteromera not far distant from it, "Nature has played strange antics" with the maxillary palpi, turning them into curiously serrated organs in *Serropalpus,* into strange long flexible trunks like the antennæ of *Blatta* in *Nemognatha,* and into distorted indescribable masses in *Cerocoma;* and in the Lymexylonidæ an analogous distortion of these organs into flabellated plates occurs. I do not remember any similar abnormal vagary appearing in the palpi of any other group of Coleoptera, except in the Palpicornes and in some of the Pselaphidæ, where it is of another character. Further, in this same heteromerous group we have a number of species where the elytra are very much diminished in size, and some (as *Myodites*) where they are almost as little developed as in *Atractocerus.* Again, in this family the number of abdominal segments varies in different genera, the number being merely a subordinate (generic) character; so it is with the Rhipiphoridæ. Now such resemblances or coincidences are to me very suggestive of affinity. We find constancy and inconstancy characteristic of whole sections of animals and plants. One tribe of plants the horticulturalist can bend in every direction he pleases; another is like cast iron, immoveable. It would be a phenomenon casting doubt on its affinity to find a plant apparently belonging to the latter varying like the former. I do not think that, in this present case, the existence of the curious phases of development to which I refer tells us more than that the Lymexylonidæ belong to that part of the Heteromerous family in which similar variations are found. Their nearest allies among the latter must be sought on other grounds, viz. the ordinary similarity of parts. Such a constitutional character is more vague, and, although probably as certain, extends over a wider field. I therefore think Westwood was wrong in condemning the earlier British entomologists who wished to place *Lymexylon* with *Cantharis* (for, before Westwood spoke, others had already seen the Heteromerous affinity) merely because he thought it came nearer *Helops* and *Melandrya,* and still nearer the Malacodermata. The character reaches as far as the abnormal deviations in question extend.

If the reader asks why I, holding that this is not the proper place for this family, still place it here, my answer is that I do so for his convenience; he would not look for it anywhere else. And as this is not an attempt to amend the classification of Coleoptera, but simply to record what species are found in Old Calabar, I sink my own opinions on such theoretical points and place the species in the order where they will most naturally be looked for; and that is, in the order followed by Lacordaire. Where I can follow my own proclivities without inconvenience, I do so.

Cleridæ.

Stigmatium, Gray.

Stigmatium dorsiger, Westw. Proc. Zool. Soc. 1852, p. 37.

I can see no difference between my specimens and Westwood's description of this species, except that he says that under a lens the surface of the elytra is finely punctate. In my specimens there is some fine granulation, but no punctation.

A number of specimens have been received. They vary a good deal in intensity of colour and degree of denudation of pubescence.

Erymanthus, Klug.

Erymanthus horridus, Westw. Proc. Zool. Soc. 1832, p. 35.

Erymanthus vesuvioides, Thomson, in Rev. et Mag. Zool. 1856, p. 114.

Var. *purpureo-niger*.

Three specimens.

Prof. Westwood describes and figures his species as shining black, with rufo-piceous protuberances. M. Thomson's specimens of *E. vesuvioides* are described and figured as varying in colour, the ground-colour being ferrugineo-testaceous encroached upon by brown and black. My specimens are all three of a rich shining dark tawny claret-colour, almost black, with rufo-piceous or tawny brown shining through on the tops of the tubercles. With the exception of the differences in colour, I see no distinction between my specimens and the descriptions and figures of these species respectively given by Westwood and Thomson. They all come from West Africa:—Prof. Westwood's from Cape Palmas; M. Thomson's from Grand Bassam; and mine from Creek Town, Old Calabar.

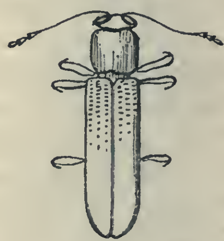
Thanasimodes, nov. gen. (See fig. 2, p. 320.)

Elongatus; palparum maxillarium ultimo articulo securiformi. Prothorace subquadrato, angulis rotundatis; elytris longis; femoribus posterioribus haud apicem elytrorum attingentibus; ceteris fere ut in *Thanasimo*.

Elongate, subcylindrical, shining and metallic. Mentum transverse, narrow. Ligula bilobed, the lobes diverging. Last article of the labial palpi very large, transversely securiform; that of the maxillary palpi also securiform, but not half so broad. Labrum emarginate. Head declined, ovular. Eyes rather large, nearly on a level with the rest of the surface of the head in front, but projecting a good deal behind, the head being narrower behind them; rather strongly emarginate on the underside, distinctly but not coarsely granulated. Antennæ longer than the head and thorax, rather slender, of eleven articles, the first conical and bent, second to eighth flattened subcylindrical, second moderately long, third longer than the second, fourth about the length of the second, fourth to eighth gradually but very slightly increasing respectively in length and thickness; the ninth to eleventh triangular and a little thicker than the preceding, forming a loose slender club; the eleventh largest, unequally ovate, and acuminate. Prothorax subquadrate, convex, with the sides subparallel and the angles rounded, constricted at the base so as to form a narrow short peduncle. Elytra long, broader at the base than the thorax, nearly parallel, and rounded behind. Wings ample. Legs moderate; the posterior thighs not reaching nearly to the end of the elytra; the tibiæ are grooved, rather large; tarsi with the first article invisible, except under the lens and when viewed laterally or from below, when it can be discerned as a small plate below and alongside the lower and basal part of the first apparent (the second) article; this second article is rather long, the third is shorter, and the fourth short; the claws are appendiculate, and not dentate, but with a slight prominence at the base. The abdomen has five segments, besides the anal projection.

Thanasimodes metallicus. Fig. 2.

2



Nitidissimus, sparsim pilosus, supra viridi-metallicus, subtus viridi-cyaneus; abdomine versus apicem et femoribus læte rufis; thorace levissime et parce punctato; elytris striato-punctatis, striis versus apicem evanescentibus.

Long. 11 lin., lat. $3\frac{1}{8}$ lin.

Very bright and shining clear metallic green above, and bearing scattered long fine fulvous hairs; below blue or greenish blue, with the anal appendage and last segment of the abdomen of a bright red, which extends along the external margin of one or more of the preceding segments; there is also a tinge of red on the margin of each of the segments and on the metathoracic parapleuræ; the femora, with the exception of the tip and the base, are of the same red colour, although not so bright. Antennæ, labrum, maxillæ, palpi, and tarsi brown; mandibles black. Head rounded, very smooth, with a few faint punctures and fine fulvous hairs on the surface, and a few wrinkles above the eyes. Thorax convex, very smooth and shining, with a slight trace of a transverse depression near the front, with a few faint punctures and fine hairs scattered over the surface; the sides subparallel, the angles rounded, the base constricted, the constriction or peduncle wrinkled. Scutellum impunctate, subtriangular, with the apex rounded. Elytra three times the length of the thorax, punctate-striate, the striæ deeper towards the base, and disappearing on the posterior half, or only to be traced in very faint distant punctures and hairs; shoulders distinct, sides inflexed and margined. The underside is shining, finely punctate; the segments of the abdomen more deeply and distinctly (but still very sparingly) punctate. The legs are more pilose than the body, and the lamellæ of the tarsi are fulvous.

One specimen.

This is one of the largest and perhaps the finest of the *Cleridæ.*

Malacodermata.

Hedybius, Erich.

Hedybius cæruleus.

Supra læte cæruleus, antennis pallidis, articulo primo et articulis duobus ultimis luridis; subtus et pedibus nigris; nitidus; capite lævi, antice utrinque impresso; thorace quam caput angustiore, subrotundato, lævi, versus latera et postice late marginato, antice leviter transversim impresso, disco modice convexo; elytris postice quam antice parum latioribus, fortiter et dense granulatim punctatis.

Long. $2\frac{1}{4}$ lin., lat. $\frac{3}{8}$–1 lin.

Above rich deep cærulean blue; the underside and the legs black; antennæ pallid testaceous, with the first and the last two articles lurid or piceous. Head smooth, longitudinally bi-impressed in front. Thorax narrower than the head, rounded or, rather, octagonal or hexagonal in shape, with all the corners rounded off, smooth, shining, and impunctate; the disk moderately convex, slightly depressed in front and surrounded on the sides and base with a broad deep channel. Scutellum distinct. Elytra broader behind than in front, deeply, coarsely, and closely granulosely and irregularly punctate, the punctation not so deep towards the base and in the neighbourhood of the scutellum and shoulders; the space near the scutellum depressed; the shoulders prominent; a distinct line near the suture and along the outer margin; apex rounded; the exsertile vesicles on the underside of the thorax and abdomen distinct.

Apparently pretty common.

The genus to which this species belongs is the African representative of *Attalus,* which is not found in Africa proper, *i. e.* south of the Sahara, being a European genus and only found in Africa in the Mediterranean district. Erichson describes a species of *Attalus* from Tasmania, which, however, I have not seen.

Of this African genus there are upwards of a dozen species, which have been described by Erichson, Boheman, &c., all from the Cape, except one from Abyssinia.

Lampyridæ.

Luciola, Casteln.

(Subgenus *Delopyrus,* Motsch.)

Luciola bimyxata.

Testaceo-fulva; capite nigro; prothorace testaceo, medio plus minusve nigro; scutello pallido; elytris singulis margine testaceo circumcinctis; pedibus pallidis.

Long. $3\frac{1}{2}$ lin., lat. 1 lin.

Pale dirty testaceous brown; females pubescent both above and below; males pubescent below. Head black, punctate. Eyes in the male very large and prominent, in the female small and level with the head. Thorax testaceous, with a larger or smaller black space in the middle and towards the anterior margin; strongly punctate; transverse; anterior margin projecting in the middle; sides parallel and nearly straight; anterior angles rounded; base bisinuate, posterior angles projecting and nearly right-angled; the sides slightly reflexed; the base (except the angles) transversely bisinuately impressed close to the margin, and with a rounded depression on each side, just within the projecting angles. Scutellum large, elongate, truncate at the apex, widest at the base, pale. Elytra with a pale margin running round each from the shoulder to the suture; irregularly punctate, and bearing faint traces of two or more costæ. Underside finely punctate; the thorax and margins of the metathorax pale testaceous. In both sexes the last two segments of the abdomen are alone phosphorescent, and nearly white and impunctate; pygidial segment rounded triangular.

Apparently rather rare.

From both sexes having only two segments of the abdomen phosphorescent, the species should belong to one or other of Motschoulsky's subgenera *Delopyrus* and *Delopleurus* (both also from Africa, and each represented hitherto by only one species, the former from South Africa, the latter from Mozambique), that being the main character of these sections. M. de Motschoulsky gives characters for distinguishing them between themselves founded on the form of the thorax and pygidium. This species comes between the two as regards the thorax, it being neither in the form of a crescent nor a transverse square (which are the respective characters of that part given by Motschoulsky), it being indeed somewhat rounded in front, but subquadrate behind. In regard to the pygidium it corresponds with *Delopyrus*. If it must go to either one or the other, that subgenus seems therefore to have the stronger claim to it.

I have called the species *bimyxata*, or "with two wicks," in allusion to there being only two phosphorescent segments of the abdomen.

Lampyris, Fab.

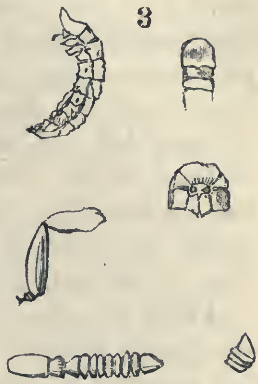
Lampyris pharos. Fig. 3.

Femina testacea; antennis brevibus; capite occulto infra thoracem; prothorace antice rotundato, postice quadrato; aptera, pedibus compressis.

Mas ignotus.

Female.—Pale testaceous or dirty fawn-coloured, with a velvety down which looks whitish in different lights. Prothorax a large plate rounded in front, quadrate behind, covering the head, which is small and placed nearly in the middle of the underside, and from it a raised rib runs obliquely to each of the anterior angles of the underside, and another straight backwards to the base, forming the foundation of the sides of the thorax, each side of which meets the other side in a ridge at the sternum, like the ridge of a house inverted. The head is withdrawn into the triangular tunnel thus formed; the eyes are black, sunken; the antennæ short, thick, eleven-jointed; the palpi also very short, with the joints like cups within each other. There are no elytra, but on the middle of the back of the mesothoracic segment there are faint indications of a suture. The stigmata are very distinct on the underside; the legs are lamellate, and the tarsi short and thick.

3



I have given the above description from two specimens which I received from the Rev. Mr. Waddell. He mentioned that the insect gave a strong continuous steady light for hours, which has suggested the name. The terminal segments show no signs of having been phosphorescent, being of the same texture as the rest of the surface.

Mr. Waddell informs me that it is rare at Old Calabar.

XLII.—*Synopsis of the African Squirrels* (Sciuridæ) *in the Collection of the British Museum.* By Dr. J. E. Gray, F.R.S., V.P.Z.S., Keeper of the Zoological Department.

The British Museum contains a large collection of the Squirrels of various parts of Africa. The series contains the original type specimens of the species described by Kuhl from the Congo, Waterhouse from Fernando Po, Ogilby from the Gambia, Rüppell from North and Eastern Africa.

There are also three or four specimens purchased from M. du Chaillu; but they can scarcely be regarded as the types of the species described in the 'Boston Journal of Natural History' under his name*, as only two of them bear any names, viz. :—

* The American zoologist who misled M. du Chaillu into believing that

1. *Sciurus eborivorus,* which is evidently only a bad bleached specimen of *S. Stangeri*; and, 2. *Sciurus minutus,* which is a distinct species of tree-squirrel. All the specimens in his collection were in a bad condition, very much bleached, and injured by dirt; so that it is very difficult to compare them with the descriptions, which were probably taken from the specimens before they were so damaged by exposure and bad usage. M. du Chaillu did not seem able to identify them with the names, or at least he did not do so when requested; so that it was of no use for the Museum to purchase his specimens. Indeed it is quite clear that M. du Chaillu is not responsible for the distinction of the species.

I may cite, as an instance of his want of zoological knowledge to qualify him for the writing of the paper that appears under his name, that he sent to the British Museum, with the other animals, at the commencement of his last travels, the skull of a Bush-Antelope or Bush-Goat (which I described, as discovered by him, under the name of *Cephalophus longiceps,* in the 'Proceedings of the Zoological Society' as soon as it arrived); yet he does not mention the animal in his narrative, and says, in the *résumé* of the zoology of the district, that antelopes are not found there (!). In the same manner he sent specimens of two kinds of *Manis,* viz. *M. tetradactyla,* with a long tail, and *M. africana* with a short one. The occurrence of only one species is mentioned in the narrative, showing that he did not know that he had collected and sent home two very distinct species. The short-tailed species was not discovered by either Dr. Baikie or M. du Chaillu; for it is evidently the short-tailed *Manis* that Illiger named *Manis gigantea,* from Guinea, more than forty years ago, which had been confused as a synonym with *Manis brachyura* of India, and so overlooked.

Temminck, in his 'Esquisses Zoologiques sur la côte de Guinée' (Leyden, 1853), gives a list of the African Squirrels, and several descriptions, in his usual general style, of the species which he regards as new and therefore gives new names. All the names in the list are marked with an asterisk, which, we are told, in a former page, indicates the adult specimens in the Leyden Museum, then under his direction; but when we turn to the notices of them in the following pages, he states that he only knows several of the species from the descriptions of the authors quoted. He places *Sciurus congicus, Sc.*

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he had discovered sundry new mammalia, and who wrote the paper that appeared in the 'Journal of the Boston Natural History Society,' seems to be ashamed of his work, and leaves the traveller whom he misled to bear the discredit of his carelessness or ignorance.

getulus, and *Sc. flavivittatus* (which he misnames *S. flavivittis*) with the earless ground-squirrels called *Xerus* by Ehrenberg, though they all have well-developed ears, soft fur, and are as arboreal in their habits as the squirrels of Europe.

Compiling zoologists, who only have the descriptions of other authors to work from, are apt to make such mistakes and refer a species to the wrong group, or to combine very different species as synonyms; but it is surprising that M. Temminck, with the specimens before him, should have done so.

I believe, as well as I can make out the very general descriptions he gives of the species, that some of those which he has described as new are the species which were described with more detail by Dr. Smith and Mr. Ogilby, which he failed to recognize; he has thus encumbered the list with "doubles emplois," which he so constantly accuses his contemporaries of doing.

Some of the African Squirrels are distributed over the whole of Africa. Thus we have *Sc. annulatus* from the north to the south and from the west to the east of that continent; and it is the same with other species.

The young specimens are coloured like the adult.

The African Squirrels, especially those found in the tropical regions, have the fur much brighter and more vivid at some seasons of the year than at others, and the fur of the males is generally brighter than that of the females; but there is little fear of these being mistaken for specific differences, except by such zoologists as are in the habit of describing allied species from single specimens and on very slight characters.

I. *Cheek-pouches none; body covered with soft fur consisting of elongated more or less rigid hairs and a soft under-fur. Ears ovate, well developed.* Arboreal. Tree-Squirrels.

2. Sciurus.

Gray, Ann. & Mag. Nat. Hist. 1867, xx. p. 271.

* *Fur one-coloured; tail annulated.*

1. *Sciurus minutus*, Du Chaillu, Boston Journ. 1860, vii. p. 366; Travels, p. 453, t.

Size of a small mouse. Fur soft, olive-grey, yellow-washed; hairs mouse-coloured, with yellow tips: chin, throat, and underside pale yellow-grey: tail like back, but obscurely black-ringed; hairs yellow, with subterminal black band and yellowish tip. Ears rounded, covered with soft hair forming a tuft and fringe.

Hab. West Africa (Du Chaillu). Type in B.M.

*** Back with four black stripes. Fur very soft. Ears covered with soft hairs.*

2. *Sciurus Isabella*, Gray, P. Z. S. 1862, p. 180, t. 24.

Fur olive-grey, very minutely punctulated; chin, underside, and inner side of limbs greyish white: tail black, obscurely pale-ringed, tip black; hairs reddish yellow, with a broad subterminal black band and grey tip.

Hab. Camaroon Mountains (Capt. Burton). B.M.

3. Macroxus.

Gray, Ann. & Mag. Nat. Hist. 1867, xx. pp. 271, 275.

A. *The cutting-teeth broad. Tail elongate, longer than the body and head, black-ringed. Underside of body nakedish. Large-sized.*

a. *Lateral streak none; sides of neck like back.* Nos. 1, 2.

b. *Lateral streak white; sides of neck white.* No. 3.

B. *Cutting-teeth compressed, narrow. Underside of the body generally well covered with hair. Middle-sized or small.*

a. *Body without any pale streaks.*

* *Tail black, pale-ringed.* Nos. 4–8.

** *Tail dark, punctulated.* No. 9.

*** *Tail red, one-coloured.* No. 10.

b. *Body with a pale streak on each side.* No. 11.

c. *Back with a pale streak on each side.* No. 12.

d. *Shoulders and fore part of sides with a short pale streak.* No. 13.

e. *Back with two pale streaks on each side.* No. 14.

A. *Cutting-teeth large, broad. The underside of the body nakedish, the hairs sparse. Tail elongate, much longer than the body and head, black-ringed; hairs long. Large-sized.*

a. *Body without any white marginal streak on each side; sides of neck like back.*

1. *Macroxus Stangeri.*

Sciurus Stangeri, Waterh. P. Z. S. 1842, p. 127; Fraser, Z. T. t. 25.
Sc. caniceps (winter), Temm. Esq.
Sc. eborivorus, Du Chaillu, Boston J. N. H. vii. p. 363; Travels, p. 284, t. 41.

Olive-grey, varied with the long white tips to some of the hairs; sides of neck, shoulders, and thighs like back; throat and underside of body grey or blackish; the hairs of the back black at the base, with a broad grey and then a broad black ring and a yellowish tip; tail black, with narrow white rings.

Hab. Fernando Po (Thompson, B.M.; Mr. Waterhouse, type; Burton, B.M.; Du Chaillu, B.M.). Niger Expedition (Fraser, B.M.)

Sciurus mutabilis, Peters, Säugeth. 131, t. 31, 32. f. 2, Mossambique, is probably a variety of *S. Stangeri,* with white tip to the tail.

The species is known from *M. Wilsonii,* which is also nakedish beneath, by the size of the cutting-teeth.

2. *Macroxus shirensis.*

Fur whitish grey, closely punctulated with black; hairs of the back dull grey at the base, with a broad black subterminal band and an opaque-white tip; tail elongate, black, white-ringed, and with a black tip; hairs of the tail black, with four white rings and a grey tip.

Hab. East Africa, River Shire (Dr. Livingstone).

Smaller and paler than *S. Stangeri,* the fur shorter and closer; the cutting-teeth in one specimen are as wide as those of *M. Stangeri,* and in the other rather narrower.

These squirrels vary in the width of the under cutting-teeth; in general they are nearly as wide in front as the upper ones, but in some specimens they are more compressed and narrower.

b. *Body with a white marginal streak on each side; sides of neck white.*

3. *Macroxus caniceps.*

Sciurus caniceps, Temm. Esq. 127 (summer), 1853.
Sc. Nordhoffii, Du Chaillu, Boston Journal, 1860, vii. p. 363.

Dark olive-grey, black-and-yellow-dotted; crown and temples black, minutely white-dotted: tail darker, with narrow white rings; hairs very long, yellow-and-black-ringed, with a grey tip: feet reddish; sides of neck, throat, and underside of body white, very sparsely hairy, except on the throat and near the dark part of the back.

Hab. West coast of Africa (Verreaux): B.M. Ashantee: B.M.

The red spot on the back of the ear is not always visible; it depends on the position of the hair. This species is at once known from *S. Stangeri* by the darker colour, more minute punctulation of the fur, the white sides of the neck, and streak along the sides of the body.

Mr. Nordhoff is the reputed writer of M. du Chaillu's first book of travels.

B. *Cutting-teeth moderate, narrow; underside of the body covered with hair, except in* M. Wilsonii. *Middle-sized or small Squirrels.*

a. *Body without any lateral streak.*

* *Tail elongate, more or less distinctly pale-ringed.*

4. *Macroxus Wilsonii.*

?*Sciurus Wilsoni,* Du Chaillu, Boston Journ. N. H. 1860, vii. p. 364.

Fur rather sparse, soft, dark olive, yellow-and-white-punctulated, of the throat and underside of the body very sparse and soft, pale reddish; the outer side of the fore legs and thighs redder; feet red: tail very bushy, black, very obscurely pale-ringed and greyish-washed, greyer at the tips; hairs long, white at the base, with two broad black and one grey ring, and a grey tip.

Hab. West Africa, Ovenza River (Du Chaillu): type? B.M. Fernando Po: B.M.

The very bushy tail and naked underside are peculiar. It differs from the male specimen of the next species, which is nakedish beneath, in the colour of the hairs of the tail.

5. *Macroxus rufobrachiatus.*

Sciurus rufobrachiatus, Waterh. P. Z. S. 1842, p. 128; Fraser, Zool. Typica, t. 24; Temm. Esq. 136.
Sc. rufobrachium, Gray, List Mamm. B. M. 146 (misprint).
?*Sc. subalbidus,* Du Chaillu.

Fur olive, punctulated with white; chin and underside pale rufous: tail like the back, with close white rings and a blackish tip; hairs black, with three or four yellow rings: the hinder edge of the fore legs and inner side of the thighs bright red.

Hab. Fernando Po (Waterhouse). Type in B.M.

Var. *Waterhousii.* Darker; underside red and very spare of fur; tail nearly black, hairs black, with several narrow bright-yellow rings.

The upper front cutting-teeth have two very obscure depressions, scarcely to be called grooves, near the inner side, which are not observed in other *Macroxi.*

See *Sciurus subalbidus,* Du Chaillu, *l. c.* 365, who describes the under surface as thickly covered with hair.

6. *Macroxus punctatus.*

Sciurus punctatus, Temm. Esq. Guinée, 138, fide Verreaux.

Blackish grey, variegated with black and white rings; face, chin, and cheeks rufous; throat and chest pale rufous grey; belly bluish grey. Tail elongate, slender, cylindrical, with close black and orange rings and a black tip; hairs orange, with two black rings and a grey tip.

Var. Face and chest blackish grey like belly.

Hab. West Africa: B.M. Ashantee: B.M. Guinea (Temm.). Niger Expedition (Fraser, B.M.).

Known from the former species by the bright colour of the tail and the absence of the red hinder edge of the fore legs.

7. *Macroxus annulatus.*

Sciurus annulatus, F. Cuv., Desm. 1820; Temm. Esq. 1837.
Sc. gambianus, Ogilby, P. Z. S. 1835, p. 103; Temm. Esq. 140.
Sc. multicolor, Rüpp. Atlas, t. 13.
Xerus multicolor, Temm.
Sc. cepate, A. Smith, Ill. Z. S. A. t. 5; Peters, Säugeth. 130, t. 32. f. 4 (skull).

Fur pale olive-grey, punctulated with black and yellow; throat and underside yellowish or white; face, sides of the throat, shoulders and thighs, and feet yellower. Small size.

Var. *albina*, West Africa (Rendal, B.M.).

Hab. West Africa, Gambia (Rendal, Ogilby, type). Central Africa (Dr. B. Baikie, B.M.). East Africa, Abyssinia (Rüppell, B.M., type). South Africa (Dr. A. Smith, B.M., type; Sundevall, B.M.).

Not distinguished by Temminck.

8. *Macroxus isabellinus.*

Fur thick, close, olive-brown, closely punctulated with grey and black; tail like the back, end very obscurely ringed, tip dark grey, hairs black-and-yellow-ringed; throat and underside of the body greyish white.

Hab. West Africa. B.M.

This species is very like the former; but it is larger, the fur much thicker, longer, and darker below, and the tail much more bushy.

The adult and young specimens in the British Museum, obtained from Mr. Warwick, are much alike, and different from any of the varieties of *M. annulatus*.

*** Tail elongated, punctulated, not or only very obscurely annulated. Small-sized.*

9. *Macroxus poensis.*

Sciurus poensis, A. Smith, S. A. Zool. Journ.; Temm. Esq. 141.

Dark olive-grey, minutely punctulated with black and yellow; chin, throat, and beneath rufous grey; hair lead-coloured, with yellowish tips. Tail elongate, coloured like the back, with a fuller black tip; hairs yellow, with two black bands and a black tip.

Hab. Fernando Po (Thompson): B.M. Ashantee: B.M.

See *Sciurus musculinus*, Temm. Esq. 142; Guinea. Body 5 inches, tail $6\frac{1}{2}$ inches long. Perhaps same as former. Who does not recognize *S. poensis* from Dr. A. Smith's description?

**** Tail one-coloured, red. Middle-sized.*

10. *Macroxus palliatus.*

Sciurus palliatus, Peters, Monat. 1852, p. 273; Mossam. 184, t. 31. f. 1 (young), t. 32. f. 3 (skull).
Sc. ornatus, Gray, P. Z. S. 1864, p. 13, t. 1.

Head, neck, chest, legs and thighs, and under part of the body red; tail bright red bay; back, shoulders, rump, and upper side of the base of the tail olive-grey, punctulated with white and black.

Hab. South Africa, Natal (Fosbrooke; Gray's type in B.M.). Mossambique (Peters).

b. *Body with a pale stripe on each side, separated from the pale colour of the under part of the body by a band of the same colour as the back.*

11. *Macroxus pyrrhopus.*

Sciurus pyrrhopus, F. Cuv. Mamm. Lith. t.; Temm. Esq. 132.
Sc. rubripes, Du Chaillu.
Sc. erythropus, F. Cuv. Mamm. Lith.; Waterh. Cat. Mus. Zool. Soc. 46.
Sc. leucostigma, Cuvier, fide Verreaux (not Temm. Esq. 133).
Xerus congicus, Temm. Esq. 125 (not *Sc. congicus*, Kuhl).

Dark brown-grey, dorsal streak yellowish; sides of the head, throat, shoulders, sides of the body, outer side of thighs and legs, and feet red; chin, throat, chest, belly, and inner side of the legs white: tail black, obscurely pale-ringed, whitish-washed, with a black tip; hairs grey at the base, with a very broad black ring and grey tip.

Hab. West Africa: B.M. Guinea: B.M. Ashantee: B.M. Fernando Po: type, Waterhouse and A. Smith.

Var. *erythrops.* Fur darker, brighter brown, of the head bright red chestnut.

? *Sc. ebii*, Temm. Esq. 129.

Hab. Gaboon (Walker).

c. *Back with a pale streak on each side; cheeks and temples pale-streaked.*

12. *Macroxus congicus.*

Sciurus congicus, Kuhl, Beitr. 66 (young). Type, B.M.
Sc. flavivittatus, Peters, Mossamb. Säugeth. 128, t. 29 (adult), t. 32. f. 1.
Xerus flavivittis, Temm. Esq. 124; Giebel, 59.

Olive-grey, minutely punctulated with grey and black; back with a longitudinal white streak along each side; cheeks with two pale streaks; chin, sides of neck, throat, underside of body, and inner side of legs pale grey: tail obscurely annulated; hairs yellowish, with a broad subterminal black band.

Hab. Congo (Tuckey; Kuhl, type, B.M.).

Very like *Sc. pyrrhopus*; but the dorsal streaks are higher up the sides, the shoulders and thighs are grey, like the rest of the fur, the tail much more distinctly ringed, and the face has pale streaks. The specimen is not half the size of *Sc. poensis*; and it has no appearance of youth. A half-grown specimen of the latter species in the Museum has the shoulders, thighs, and sides as red as the adult. It is well figured by Peters, but rather paler than the Museum specimen.

See also *Sciurus leucostigma,* Temm. Esq. 133, from Guinea.

See *Sciurus superciliaris,* Wagner, Schreb. Säugeth. iii. 212. Giebel refers it to *Sc. annulatus*!

d. *The shoulders and fore part of the sides with a short pale streak.*

13. *Macroxus erythrogenys.*

Sciurus erythrogenys, Waterh. P. Z. S. 1842, p. 129; Fraser, Z. T. t. 26.
Sc. leucogenys, Waterh. Ann. & Mag. Nat. Hist. 1842, p. 203.

Fur blackish, minutely punctulated with white or yellow, rather paler on the sides; sides of head reddish; chin, throat, chest, belly, and inner side of the limbs white: tail black, washed with grey, end black; hairs black, yellowish at the base, with a short grey tip. Young and adult are exactly alike.

Hab. Fernando Po. B.M., Mr. Waterhouse's type.

e. *The back with two pale streaks on each side; sides brown beneath the outer stripes.*

14. *Macroxus getulus.*

Sciurus getulus, Linn. S. N. i. 87; Gervais, Mag. Zool. 1842, p. 4.
?*Xerus getulus,* Temm.
Barbarian Squirrel, Edw. Birds, iv. t. 195.
L'Ecureuil barbaresque, Buffon, H. N. x. 141 (copied Schreb. t. 221).

Hab. Mogador, Morocco (M. Delaporte). Mus. Paris.

This is a species that I have not seen in any English collection. The animal sent by Mr. Drummond-Hay from Morocco as the Ground-Squirrel is *Xerus trivittatus.* It is to be observed that Temminck refers *Sc. getulus* to the genus *Xerus*; so that he probably called *X. trivittatus Sc. getulus*; but M. Gervais, who described a soft-furred squirrel from Morocco, which is the one described by Edwards and Buffon as *Sciurus getulus,* also refers it to the genus *Xerus*!

Sciurus dimidiatus, Waterh., which he thought might be an American squirrel, has much the habit of the African tree-squirrels. It will be noticed among the American Squirrels in the next Number of the 'Annals.'

II. *Cheek-pouches none. Body covered with flat channelled spines, sometimes intermixed with short cylindrical bristles, without any under-fur. Ears rounded, only slightly raised from the head.* Terrestrial. Ground-Squirrels.

6. Xerus.

Gray, Ann. & Mag. Nat. Hist. 1867, p. 271.

Xerus, Ehrenb., Temm. Esq. 121. *Xeros,* Peters.
Geosciurus, Lesson, A. Smith.
Tamias, sp., Gervais.

Head moderate; nose rounded. Ears short, nearly naked, little raised from the head. Cutting-teeth smooth in front. Fur consisting of flat channelled spines, in some species intermixed with black cylindrical tapering bristles. Front claws long. Tail depressed, with two rows of elongated, rigid, drooping bristles. Male organ very large.

["mostly," in the generic character at p. 271, should be "scarcely."]

a. *Fur consisting only of flat channelled spines; back grizzled, without any longitudinal streak.* Xerus.

b. *Fur consisting of flat channelled spines and black cylindrical tapering bristles; back grizzled, with a longitudinal streak on each side.* Geosciurus.

Temminck and Gervais have referred to this genus some *Macroxi.* The flattened form of the fur is certainly the best character, as that agrees with the terrestrial habit of the animal.

a. *Back grizzled, without any longitudinal streak; fur consisting only of flat channelled spines.* Xerus.

1. *Xerus rutilans,* Gray, L. M. B. M. 144.

Sciurus rutilans, Rüpp. Atlas, t. 24.
X. rutilus, Temm. Esq.
Sciurus rutilus, Schinz.
Sc. brachyotus, Ehrenb. S. P.

Fur reddish grey-brown, punctulated with white; orbits, nose, cheeks, and beneath white; tail-hairs reddish brown, with a darker subterminal band and long white tip.

Hab. Abyssinia, Massana (Rüppell's type in B.M.).

b. *Back grizzled, with a white streak along each side from the shoulder to the upper part of the thigh; with flat channelled spines and black cylindrical tapering bristles.* Geosciurus.

2. *Xerus setosus.*

Sciurus dschinschicus, var., Desm.
Sc. albovittatus, Fischer.
Sc. setosus, Forster.
Sc. capensis, Thunb.
Macroxus albovittatus, Lesson.
Sc. namaquensis, Lecht.
Sc. erythropus, Schinz.
Sc. albovittatus, Desm.
Sc. leucoumbrinus, Rüpp. Atlas.
Geosciurus capensis, A. Smith.
Sc. prætextus, Wagner.
Xerus erythropus, Temm. Esq. 124.

Fur grey-brown, yellow-and-black-punctulated; orbits, nose, chin, underside of the body, and streak on sides of the body white; tail white, with two black bands.

Hab. West Africa, Senegal (Rendal): B.M. East Africa, Abyssinia (Rüppell's type of *Sc. leucoumbrinus*, B.M.). North Africa, Egypt. South Africa (Andrew Smith): B.M.

Var. Darker, back punctulated with reddish yellow and black.
Hab. West Africa (Whitfield). B.M.

Prof. Sundevall (in K. Vet. A. Hand. 1842, p. 216) considers *Sciurus leucoumbrinus*, Rüppell, of North-east Africa and Arabia distinct from *Sc. setosus* of South Africa; the latter has the "ears smaller, scarcely prominent, the hairs longer, thinner, and with a long very fine tip; the hairs of the tail are black-brown at the base, then white, with a black band and white tip; the teeth are white in front. In size and every other particular they are similar; but he says the skulls are very different, that of *Sc. setosus* being the broadest, with the zygomatic arch more curved, the nose short, blunt, and linear, not conical and sub-acute."

The form of the ear in the stuffed specimens depends greatly on the animal-preserver, and the length of the tips of the hair on the state of the specimen.

The two species may be distinct; but I am inclined to regard the characters given as only individual peculiarities, though my idea may prove incorrect when a large series from each country can be compared; skulls, however, are as apt to vary as other parts of the animal, and are only to be depended on when a series can be examined and compared.

3. *Xerus trivittatus*, Gray, Ann. & Mag. Nat. Hist. 1842, vol. x. p. 264.

Xerus getulus, Temm. Esq. 124?

Fur dark grey-brown, white-and-black-punctulated; vertebral line rather paler; throat, chest, streak on sides of back, and part of the sides white; belly nakedish, black: tail black-and-white-varied; hairs white, with three black bands.

Hab. North Africa, Morocco (Drummond-Hay). B.M., type.

The specimen in the Museum, which I described in 1842 as *X. trivittatus*, was said by Mr. Leadbeater, from whom it was obtained, to have come from India; but I have no doubt he was misled; and we have lately received living specimens direct from Morocco, some of which are preserved in the Museum. This species differs from *X. setosus* in the spines being thinner, shorter, less rigid, the vertebral line paler, the sides white, and the belly black. The black hairs are not so abundant, and they are not to be observed amongst the white spines that form the streaks.

XLIII.—*On some undescribed points in the Anatomy of the Limpet* (Patella vulgata). By E. Ray Lankester, Christ Church, Oxford.

At the late meeting of the British Association I drew attention to certain structures in connexion with the digestive and urinary apparatus of the Limpet which had not been previously recorded, and which have some importance as bearing on the general morphology of the prosobranchiate Gasteropods. Although I have not yet completed my drawings or fully worked out my notes, I am anxious to give here a brief record of their substance.

Since Cuvier's memoir on *Patella*, M. Milne-Edwards has written on the circulatory organs of that mollusk, and MM. Robin and Lebert have briefly noticed the generative organs, and other authors have paid attention to the nervous system. The points which I believe have been overlooked are:—

1st. The existence of an orifice on each side of the "head," in the angle formed by its junction with the muscular foot, and opening into the blood-sinus surrounding the pharyngeal viscera. These orifices I propose to call the capito-pedal orifices.

2nd. The existence of a pair of very large, orange-coloured salivary glands opening by four ducts (two on each side) into the buccal cavity.

3rd. The peculiar laminated "crop," like that of *Chiton*, resembling in structure the psalterium or manyplies of ruminants.

4th. The form, size, and structure of the renal organ; its communications with the exterior and with the pericardium.

5th. The absence of the oviduct described by Cuvier, or of any such organ. In this matter I can merely confirm MM. Robin and Lebert.

In working out these matters I have been most kindly aided by my friend and teacher, Prof. Rolleston. On my showing to him the capito-pedal orifices, and one or two other points, he investigated them further with me, and has given much of his valuable time and many suggestions towards confirming and elucidating these and other structures.

With regard to the capito-pedal orifices, it seems somewhat extraordinary that they have not been noticed by those very careful observers who confine their studies to the external characters of Mollusca. They immediately overlie the salivary glands, and are often coloured with an orange-red secretion, the origin of which is very obscure. The generative gland is in direct communication with, or, rather, lies in, the cavity into which they open; and they *may* serve as genital pores.

Of the salivary glands and crop I need say no more here. Cuvier did not find either of them; and probably those who have dissected *Patella* since have not directed their attention to the digestive tract.

The renal organ has never been properly described. It is a very large sac spreading between the liver and the muscular tunic or mantle, and in many parts dendroid or branching. It has two orifices, one on each side of the anus, which opens on the right-hand side into the open chamber formed by the extension of the mantle over the "head and neck" of the animal. Cuvier only recognized one of these orifices; and his error has not been corrected. Each orifice is placed on a little yellowish papilla, varying much in size and continuous with the substance of the large anal papilla. The papillal orifice nearer the median line is the smaller, and may be called the supraanal orifice; whilst that on the right hand is larger, and may be called the infraanal. These two orifices *represent two renal organs*, as in Lamellibranchs. The supraanal organ is very small and abortive; it lies in the superficial curve of the rectum, and is continuous around that portion of the intestine with the large infraanal or right kidney-organ. The orifice leads into a small cavity, with reticulated walls of a compact brownish tissue, perhaps contractile. The infraanal orifice leads into a great crescent-like sac which curves round the whole liver-mass, extending under it on the right side over the muscular foot-disk, but on the left side skirting the generative gland and terminating at the left anterior corner; it branches out dendritically on the upper surface of the liver-mass, but does not completely enclose it. This sac has a dark greenish-brown pulverulent tissue, which is to a certain extent laminated; and from its orifice quantities of a dark powder can be forced. It is not improbable that water distends this sac when the limpet is in a state of expansion, and that the liquid which oozes from the animal when touched on its rock, exudes from the infraanal or supraanal orifice.

By most careful dissection, Dr. Rolleston and myself detected what appears to be a minute opening from the pericardium into the supraanal articulated sac, lying in the curve of the rectum. The orifice I found first by opening the pericardium, when it was seen between the bifurcation of the auricle at the right side of the cavity, and was then traced from both the pericardium and supraanal sac in other specimens.

Comparing this with Mr. Hancock's description of the renal organ of Nudibranchs, it is found that they differ chiefly in that *Patella* retains the double character of the organ to a greater extent than do the Nudibranchs; and this is what might be expected from the bilateral symmetry exhibited in other parts of its organization,—*e. g.* the capito-pedal orifices and the disposition of the gills. The small supraanal sac communicating with the pericardium may be compared to Mr. Hancock's "pyriform organ;" but it differs in having a separate communication of its own with the exterior, thereby retaining its character as the left half of Bojanus's organ. The infraanal or right sac and orifice, on the other hand, undoubtedly corresponds to the dendritic glandular sac and orifice of *Doris, Bornella,* &c. Any comparison of adult structures must, however, necessarily be very unsatisfactory in animals which have undergone such different modifications as Lamellibranchs, Prosobranchs, and Nudibranchs; and we can only guess at homologies until the development in each case is fully understood.

As to the absence of oviducts or sperm-ducts, I can most fully confirm MM. Robin and Lebert, Dr. Rolleston having most carefully tested my conclusions on this point before we had seen the paper of the French naturalists.

Reverting again to the capito-pedal orifices, I may just observe that their opening into a blood-sinus is not a little remarkable, calling to mind the discoveries of M. Lacaze-Duthiers as to orifices bringing water from the exterior into the branchial veins of *Tethys, Pleurobranchus,* &c. Whether such be their function, or whether, as seems most probable, they are genital pores, I cannot say. *Chiton,* which is allied to *Patella* very closely, forms a notable exception to the rule of an asymmetrical genital pore among Gasteropods, having two bilaterally symmetrical sexual orifices. The orange-coloured matter surrounding these orifices in *Patella*, and their position close to the mass of the salivary gland, is somewhat inexplicable, unless it should appear that part of the salivary gland is an accessory generative gland.

I have been induced to offer this abstract before proceeding to publish a fuller account, with drawings, as there may be a delay of some time in this; at the same time an opportunity may be obtained of correcting or adding to some of these notes.

XLIV.—*On the Structure of the* Annelida; *including a critical Examination of the most recent Works on this class of Worms.* By E. Claparède*.

A sojourn of five or six months at Naples, during the winter of 1866–67, enabled me to devote myself persistently to the study of the Annelida of its bay. The extraordinary richness of this sea surrounded me with an abundance of materials so great that I could not make use of the whole; and from the very first day I was convinced how erroneous is the opinion of M. Quatrefages † that volcanic shores are poor in Annelida. The poverty which has been detected here and there by that naturalist was certainly due to other causes than vulcanicity.

The Annelida of Naples have been on the whole but little investigated. They have, however, been more studied than is generally supposed. Delle Chiaje, with his indefatigable spirit of investigation, devoted to them many hours of observation. He has accumulated drawings upon drawings, often without taking the trouble to append to them any corresponding text. His publications were made with but little method or continuity. Moreover Delle Chiaje has been but little understood, and often misunderstood ‡. His works are inexhaustible quarries, from which the roughly squared blocks will only be slowly extracted. How many times have I thought myself in a position to publish entirely new facts, only to convince myself, by the careful exa-

* From the 'Bibliothèque Universelle, Archives des Sciences,' September 1867, pp. 1–44. Communicated by the author. Translated by W. S. Dallas, F.L.S.

This memoir forms part of the introduction to a work on the Annelida of the Bay of Naples, to be published under the auspices of the Société de Physique et d'Histoire Naturelle de Genève. This work, which is now in the press, will be accompanied by thirty-one plates in 4to.

† Histoire Naturelle des Annelés, tome i. p. 153.

‡ Delle Chiaje himself complains of having been misunderstood by Carus, Meckel, Wagner, Milne-Edwards, and Grube (Descrizione e Notomia, &c., 1841, tome iii. p. 69). Now-a-days he might still further enlarge this list.

mination of the figures of my illustrious predecessor, that these facts were perfectly familiar to him *. Thus in every page, in the course of this memoir, I shall have to bring Delle Chiaje out of the undeserved obscurity in which he has too often remained immersed, and to show him shining in the first rank. I hope I shall not be accused of partiality in his favour. If I often leave his errors, which I admit are numerous, in oblivion, it is because they have no influence on the progress of science.

The circumstances under which I undertook the present researches were eminently favourable. Science had just been enriched by two important works relating to the Annelida—one by M. Ehlers, the other by M. Quatrefages. Both of them professed more or less to represent the actual condition of our knowledge. Aided by this double compendium, I could advance with much more certainty upon a road which had been rendered easy.

I do not conceal from myself how much I am indebted to the authors of these works for trouble avoided, for facilitated investigation †, for the sapping of errors even before their birth. Nevertheless, without injustice towards them, I may be allowed to say that the compendium has not always performed what it seemed to promise.

The work of M. Ehlers, of which only one part (including the

* At the moment I shall only cite an example taken from beyond the limits of the subject with which I am at present occupied. A fine Dendrocele Turbellarian, *Thysanozoon tuberculatum* (*Planaria tuberculata*, Delle Chiaje, *Thysanozoon Diesingii*, Grube) is found in abundance in the Bay of Naples. In studying this animal, I was struck by various anatomical peculiarities, but especially by the following one:—The male apparatus is formed of two perfectly distinct halves. There exist two penises opening outwards, each separately, in the anterior part of the body, in front of the female pore. Dendrocœla were already known with a single sexual orifice, and others with two; but here was one with three apertures. This exceptional fact naturally struck me. But what was my surprise, on turning over the works of Delle Chiaje, to find a figure, without explanation, without text, without even a name at the bottom of the page, representing beyond any doubt a portion of the ventral surface of *T. tuberculatum*, and indicating very exactly the three sexual pores (see Descr. e Notomia degli Animali senza Vertebre, tab. 109. fig. 19. The male pores bear the letter *d*, and the female pore the letter *r*). This figure has slumbered since the year 1841, unknown to anybody. Delle Chiaje has inscribed at the head of one of his works the motto "*Res non verba.*" He has been faithful to it, perhaps even too faithful.

† In connexion with this, however, it is impossible for me not to point out a defect in the work of M. Quatrefages, which, no doubt, is not to be ascribed to its author. I mean the number of false citations. The quantity of typographical errors in the indication of volumes, pages, plates, and figures exceeds anything that could be imagined, and deprives the work of one of the merits which ought to have led to its most frequent consultation. Nowhere would exactitude have been more desirable than in this sort of dictionary of science.

order Nereidea) has appeared, has nothing general except its title. It contains in reality a series of monographs devoted to certain species found in the Adriatic. These monographs are combined into a sort of whole by taxonomic considerations. There is nothing deserving the name of a 'Treatise on Annelida;' the number of types investigated by the author is too small for this. Nevertheless M. Ehlers's monographs are models of exactitude. Whenever I have had the opportunity of repeating the observations of this anatomist, I have been obliged to admit their perfect truthfulness, even in details of secondary importance.

The 'Histoire Naturelle des Annelés' of M. de Quatrefages corresponds better with its title. It is a real treatise on the Annelida Polychæta. The author has set before him two objects:—in the first place, a natural classification founded on anatomy; and then an enumeration of all names and synonyms, in order to enable any one to find more easily the numerous memoirs and passages relating to Annelida which are now-a-days disseminated pretty nearly everywhere. The author has devoted long-continued attention and assiduous and prolonged labour to this rather dry work, the fruits of which will chiefly be gathered by others. No doubt this immense compilation presents some gaps or omissions, several of which will be indicated in the present memoir; but it could hardly have been otherwise, considering the labyrinth through which the author had to find his way. The clue which the 'Histoire des Annelés' places in our hands will be henceforward a guide which cannot be disdained. This guide, indeed, must not be employed without a check. The author has often consulted plates without taking the trouble to read the corresponding text. The imperfection of a figure, or a slip of the graver, has often led him into serious mistakes. Thus, in his family Nerinea, M. de Quatrefages characterizes the worms of the genus *Pygospio* (Clap.) by the sole circumstance of their having uniramous feet, in opposition to all the rest of the family, in which the feet are biramous *. It is only necessary to open the volume in which I established the genus *Pygospio* † to see that I indicate the feet as biramous, and that I describe in detail each ramus and the setæ which it bears. M. de Quatrefages, neglecting to read the text, has, no doubt established his false diagnosis from a figure on a small scale which accompanies my memoir, in which the dorsal ramus covers the ventral one, and scarcely allows it to be seen. The following is another perfectly similar example. Under the name of *Lumbri-*

* Hist. Nat. des Annelés, tome i. p. 437.

† Beobacht. über Anat. und Entw. wirbelloser Thiere an der Küste der Normandie angestellt. Leipzig, 1863, p. 37.

conereis Edwardsii, I have described* a Eunicean from the shores of Normandy, which M. de Quatrefages refers to the genus *Notocirrus*†, distinguished from *Lumbriconereis* by the existence of a dorsal cirrus on each foot. Now the Annelide in question has the feet of a true *Lumbriconereis*; and I have nowhere described or figured a dorsal cirrus. Here, also, the mistake of M. de Quatrefages arises from his having neglected the text, and attended only to the plate. In this, by a mistake of the the engraver, the foot is represented reversed; and the little terminal ligulet which occurs in all species of *Lumbriconereis* must, no doubt, have been taken, in this position, by the French zoologist for the dorsal cirrus of a *Notocirrus*. Nevertheless a little care ought to have led to the recognition of the reversal of position, especially by M. de Quatrefages, who has not allowed himself to be led into error by the plates of Audouin and Milne-Edwards, in which the feet of *Lumbriconereis* are also represented reversed.

I have cited these two examples because they concern myself; but I have not been worse treated than many others, and I shall too frequently have to point out analogous mistakes in the course of this memoir. Nevertheless I repeat, with a little circumspection, the 'Histoire des Annelés' might be employed as a very useful guide.

On the other hand, I cannot admit that the 'Histoire des Annelés' represents the present state of science from an anatomical and physiological point of view. We owe to M. de Quatrefages a multitude of important observations upon this subject. No one has studied the Annelida so persistently as he; no one, especially, has had under his hands so great a number of types, or studied them from such varied points of view. Elsewhere I have already paid, in the most formal manner, my tribute of admiration to these investigations ‡. Unfortunately, in the strength of his own numerous and profound researches, the author of the 'Histoire Naturelle des Annelés' has too often forgotten that he had predecessors, and that some of his contemporaries were exploring with ardour the same field as himself. No doubt, in a work which is only an epitome of science, history cannot occupy a great space, and the author is obliged to place himself in an entirely objective point of view. But this is not what M. de Quatrefages has done, whose personality is always put forward, even in the narration of facts known twenty or thirty years before the first scientific efforts of the author. Hence

* Beobacht. &c. p. 58.

† Hist. Nat. des Annelés, tome i. p. 376.

‡ See 'Glanures zootomiques parmi les Annélides de Port Vendres.' Geneva, 1864.

results an actual falsification of scientific history, an unconscious falsification, no doubt, but one which we must nevertheless regret. If, in the course of this memoir, I often refer to the labours of old observers, this is partly as a protest against the ostracism with which they are beginning to be treated.

However, if M. de Quatrefages has frequently thought that he could dispense with the observations of his predecessors and contemporaries, it is to his own detriment. How many errors which I shall have to combat would have been avoided if the author had conscientiously studied the works of Rathke, Delle Chiaje, Grube, and many others, if he had taken count of the investigations of histologists such as Kölliker, Leydig, &c. He would not then, as has sometimes occurred to him (with regard to the structure of the branchiæ, for example), have made science retrograde to the period of Pallas.

This judgment may appear severe, but it will be amply justified. Nor do I think that the greatness of the work interdicts one from indicating its defects; moreover that just pointed out could not be concealed. There is a second upon which I cannot keep silence. Why has M. de Quatrefages, whose knowledge of the Annelida is so admirable, permitted himself to be induced to describe so many genera and species from individuals preserved in spirits in the Paris Museum? He knows better than any one else that this kind of work is positively useless, and that the Annelida can only be well studied at the seaside and by means of living individuals. To describe as he has done so many *alcoholic varieties* is to embarrass science with a *caput mortuum* which will require many years to get rid of*.

I shall follow step by step in these pages the introduction to the 'Histoire Naturelle des Annelés,' but neither to reedit it nor to criticise it in the style of a Zoilus. But if it is useless to go over a multitude of facts which are established in it definitively, I wish, nevertheless, to dwell upon some points in which I cannot agree with the author. I also wish to recall many old observations which ought not to be forgotten. In a general way I adopt the terminology of M. de Quatrefages; and when I depart from it, it is not without indicating my reasons.

Regions of the Body and Appendages.

After much discussion as to the equivalence of the external parts of the body in Annelida, most recent authors have adopted the nomenclature of M. Grube, who gives the name of "buccal segment" to the segment which bears the mouth, and that of

* A very competent judge, Prof. Schjödte, of Copenhagen, said to me only a few days ago, "The museums press heavily upon science"—a phrase only too true in many cases.

"cephalic lobe" (*præstomium,* Huxley) to everything situated in advance of it. I adopt this view, which has the advantage of not attempting to solve the question, still undecided in many cases (*Glycera, Nemodrilus,* &c.), of the number of segments composing the cephalic lobe. Moreover the buccal segment is often so similar to those which follow it that it is hardly possible to refer it to a different region. M. de Quatrefages, taking up an opinion already maintained by Rathke*, regards the cephalic lobe and buccal segment as together forming the head; but he does not himself adhere too rigidly to this opinion, since in his descriptions he most frequently gives the name of *head* to the cephalic lobe alone.

M. de Quatrefages has endeavoured to introduce a simplification in the nomenclature of the appendages of the cephalic region, by giving the name of *antennæ* to all the appendages which spring from the cephalic lobe, that of *tentacles* to all those of the buccal segment, and that of *tentacular cirri* to those of the first feet, when they display characters which distinguish them in a marked manner from their homologues belonging to the feet placed further back. This nomenclature, which seems well chosen at the first glance, nevertheless presents many inconveniences, and is often specifically inapplicable. In the first place, the appendages of the cephalic lobe sometimes differ entirely among themselves both as regards function and structure, which has led most authors to give them different names. What a difference there is, in particular, between the palpi (*antennes latérales,* Aud. & Edw., Quatref.) and the frontal antennæ of the *Lycoridea*!—the former fleshy, multiarticulate, partially retractile, and occupied by the expansion of the largest nerve of the body; the latter filiform, simple, not retractile, and scantily provided with nerves. What a distance there is likewise between the palpi (Kinberg and all recent authors) and the true antennæ in the *Aphroditea*! So true is this, that M. de Quatrefages has not been able to remain faithful to his principle in all cases. Thus, in the *Syllidea,* he retains the name of *frontal lobes* for organs evidently homologous with the *palpi* of the *Lycoridea,* and which ought, consequently, in his nomenclature to bear the name of *antennæ*. This homology was demonstrated by Rathke; and no one, so far as I know, has yet contested it. It is true that M. de Quatrefages is not always consistent in his inconsistency; for when in certain *Syllidea* the palpi become elongated, he restores to them the name of *antennæ* †.

* De *Bopyro* et *Nereide,* commentationes anatomico-physiologicæ duæ. Riga et Dorpat, 1837, p. 26.

† He restores it to them even with usury; for in the *Polybostrichi* he regards the two palpi bifurcated at the extremity as four antennæ.

A second inconvenience of the nomenclature of M. de Quatrefages is that it is inapplicable in all those cases in which the anterior segments are much condensed, and in which it is no longer possible to determine to what segment a given pair of appendages belongs. We shall see, for example, that in the *Phyllodocea* and the *Hesionea* authors are unable to agree upon this determination, and that M. de Quatrefages allows himself to be led away by his theory of the appendages to establish genera which no one will adopt. We also find the learned Academician, for love of his theory, suppressing by a stroke of his pen the buccal segment in most of the Sigalionida, or at least attributing to them "an *indistinct* buccal segment, destitute of appendages." But nothing is more distinct than the buccal segment of these Annelida; only it bears a pair of feet with setæ, which a buccal segment ought never to do, according to the theory of M. de Quatrefages. Unfortunately the author does not suspect that all the *Polynoæ* likewise bear some setæ on the segment which he regards as the buccal ring, and that it would consequently be necessary to imagine in them an "indistinct buccal segment without appendages."

M. de Quatrefages, however, gives us a rule (difficult of application indeed, but still a rule) for the determination of the segments and their appendages. The cephalic lobe and the antennæ, he says, receive their nerves from the cerebral ganglion, the buccal segment and its tentacles from the œsophageal connectives, and the tentacular cirri from the ventral ganglionic chain. This thesis is not tenable in presence of the modern progress of embryology. Schaum asserted that in all Articulata a segment is characterized by the presence of a ganglion, and he started from this principle in denying that the head in Arthropoda is formed of several segments amalgamated together. This doctrine was immediately refuted. In fact, the nervous system is comparatively very late in being differentiated in the embryos of Articulata; on the contrary, the appearance of the segments (the *protozonites* as they have been called) is in many cases the result of one of the first modifications of the blastoderm. These primitive segments unite in groups, and sometimes become soldered together, long before the differentiation of the nervous system; and when this system is developed, the number of its ganglia is not necessarily identical with that of the primitive segments. In the Annelida especially, the formation of the nervous system certainly sometimes follows very closely upon that of the segments, as in the embryos of *Capitellus*, for example; but most frequently it is much later. I do not, indeed, dispute that in many Annelida the origin and distribution of the nerves is in accordance with the rule of M.

de Quatrefages. However, we shall see that, in certain cases, not only the buccal segment, but also some of the following segments receive their nerves from the œsophageal connectives, as in certain *Aphroditea*, some *Hesionea*, &c. According to the theory of M. de Quatrefages, it would be necessary to regard the whole of these segments as constituting a multiannular buccal segment; and yet each of them bears a pair of feet, and otherwise presents all the characters of an independent segment.

For my part I employ the name of *antennæ* for all the appendages of the cephalic lobe; but where two of these appendages originate from the lower part of this lobe, at the same time acquiring special anatomical and physiological characters, I give them, like most other authors, the name of *palpi*. The modified cirri of the buccal segment and of the following segments are designated in this memoir as *tentacular cirri*.

Without wishing to enter into details here upon the structure of the feet in the Annelida, I desire to indicate what are the relations of the setæ to the tissues which surround them. Some authors regard them as enclosed in a sac which is only an invagination of the integuments; others think that they are formed in an internal follicle, and only secondarily arrive at the surface. This second opinion only is correct. In certain cases (in *Hesione* and others, for example) the whole bundle issues in a compact form through a single pedal aperture; but in others each seta has its own orifice. This is the case especially with the flabelliform bundles. The pore from which each seta issues is not previously formed, but is perforated by the seta itself. This is easy when the tissues of the worm are soft. But this is no longer the case when the Annelide is protected by a resistant cuticle, and when the seta, armed with hooks in various directions, seems fit to get itself entangled in the tissues and to produce serious lesions in them. In these cases the extremity of the young seta is surmounted by a small provisional apparatus terminated by an extremely sharp plate, destined to cut a free passage for the seta in the tissues, and to prevent tearing. The form of this piece varies greatly, like that of the seta and, especially, that of the hooks, the passage of which is to be effected without lesion of the neighbouring parts. I have already pointed out some examples of this singular arrangement, but they have been passed over without notice. Many others will be found in the course of this memoir*.

Integuments and Muscular Apparatus.

The integuments are composed of two layers:—one internal

* See especially under the head of *Aphrodita aculeata*, where this subject is treated in detail.

and cellular (*corium,* Rathke, *derme,* Quatref.), corresponding with the subcuticular or chitinogenous layer of the other Articulata; the other extra-cellular, the cuticle (*epidermis,* Rathke & Quatref.), sometimes very delicate, sometimes composed of a thick layer of chitine. The integuments have hitherto been studied with care only by M. Kölliker, to whom we are also indebted for several other excellent works on the histology of the Annelida, works all of which have unfortunately remained unknown to the author of the 'Histoire Naturelle des Annelés.'

The superficial layer deserves the name which has been given to it by M. Kölliker. From a histogenetic point of view it falls perfectly under the category of cuticular formations. The subcuticular layer (*hypodermis,* Weism.) which secretes it may often be denominated, as it is by M. Kölliker, an epithelium; however, in most cases it is impossible to recognize the limits of its constituent cells. The nuclei seem rather to be scattered in it with considerable regularity in a continuous granular stratum, as has been seen by M. Baur in certain Arthropoda. Wherever the cuticle attains a certain thickness, it presents two systems of striæ at right angles (or more frequently about 70°), which have been already well observed by M. Kölliker*. The tubular pores (*Porenkanäle* of the Germans), when they exist, are distributed in lines congruent with these striæ. M. Kölliker has been struck by the distance which separates these pores from each other. Frequently, he says, not more than one of them corresponds with each subjacent cell; and he asks whether these apertures are really the homologues of the tubular pores (*Porenkanäle*) of the Arthropoda, or whether they may not rather be compared with apertures of the cutaneous glands, such as those discovered by M. Leydig in the *Piscicolæ,* or with the hairs of Insects and Crustacea. To this question I can reply positively that the two categories of pores exist in the Annelida. Those which serve for the discharge of certain secretions seem to exist in all species. Sometimes, especially in the large species, they attain a considerable diameter; but usually they are very wide apart. Sometimes, however, we find them brought together in groups or islets. The canalicular pores are much smaller and much closer together, and do not correspond with glands. They occur only in the species with a thick cuticle, and not even in all these. I shall describe some examples in detail, especially among the *Eunicea.* Wherever these very fine and approximated

* M. de Quatrefages, to whom these striæ are not unknown, sees in them the indication of two systems of fibres—an opinion which may be provisionally admissible in the case of certain worms. In any case the learned Academician with justice attributes to these striæ the iridisation of the surface of the body in many Annelides.

tubular pores exist, we likewise find the large scattered glandular pores. This description applies not only to the external cuticle, but also to that of the pharynx when it attains a great thickness.

The subcuticular layer (the dermis of M. de Quatrefages) appears almost always to contain glandular follicles in all the regions, even in the cirri and antennæ. These follicles discharge themselves outwards through the glandular pores that I have just described. Some of them only secrete a thick liquid; others produce bundles of bacilli in their interior (I shall indicate these under the name of *bacilliparous follicles*); others, again, secrete granules.

The bibliography relating to the bacillar corpuscles of the Annelida is already rich. To M. Max Müller belongs the priority of the discovery of these organs, which he described and figured from the skin of two larval forms and from that of *Chætopterus*. They have since been observed by Dr. Strethill Wright in *Spio*, by M. F. Müller in *Cherusca*, by M. Danielssen in *Scalibregma*, &c. I have myself devoted particular attention to them. I have indicated them in the *Phyllodocea*, in a *Tomopteris* (in concert with my friend Dr. Carpenter), in a *Sphærosyllis*, in *Sphærodorum*, and in the *Palmyrida*; and I have shown that, under certain circumstances, the contents of these follicles are suddenly discharged outwards. M. Kölliker has completely confirmed these observations. In the *Phyllodocea* M. Ehlers has likewise found the bacilliparous follicles, and ascribed to them the secretion of the mucosity. It is curious that observations so numerous as these should have entirely escaped the author of the 'Histoire Naturelle des Annelés.'

Certain families have their integuments literally crammed with bacilliparous follicles, even in the cirri and antennæ. This is the case especially in all the *Spiodea* and *Ariciea* and a great part of the *Chætopterea*. Their abundance is also remarkable in a great number of *Phyllodocea* and in some *Hesionea*. In the latter, especially, their grouping and their relation to the excretory pores are very remarkable. The function of these organs, indeed, is still quite problematical. I formerly compared them with the cells filled with aciculæ of the Turbellaria, and with the urticating organs of the Apneustic Mollusca, the Acalephæ, and Anthozoa; but this is pure hypothesis.

The tubular glands filled with spherical granules were first indicated by me in several Annelida. They sometimes attain a very large size, particularly in the *Lycoridea*; and in this case the glomerule formed by the interlacing of the glandular tubes was known even to the older writers, and regarded by them as a sac. M. de Quatrefages* was acquainted with one of the pas-

* Hist. Nat. des Annelés, tome i. p. 75.

sages* in which I mentioned these organs, and cited an analogous observation of M. Keferstein; but by a singular mistake he makes us describe convolutions of blood-vessels, whilst we speak very positively of glandular coils. Such a confusion is hardly possible; for the passage relates to Nereids, in which the coils in question are colourless, whilst the vessels are of a fine red colour. M. Kölliker was the first to discover, in *Sphærodorum peripatus,* that each coil of the glomerules contained in the spherical appendages opens outwards by a separate pore. This observation has just been repeated by M. R. Greef in *Sphærodorum Claparedii*†.

Muscular System.

The muscles of the Annelida present extraordinary variations in their histological structure, as I shall have more than one occasion to show in the course of this memoir. Sometimes they are composed of fibres with parallel edges and entirely destitute of nuclei, sometimes, on the contrary, of fibre-cells furnished with large nuclei.

The existence in the Annelida of fibre-cells of a muscular nature has indeed been entirely denied by M. Schneider‡. But although this naturalist may be right in the immense majority of cases, we shall see that this rule is liable to some exceptions (pharynx of certain *Nereidea,* tentacles of various *Terebellea,* &c.). Sometimes the muscular fibre separates into two distinct layers (one axial, the other cortical), as M. Leydig was the first to remark§. Nowhere is this structure so distinctly shown as in *Nephthys.* Lastly, in some Annelida, as M. de Quatrefages very justly indicates, the muscular system undergoes a remarkable simplification, in the loss of its fibrillar structure. Sometimes we find, in place of the muscles, nothing but a contractile protoplasm with nuclei dispersed through it. Of this we shall indicate some examples hereafter.

The 'Histoire Naturelle des Annelés' indicates between each segment a sort of tendinous raphe upon which the muscular fasciculi are inserted‖. These raphes have no existence. It is easy to ascertain, from longitudinal sections of Annelida, that the longitudinal fasciculi are continued without any interruption throughout the length of the worm. This has already been seen and described by De Blainville, Delle Chiaje, Rathke, Meckel, &c.

* Beobacht. &c. p. 52.

† See 'Annals' for July, vol. xx. p. 4 *et seq.*

‡ "Ueber die Muskeln der Würmer, &c.," Müller's Archiv, 1864, p. 590.

§ "Ueber *Phreoryctes Menkeanus,*" Archiv für mikrosk. Anat. Band i. p. 249.

‖ This notion, however, is revived from Cuvier.

More or less complete muscular floors sometimes divide the perivisceral cavity into several chambers. M. de Quatrefages cites, as presenting this arrangement, the genus *Polyophthalma* and *Terebella conchilega*. Many other examples might be cited. Such are:—the *Opheliea,* the *Polycirrida,* many *Terebellea,* the *Aphroditea,* and the great majority of the Annelida Errantia, in which the perivisceral cavity is divided into three longitudinal chambers; the *Glycerea,* in which it is divided into two, &c.

Digestive Organs.

For the different parts of the alimentary tube and, especially, of the trunk, M. de Quatrefages has endeavoured to establish a complete nomenclature, the opportuneness of which is at least contestable so long as the homologies upon which it is supposed to be founded are by no means demonstrated. Why, for example, in the *Syllidea,* should we give the name of *dentary region of the trunk* to an organ with glandulous walls, which constitutes no part of the trunk and contains no teeth*? The names employed by other authors—such as *fleshy portion of the pharynx* (Milne-Edw.), *gizzard* (Williams), and *proventriculus* (Œrsted)—appear to me to be very preferable. Are there any sufficient reasons for setting aside the names *ventriculus* and *glands of the ventriculus,* employed originally by Rathke for the *Nereidea,* and repeated by his successors? Is it really necessary to replace them by those of *œsophagus* and *salivary glands*†? I do not think so. Rathke's names were at least justified by analogy. One generally regards the salivary glands as more or less connected with the buccal cavity, whilst the glands in question often occur twenty or thirty segments behind the buccal segment.

In certain Annelida the posterior region of the intestine, following the biliary region, acquires a peculiar appearance. Its wall becomes filled with cells secreting curious concretions destined, no doubt, to be eliminated with the fæces. I designate this part of the intestine by the name of the *urinary region,* although, chemically, it does not seem to contain any uric acid‡.

* M. de Quatrefages, it is true, enumerates a certain number of *Syllidea* armed with teeth in this region; but we shall find that in most cases, probably even in all, there is an error, and that the worms in question belong to totally different families.

† This name of *salivary glands* is indeed borrowed from Rud. Wagner, who employed it, as well as that of *poison-glands,* because he assumed that a canal starting from these glands penetrated to the extremity of the jaws. This canal does not exist. (See "Zur Anatomie von *Nereis,*" Isis, 1834, p. 133.)

‡ I shall speak of this again in more detail in connexion with certain *Syllidea.*

Perivisceral Cavity and Circulatory System.

We are indebted to M. de Quatrefages and Dr. Williams, but especially to the former, for a profound investigation of the perivisceral cavity and of the lymph which it contains. These naturalists, more than any one else, have pointed out the physiological importance of this liquid, which cannot be too highly estimated. Some details, only, require a slight rectification here. The perivisceral cavity is lined by a delicate membrane, which is not easily demonstrable, except in the larger species—a membrane the discovery of which M. de Quatrefages ascribes to himself, and to which he gives the name of *peritoneum*. Had he thoroughly explored the works of Delle Chiaje and Rathke, he would have found in them both the membrane and the name. The structure of this peritoneum (*tunica sierosa, tunica peritoneale* of Delle Chiaje) is subject to considerable variations, as I shall show in the course of this memoir. At any rate, the perivisceral cavity is clothed, in some species, with vibratile cilia borne by the peritoneum. If I am not mistaken, Dr. Sharpey was the first to describe these, in *Aphrodita*; Dr. Williams then detected them in the branchiæ of the *Glyceræ*; and I described them as occurring in the whole of the perivisceral cavity of the latter worms. They have also been seen in the *Tomopteridea*. M. de Quatrefages, who only notices in passing the observation of Dr. Williams, adds that this ciliary movement was long since known to him in a great number of Annelida, and that it will be met with in all the species, if we take the trouble to look for it. This opinion is not well founded. The immense majority of the Annelida present no ciliary movement in the perivisceral cavity, except at the entrance to the segmental organs. For my own part I am acquainted with the perivisceral ciliary coat only in the following groups:—in all the *Aphroditea, Glycerea,* and *Polycirrida,* in the *Tomopteridea,* and in a small and rather abnormal *Terebella* (*T. vestita*). It is a striking circumstance that all these Annelida, with the exception of the little *Terebella* and *Aphrodita aculeata,* are completely destitute of vessels. Now, of these two exceptions, one (the *Aphrodita*) is an animal with a rudimentary vascular system, belonging to a family which is otherwise entirely anangian; the other, the *Terebella,* belongs to a family which is generally vascular, but one tribe of which, that of the *Polycirrida,* is anangian. Considering these facts, I must regard the perivisceral ciliary movement as a function vicarial of the circulation in Annelida deprived of a true circulatory system.

The circulation of the Annelida has been most carefully described by M. de Quatrefages, who at the same time renders full justice to the beautiful investigations of M. Milne-Edwards. It is to be regretted that he has not shown the same favour to Rud. Wagner and Rathke. The distinction which he establishes between the arterial and venous currents appears to me to be very just in its principal features. The same view has been entertained by some authors; witness the name of *nervàrteria* given by Delle Chiaje to the ventral vessel—that is to say, the aorta in the sense of M. de Quatrefages.

The existence of blood-corpuscles in the vessels of certain Annelida is now-a-days indubitable. M. de Quatrefages, in his 'Histoire Naturelle des Annelés,' admits three examples of this —the *Glyceræ, Phoronis,* and the *Syllidea.* The latter alone is of any value. Thus in the *Glyceræ* the red corpuscles belong to the liquid of the perivisceral cavity; and as to *Phoronis,* that genus can hardly retain its place among the Annelida. But, without speaking of an old observation of Rud. Wagner with regard to a *Terebella,* which has, moreover, been confirmed by M. Kölliker, other examples may be cited. In the present memoir true blood-corpuscles will be found described in the *Opheliea,* the *Cirratulea,* and the *Staurocephalæ.*

Respiratory Apparatus.

M. de Quatrefages has made science actually go back as regards the structure of the organs of respiration. This is the weakest part of his book—weak in the introduction, weak in the general remarks on each family. The branchiæ, in the opinion of the honourable Academician, have a proper structure, which enables them to be always distinguished. "These organs," he says, "are characterized by a single canal, at and from which afferent and efferent vessels arrive and depart. This canal, the proper walls of which are sometimes visible and sometimes indistinct, is surrounded by a diaphanous substance which seems to be produced by the thickening of the dermis. In this substance are hollowed out ampulliform lacunæ more or less developed, and always destitute of proper walls. The whole is surrounded by an extremely fine epidermis, which presents no appreciable structure. Finally, this epidermis is beset with vibratile cilia. . . . . . At the end of a variable time the branchia contracts, although no muscular fibres can be discovered in it. The ampullæ empty themselves, so as sometimes to disappear entirely. The blood flows through the central canal of the branchia, and, on arriving at the base of the organ, passes into the efferent vessel. In this movement of return it necessarily meets the venous blood, and cannot but become mixed with a certain quantity of blood which has not undergone the action of the air."

In contrast to this radically false description, let us see how the circulation is effected in the normal branchia of an Annelide. There cannot be in a regular way any mixture of arterial and venous blood; in fact the artery travels as far as the extremity of the branchia, where it bends round to return as a vein. The vein and the artery are exactly parallel to each other. Through the whole length of the branchia these two vessels are put in communication by a double series of vascular loops, which pass into the subcuticular layer, and which are subjected with the greatest facility to the action of the water charged with oxygen, through the very thin cuticle. As to the contraction of the supposed ampullæ, there is nothing of the kind. Some genera, such as the *Terebellæ* and the *Telethusæ*, for example, certainly present rhythmical contractions of the whole branchia, but not of the vessels themselves. This fact, however, is exceptional. The family *Serpulea* alone presents in the structure of its branchiæ a distant resemblance to the description of M. de Quatrefages. In these Annelides the artery is continued directly into the vein at the base of the branchiæ, and from their point of union starts a single vessel, which penetrates into the branchia and sends a cæcum into each branch of it. But M. de Quatrefages describes in the secondary branches of the branchiæ of the *Serpulea* all his apparatus of ampullæ, of which not the least trace exists. The cæcal vessel does not present any ramification; it is simply cylindrical and contractile, as described by MM. Grube and Kölliker*. In these branchiæ the blood exhibits an alternating circulatory movement; but this is the only exception†; in all the other families the branchial circulation constantly takes place in the same direction. Cæcal vessels with alternating circulation are met with also in the tentacles of the *Spiodea*, *Amphictenea*, and *Pherusea*, and in *a part* of the so-called branchial filaments of the *Cirratulea*; but the latter organs are not respiratory (unless perhaps lymphatic).

How could M. de Quatrefages commit an error so manifest and so frequently repeated? This is easily explained. The branchiæ are in general not cylindrical, but slightly compressed. Now, in the position which they must naturally take under the microscope, the artery exactly conceals the vein, and one might

* M. Milne-Edwards, ignoring these observations, erroneously attributes to the Tubicolous Annelida lymphatic branchiæ exclusively (Leçons sur l'Anat. et la Physiol. tome ii. p. 103).

† I think I have a right to speak thus categorically. Of the twenty-six families of Annelida admitted by M. de Quatrefages, I have studied twenty-five anatomically, by the dissection of numerous species or individuals. As to the twenty-sixth, that of the *Hermellea* (*Sabellaria*), it is too nearly related to the *Amphictenea* and *Terebellea* to allow us to suppose that it differs much from them.

suppose that there is only one vessel. As to the supposed ampullæ, these are the projections of the vascular loops. It is only necessary to turn the branchiæ a little, in order to dissipate the first illusion. M. de Quatrefages has allowed himself to be deceived by the first examination, as Pallas did long since.

But this error is not permissible at the present day. It is already thirty years since M. Grube settled it. It is thirty years since, in his anatomy of *Pleione caruncutata,* he indicated the occurrence, in the *Terebellæ* and *Arenicolæ,* of this deceptive appearance, which led Pallas into an error which M. de Quatrefages has now reproduced. He showed that a less superficial examination led to the recognition of the artery, the vein, and the loops which unite them. No microscopist warned of the danger will go and throw himself upon it. Many modern observers have described and figured the duplicity of the axial vessel of the branchia,—amongst these M. Grube and M. Schmarda in the *Cirratulea,* M. Schmarda in *Nephthys,* Dr. Johnston in the *Nerinæ,* M. Keferstein in the *Spiodea,* and myself in the *Spiodea* and *Eunicea.* At a still earlier period, Delle Chiaje* described in detail in *Eunice* and *Diopatra* the artery and the vein passing spirally side by side† in the interior of the branchia, at the same time emitting numerous vascular branches ‡. But all these observations have remained dead letters to the author of the 'Histoire Naturelle des Annelés.'

I have stated that all Annelida present the typical structure of the branchiæ, except the *Serpulea.* I must, however, add that one family presents a remarkable simplification of this organization. This is the family *Spiodea.* Throughout this family the branchiæ only contain the two principal vessels, the artery and the vein; the lateral loops are wanting.

The lymphatic branchiæ will form the subject of a special investigation, in the Annelida which present them (*Sigalionida, Dasybranchi, Glyceræ*).

* Istituzioni di Anatomia comparata, 2a ediz. tome ii. p. 76. Naples, 1836.

† This description is very correct, as we shall see hereafter in connexion with *Diopatra neapolitana* (Delle Chiaje).

‡ M. Milne-Edwards, that excellent observer, has likewise recognized the duplicity of the branchial vessel; but, in his 'Leçons sur la Physiol. et l'Anat. des Animaux' (tome iii. p. 217), he has modestly put his own observations into the shade, in order to set off those of M. de Quatrefages and proclaim the existence of a cæcal vessel with ampulliform diverticula. The observations of M. de Quatrefages upon the branchiæ of the *Glyceræ* and *Polydoræ,* the only ones that he cites, appeared to him decisive. M. de Quatrefages has been unfortunate in the selection of his examples: the *Polydoræ,* with their simple branchial loop, cannot produce the illusion of the ampulliform diverticula; and the *Glyceræ* have no vessels at all!

Reproductive Apparatus.

The reproductive apparatus of the Annelida has hitherto been very imperfectly known. Numerous works have indeed thrown fresh light upon the educatory organs, known, since Dr. Williams wrote upon them, by the name of *segmental organs*. But as regards the sexual glands our knowledge has made but little progress for the last thirty or forty years. This memoir will, I hope, make known these organs in a satisfactory manner in a great number of species. M. Ehlers limits himself to saying that the sexual glands may be referred to a single fundamental type—namely, that of a coherent cellular mass, engendered on the inner surface of a part of the wall of the body, or on the dissepiments. This statement is true in many cases. M. Krohn saw the ovules make their appearance as a sort of epithelium on the surface of the dissepiments in *Alciope*; and I have myself made perfectly similar observations on *Protula Dysteri*. This rule cannot, however, be regarded as general. The sexual glands often present themselves under perfectly different conditions.

The observations of M. de Quatrefages relate chiefly to the *Nereida* and *Eunicea*. He has seen the sexual elements make their appearance in these Annelida in a glandular organ extended beneath the abdominal nervous chain. This description is at any rate very inaccurate, as will be seen hereafter on reading the exposition of the singular construction of the sexual glands in various *Lycoridea* &c.

The distribution and structure of the sexual glands in the Annelida is subject to numerous variations, which will be illustrated by a multitude of examples in the course of this memoir. Nevertheless the following form may be regarded as the most generally diffused among the Annelida:—The sexual glands form more or less complex racemes or networks of cords, the axes of which are occupied by sanguiferous branches, which are often contractile. The sexual elements in course of growth form ruffs all round the vascular axes, and become developed at the expense of a layer of nuclei contiguous to the vessel. In the females the ovules are often in immediate contiguity to each other in the ovary; but sometimes (in *Owenia*, Delle Chiaje, and some species of *Polynoë*) each of them is enclosed in a special ovisac. In all cases the ova, when arrived at maturity, detach themselves from the ovary, either immediately, or mediately by the rupture of the ovisac. For the most part the spermatozoids likewise detach themselves from the testes to float freely in the perivisceral cavity.

This fundamental form undoubtedly sometimes undergoes important modifications—for example, to produce the singular sexual tissue of the *Nereidea* or the floating testes of the *Dasy-*

branchi, which will be described in the special portion of the present memoir. The formation of the ova in the *Terebellea* and *Serpulea* departs from it still more widely; but throughout we shall find a cellular tissue, either fixed or composed of floating elements, in the midst of which the sexual elements are developed.

The sexual glands have indeed been known for a long time in certain Annelida; but these early observations have been in part forgotten. Thus whilst Pallas* erroneously represented the ova of *Aphrodita* as originating in the liquid of the perivisceral cavity, G. R. Treviranus† and Delle Chiaje‡ were well acquainted with the true ovaries at the base of the feet in these worms. Delle Chiaje also indicates the ovaries of the *Pherusea, Hermione, Polyodonta, Parthenopeia, Diopatra, Nephthys, Telamon,* &c. He knew very well that the ova are formed in the ovaries, but that, when arrived at maturity, they detach themselves therefrom, and float freely in the perivisceral cavity§. Even the existence of a blood-vessel in the axis of the sexual glands was not unknown to some observers. Thus Delle Chiaje|| indicates the axial vessels of the ovarian racemes in *Siphonostomum* and the *Stylarioïda*; M. Stannius¶ has made analogous observations on *Amphinome rostrata*; M. Grube has seen the ovules originate round vessels in the *Arenicolæ***; and M. Schmarda†† describes the axial vessel in the ovaries of *Euphrosyne.* All these observations appear to have met with little credit, but they are none the less perfectly correct.

Frequently, it is true, organs have been wrongly regarded as sexual glands. For example, wherever Rathke believed he saw testes in the *Nereides, Pectinaria,* &c. he was mistaken‡‡. All authors have been mistaken with regard to the testes of the *Arenicolæ*. The segmental organs of the *Terebellea* have also had the fate of being taken for ovaries by nearly everybody from Cuvier to MM. Milne-Edwards, Grube, Quatrefages, and even Sars. Dr. Williams, of course, did not remain behind, as this

* Miscellanea Zoologica, p. 91.

† Zeitschrift für Physiol. Bd. iii. p. 165. Darmstadt, 1829.

‡ Descrizione e Notomia, &c. tom. v. p. 59.

§ Istituzioni di Anat. Comp. ed. 2. tom. ii. p. 158.

|| Descrizione, &c. tom. iii. p. 78.

¶ Isis, 1831, pp. 989–990.

** Zur Anatomie der Kiemenwürmer, 1838, p. 16.

†† Neue wirbellose Thiere, Bd. ii. p. 137.

‡‡ Rathke himself, however, recognized these errors as soon as he perceived that the *Arenicolæ*, the *Ammotrypanæ*, &c. had the sexes separate. The segmental organs, which he had previously regarded as testes, then became to him *muciparous glands*. (See "Beiträge zur Fauna Norwegens," Nova Acta, &c. 1843, tom. xx. p. 201.)

was too favourable to his theory. The mistake appears to have been caused in some cases by the presence of ovules in these organs, which are probably concerned in oviposition*.

Since the investigations of Dr. Williams, the segmental organs have given rise to much controversy. Most recently, M. Ehlers regards them as apparatus destined to conduct outward the mature sexual elements; and this opinion is certainly correct. Besides the facts cited in its support by that anatomist, others will be found in the course of the present memoir. Nevertheless this is not the only function of the segmental organs. Thus they exist in the anterior segments of many Annelida in which the ovules and spermatozoids never penetrate into that region. Their wall is often glandular, and histologically comparable with the elements of the kidney in the Gasteropoda (*Amphictenea*, *Pherusea*). Therefore I hardly doubt that these organs also play an excrementitial part. We know also that in the Oligochæta only a small number of these segmental organs are modified for the purpose of conducting outward the sexual elements, whilst the rest incontestably fulfil other functions. In the Polychæta, likewise, it is only a part of the segmental organs that take the part of an efferent generative apparatus.

The older authors, who were acquainted at least with the external apertures of the segmental organs, such as Treviranus (who describes them in *Aphrodita*) and Delle Chiaje (who assumes their existence in all Annelida, and mentions them in many species), attributed a very different function to these organs. They regarded them as serving for the introduction of water into the perivisceral cavity. This opinion can no longer be maintained. The direction of the ciliary movement in the calibre of the tube is opposed to it, as also the circumstance that the inner orifice of the segmental organ seems to be wanting in some instances; at least I believe I have ascertained this to be the case in some *Capitellea*.

M. de Quatrefages, who has never been able to see a segmental organ, attributes to M. Ehlers and myself the honour of having contributed most to the extension of Dr. Williams's

* It is chiefly to M. de Quatrefages that we owe the recent demonstration of the diœcious nature of the immense majority of the Annelida. We must, however, not forget that before him Delle Chiaje maintained this diœciousness in opposition to all his contemporaries, and that in the most formal manner. He knew that the generative organs present the same form in both sexes. According to his observations, the males are less abundant than the females. (See Descrizione e Notomia, &c., tom. iii. p. 100). Baster and Pallas, however, appear to have been the first to ascertain positively the diœciousness of an Annelide, *Aphrodita aculeata*. (See Natuurkundige Uitspanningen, &c., Deel ii. p. 68, edit. 1817, and Miscellanea Zoologica, 1766, p. 90.)

discovery. He ought, I think, to have cited in the first place the name of M. Hering, who is nowhere mentioned in the 'Histoire Naturelle des Annelés.' However this may be, the honourable Academician reproaches us, and especially myself, with having said a great deal and drawn but little. I do not think I deserve this reproach, as the segmental organs of the Annelida, being very simple modifications of a very constant type, may be easily described without having recourse to the pencil. Moreover, without speaking of the works of M. Ehlers and myself, M. de Quatrefages might have found segmental organs described and figured by M. Keferstein, in *Cirratulus filiformis* (Keferst.), *Capitella* (*Notomastus*) *rubicunda* (Kef.), *Terebella gelatinosa* (Kef.), and *Syllis oblonga* (Kef.). Nevertheless, in order to satisfy the desire expressed by M. de Quatrefages, figures relating to the segmental organs of various Annelida will be found in the plates following this memoir.

It is, moreover, indubitable that there are Annelida destitute of segmental organs, or at least in which these organs are reduced to simple apertures in the wall of the body.

Nervous System.

It is undoubtedly to M. de Quatrefages and M. Leydig that we owe the finest investigations upon the nervous system of the Annelida; the former has occupied himself especially with the exterior form of this system, and the latter with its histology. The 'Histoire Naturelle des Annelés' omits all historical details upon this subject; but if we go back to the earlier works of the author, we shall find a concise and well-executed summary of the previous researches*. It is more to be regretted that it takes no notice of the labours of recent histologists, MM. Leydig, Mettenheimer, &c. On the whole we find in the portions of this memoir relating to the nervous system a confirmation of the investigations of M. de Quatrefages. On some points, however, I must differ from him. Lastly, there is an important chapter upon which I have hardly a right to pronounce judgment. In nearly all the families M. de Quatrefages has been fortunate enough to detect a stomato-gastric nervous

* See "Etudes sur les types inférieurs de l'embranchement des Annelés. Mémoire sur le système nerveux des Annélides," Ann. Sci. Nat. tome xiv. p. 332, 1850. No doubt this summary presents some gaps. We regret especially to see no mention in it of the investigations of G. R. Treviranus upon the nervous system of *Aphrodita*; for this observer was already well acquainted not only with the ventral chain and the nerves which originate from it, but also with the ganglia of reinforcement at the base of the feet.

system, similar to that of the *Hirudinea*. I confess that I have been unable to discover it; but I feel that this negative result is of no great weight in so difficult an investigation. I am, however, astonished to find that so many other observers have had no better fortune than myself in perfectly similar endeavours.

M. Leydig has described in the *Hirudinea* a structure of the nervous centres which he characterizes as *follicular**; and he opposes it to that of the Annelida, according to his own researches on the Oligochæta and those of M. de Quatrefages on the Polychæta. This distinction cannot be made so absolute. Certain Annelida Polychæta have a follicular nervous system as well as the Hirudinea. This is the case, for example, in *Nereilepas caudata* &c., as I shall show hereafter. Others present nothing of the kind.

The structure of the nervous system varies, however, astonishingly in the series of the Annelida; the distribution of the nerve-cells especially is subject to a multitude of modifications which we shall point out in particular cases. In the ventral chain, the cells belong chiefly to the ventral surface and the sides, as M. Leydig has already noticed. The existence of large tubular fibres on the dorsal surface of the nervous chain, so general in the Oligochæta, is restricted in the Polychæta to a small number of families (*Capitellea*, *Ariciea*, *Spiodea*, *Syllidea*, *Eunicea*), and apparently even only to certain representatives of these families.

The terminations of the nerves in the Annelida have hitherto been studied only by myself, M. Keferstein, and M. Kölliker. Numerous observations on this subject will be found in the present memoir. All these terminations seem to be in relation to the function of touch. The nervous expansion of the organs of sight and hearing † is in reality still very imperfectly known, even in *Alciope*, notwithstanding the investigations of M. Leydig. In connexion with this, I cannot abstain from mentioning an opinion of J. Müller's, which has fallen into oblivion. We owe to that great physiologist ‡ an excellent figure of the central nervous system and of the eyes of the *Nereides*, a figure to which his successors have added nothing very positive. In his opinion, the organ which we now call the *crystalline* is not a dioptric medium; he denies its transparency, and regards it as a terminal inflation of the optic nerve. Although the trans-

* The observations of M. Baudelot upon *Clepsine* (Ann. Sci. Nat. tome iii. 1865, p. 126) are a complete confirmation of this.

† When M. Victor Carus (Handbuch der Zoologie, p. 430) ascribes auditory capsules to the majority of the Annelida, he deceives himself very greatly. The existence of these organs is peculiar to a very restricted number of species.

‡ "Mémoire sur la structure des yeux chez les Mollusques Gastéropodes et quelques Annélides," Ann. Sci. Nat. tome xxii. 1831, p. 23.

parency of the crystalline is incontestable in many cases, Müller's opinion as to the functional value of this organ must not be rejected. The eyes of the *Nereides* and of most of the Annelida appear to be destitute of any apparatus of accommodation. If therefore we assume that the perceptive elements are lodged between the granules of the pigment, only objects placed at a determinate and perfectly fixed distance can project their images upon the surface of this choroid pigment. The vision of the animal would, in this case, necessarily be very restricted. This difficulty disappears if we seek in the crystalline at once a refractive body and a perceptive organ, nearly as we seem compelled to admit with regard to the crystalline cones of the Arthropoda. The image projected at various depths in the crystalline by objects placed at variable distances would then always be formed in a sensitive layer.

Regeneration of Mutilated Parts.

The observations of Bonnet upon the regeneration of mutilated parts in the Earthworms, confirmed by Lyonnet, Réaumur, Dugès, &c., were hesitatingly doubted by Vandelius * and Bosc †, and more recently and positively by Dr. Williams ‡, M. Vogt §, and others. We must therefore be thankful to those who, like Dr. Baird ||, have brought to light certain early observations, or, like M. de Quatrefages ¶, have corroborated and confirmed them by fresh experiments.

The reproduction of mutilated parts in the Annelida is incontestable. A great number of these worms, perhaps all, can even reproduce the anterior region including the head. Among

* "Dominici Vandelii philosophi ac medici dissertationes tres. De Aponi Thermis, de nonnullis insectis terrestribus, et Zoophytis marinis, et de Vermium terræ reproductione, atque *Tænia canis*. Padua, 1758," pp. 98–147. This work, which seems to have been forgotten, is nevertheless the production of a good observer. In very careful experiments, repeated for two successive years, he did not succeed in seeing mutilated Earthworms reproduce their anterior extremity. He, nevertheless, prudently concludes that these experiments require to be made with extreme care, and does not accuse Réaumur of having deceived himself. We know that Dugès afterwards likewise began by obtaining negative results, but that subsequent experiments succeeded with him completely. The regeneration of the anterior part takes place, in fact, only when the number of segments removed is not too great.

† Histoire Naturelle des Vers, tome i. pp, 128 & 215.

‡ "Report on the British Annelides," Report of the British Association, 1851, p. 247.

§ Vorlesungen über nützliche und schädliche, verkannte und verläumdete Thiere. Liepzig, 1864, p. 91.

|| Johnston's Catalogue of British non-parasitical Worms. Appendix.

¶ Ann. Sci. Nat. tome ii. 1844, p. 100; Hist. Nat. des Annelés, tome i. p. 126.

recent authors, M. de Quatrefages has afresh demonstrated this fact in *Eunice*, and Dalyell followed step by step the reproduction of a head and branchiæ by the posterior extremity of a *Sabella* *. For my own part I have frequently met with marine Annelida (*Eteone, Nephthys*, &c.) which had undoubtedly reproduced their anterior region. The regenerated part is distinguished by a lighter colour and smaller diameter. The aspect of these worms recalls that of the *Heteronereides*; so much do the two regions strike the observer by their different appearance. One might think them two sections of different worms united together. An interesting question presents itself in connexion with this: in a worm cut transversely does the posterior part always reproduce a number of segments equal to that of the anterior part which has been suppressed in front of it? This seems probable. At least I have found an *Eteone* which had reproduced an anterior section of nearly fifty segments. The head is no doubt the part first formed; then the new segments are produced successively at the point of union of the old and new parts. This, however, requires to be supported by positive observations.

Geographical distribution of Annelida.

This subject, which is still imperfectly known, has only been approached in a positive manner by M. de Quatrefages; but the data which that naturalist had at his disposal were insufficient to admit of his drawing any very certain conclusions. There is, however, one point upon which I must contradict him, namely the extreme localization of the faunas. For example, M. de Quatrefages does not admit that the Mediterranean and the Ocean can be inhabited by the same species. It sometimes happens that he founds specific distinctions solely upon this circumstance of different habitat, although authors have been unable to establish any morphological difference between these supposed species. He insists especially upon the impossibility of a littoral species supporting conditions of life so different as those resulting from the presence or absence of tides. At Naples, however, I kept littoral Annelida for months in captivity, and found that the best means of making them thrive is to deprive them of water for several hours every day, so as to allow the mud to become oxygenated. These new conditions did not prevent their living very well and depositing their eggs.

No doubt, in a general way, the fauna of the Mediterranean

* The powers of the Creator displayed in the Creation, &c. vol. ii. 1853, p. 231.

is very distinct from that of the ocean; but several species appear to be positively common to the two seas. M. de Quatrefages, moreover, is perpetually untrue to his own theory; we find him uniting even very distinct species, one belonging to the Mediterranean and the other to the Atlantic or even to the Arctic seas *.

Faunistic works alone will throw any real light upon the geographical distribution of the Annelida. It is therefore to be desired that we may witness the multiplication of such investigations as those of M. Malmgren † upon the Annelida Polychæta of Spitzbergen, Greenland, Iceland, and Scandinavia. It is undoubtedly the best work of its kind that we possess. It has the advantage, in most cases, of being enriched with bathymetrical data. The absence of particulars of this nature is a defect in most memoirs on Annelida. It is especially a gap which I regret I am unable to fill up in this fauna of the Bay of Naples. M. Malmgren seems to lead us to hope for the early publication of a work on the Annelida dredged off the coasts of Spitzbergen at a depth of 1400 fathoms (*famnar*) by M. Carl Chydenius. An accurate knowledge of Annelida living under such conditions would be of great scientific interest.

Classification.

It is gratifying to see that we are every day approaching more and more towards a natural classification of the Annelida. The families now established are for the most part well founded. The discovery of types so new as to necessitate the formation of new families becomes rarer every day. For my part I shall propose no new family name. I know that on this point there is a difference of opinion among naturalists. MM. Kinberg and Malmgren have recently considerably increased the number of families. But this augmentation is only apparent. Certain very natural families of Savigny's have been divided into several by M. Kinberg; but that naturalist has been careful to preserve Savigny's sections as divisions of a higher rank, under the name of *orders*. This is a slight displacement of the terms of the taxonomic hierarchy, the importance of which is not very great. For my own part I take, to a certain extent, the same view as M. Kinberg; but I regard as *tribes* what he calls *fami-*

* Thus he unites *Polynoë maculata* (Grube) and *P. fasciculosa* (Gr.) of the Mediterranean with *P. cirrata* (Fab.) from Greenland, *Amphis tubicola* (Gr.) of the Mediterranean with *Nereis tubicola* (O. F. Müll.) from the coast of Denmark, *Lysidice Valentina* (Sav.) of the Mediterranean with *L. rufa* (Gosse) of the British coasts, *Nereis cultrifera* (Gr.) of the Mediterranean with *N. bilineata* (Johnst.), &c. &c.

† "Nordiske Hafs-Annulater," in Œfvers. af K. Vet.-Akad. Förhandl. 1865, Nos. 1, 2 & 5; 'Annulata Polychæta Spetsbergiæ, Grœnlandiæ, Islandiæ et Scandinaviæ hactenus cognitæ,' Helsingfors, 1867.

lies, and I retain for his *orders* the name of families given to them by Savigny and his successors. The entire suppression of the *orders* in M. Kinberg's sense, and retention only of greatly multiplied families, according to M. Malmgren's practice, is, in my opinion, to be regretted.

Certain families of recent creation seem to me to be excellent—for example, that of the *Sphærodoridæ* (Mlmgr.). It is also with pleasure that I find M. Malmgren reverting to the opinion of Oken and of MM. von Siebold and Max Müller, and placing the *Sternaspidæ* among the Annelida. This author is astonished that, in the year 1865, M. de Quatrefages, in assigning to *Sternaspis* a place among the Gephyrea, should still mistake the head of these animals for the tail, without taking any notice of the beautiful anatomical investigations of MM. Krohn and Max Müller. I share in M. Malmgren's astonishment, especially as neither Bianchi (Janus Plancus), Ranzani, nor Della Chiaje had fallen into the error of Oken and Otto, now corroborated by the authority of M. de Quatrefages.

It is less easy to come to an understanding upon the genera than upon the families in the class of Annelida. Their number has been increased in very considerable proportions both by M. Kinberg and by M. Malmgren. I am far from adopting the views of those naturalists, whose works have nevertheless been of great use to me, as will be seen from nearly every page of the present memoir. The species investigated by them have been examined with extreme care, if not as to their anatomical construction, at least in their external zoological characters. I think, however, that among the characters considered by them to be generic, many have only a specific value, or may even serve at most to distinguish the varieties of a single species. This is the case especially with the denticulations of the setæ, as I shall show by more than one example in the present memoir. I have nevertheless retained a great part of the generic groups of MM. Kinberg and Malmgren, but frequently only according them a subgeneric value. As a matter of course, however, among the genera established by these authors there are some excellent ones which every one will accept without hesitation.

XLV.—*On the* Campodeæ, *a Family of* Thysanura. By Dr. Fr. Meinert*.

Since J. C. Fabricius first drew the attention of entomologists to the systematic importance of the organs of the mouth in In-

* Translated from 'Naturhistorisk Tidsskrift,' ser. 3. vol. iii. p. 400. Copenhagen 1865. The Danish original is accompanied by a plate, from which the woodcuts are copied.

sects, it has been attempted by several authors to maintain the subdivision of the whole class (first indicated by him) into *Mandibulata* (Masticatores) and *Haustellata* (Suctores),—the former division comprising Eleutherata, Ulonata (Synistata), and Piezata, the latter Glossata, Antliata, and Rhynchota. It may be objected with truth against this classification that many so-called Mandibulata or Masticatores have but imperfectly developed mandibles, unfit for mastication, whilst many Haustellata are without any vestige of an haustellum or sucking-tube. But its principal defect seems to be that it disregards natural relationships in separating two orders so nearly allied as Piezata and Glossata, and associating the latter with animals with whom they do not agree as regards the structure of the mouth, except inasmuch as the organs of the mouth are generally prolonged—a circumstance which has no typical but merely a biological significance. It is not, however, my intention by these remarks to derogate from the importance of the organs of the mouth for the establishment of principal as well as of subordinate divisions of insects, so clearly demonstrated by the imperishable works of the great Danish entomologist; nor do I deny that two principal types are observable in the structure of the mouth in that class. But I believe that their essential point of difference has been overlooked, and therefore an erroneous classification adopted. This essential point of difference is, in my opinion, to be found in the position of the first two pairs of appendages of the mouth with reference to the skull *.

One of these two principal types is characterized by the *mandibles articulating with the skull* by means of a hinge-joint, while the maxillæ are connected with the skull through a less perfect articulation, sometimes merely sliding on its anterior margin, which surrounds the mouth. This arrangement leaves the organs of the mouth entirely free outside the mouth; they can be moved laterally, and are so far fit for biting; and whilst the mandibles are altogether incapable of being protruded in front of the mouth, the maxillæ are only in a very limited degree capable of such a displacement †. The appendages of the mouth cannot, therefore, be used as stinging-instruments; and when

* The first indication of this view may be found in a passage of the important paper by Latreille, "De quelques Appendices particuliers du Thorax de divers Insectes" (Mém. du Muséum, 1821, t. vii. p. 20, concluding note, "La nature me paraît avoir formé," etc.). But he has not carried it out in practice; otherwise he could not have placed Glossata amongst Suctores.

† The apparent protrusion of the proboscis in bees, which is formed by the second and third pair of appendages of the mouth, consists principally in its being stretched out, whilst ordinarily it is folded up; but it is always outside the mouth.

they are adapted for sucking, this process is carried on either by means of the lingua, as in bees, or by means of an extension of the œsophagus, as in Glossata. Where this arrangement of the mouth is adopted, the skull must possess a certain degree of firmness in order to afford sufficient support for muscles and articulations.

In those insects, on the other hand, which belong to the second type, the mandibles and maxillæ are not articulated with the skull or otherwise connected with it; but their bases are *retracted within the cavity of the skull,* surrounded by muscles, whilst generally only their points project outside the mouth. In this case the appendages in question can be protruded and retracted, but not moved laterally against each other. They may be used as pungent-instruments, but not for biting; and in this case the skull has generally much less consistency than where the mandibles articulate with it.

In both divisions the labium (that is, the third pair of appendages of the mouth) plays about the same part, covering as it does, more or less, the other parts of the mouth from beneath. In the latter division it is generally prolonged into a tube, which often serves as a sucking-instrument, whilst the proboscis of Glossata, which formerly were classed with the insects of this division, is formed by the maxillæ, and is entirely analogous to that of Piezata.

Free mandibles and maxillæ, of which at least the former articulate with the skull, are characteristic of Eleutherata, Ulonata (Synistata), Glossata, and Piezata; whilst, amongst the larger orders, only Antliata and Rhynchota have retracted mandibles and maxillæ, of which neither pair articulates with the skull.

If next we take into consideration the larvæ of Insecta with perfect metamorphosis, we find amongst them two corresponding principal types, one of which is distinguished by the possession of a well-developed skull, with which the mandibles articulate, whilst those of the other type have no skull, properly speaking, and then the mandibles are retracted into the mouth without articulation. Generally speaking, the larvæ and the imagos of the same insects agree in this respect; nevertheless exceptions are met with amongst Antliata, not a few Nemocera possessing in their larval state a well-developed skull and articulating mandibles. In insects which have no true metamorphosis the construction of the mouth must necessarily remain the same in all the stages of development.

But, besides these two principal types, there exists a third, which as it were connects them. In some insects the mandibles and maxillæ do not articulate properly with the skull, and are retracted within the cavity of the skull, so that only their apices are visible outside the mouth; but nevertheless they are calculated for biting, and capable of being moved laterally against each other. The absence of articulation or other connexion with the skull allows of their being to some extent pushed out of the mouth when in use, which is neither possible nor necessary in the case of free biting mandibles and maxillæ; at the same time it is to be observed that, in the case of this intermediate type, the process of protrusion is effected by a special contrivance, entirely different from that whereby the mandibles and maxillæ of the ordinary retracted type are moved forwards and backwards.

This intermediate type, which reminds us of the arrangement of the mouth in Crustacea, is amongst insects only found in Thysanura, and affords one of the two principal characters of this order (or suborder), the other being this, that they remain in the larval stage without undergoing any metamorphosis at all. Not only are the individuals possessing perfectly developed sexual organs without even a vestige of wings, but the segmentum mediale forms a complete ring as in larvæ, and they are unguligrade*; their eyes, finally, when they do occur, are single or at the utmost agglomerated. This larval character is typical for these insects; and we cannot fancy winged species interspersed amongst them in the same way as apterous species occasionally occur in the families of typically winged insects. Thysanura may be regarded as forming two families, Campodeæ and Poduræ, of which for the present only the former will occupy our attention. I do not consider that the Lepismæ properly belong to Thysanura, but class them with Ulonata, amongst which they occupy the lowest place, being apterous and unguligrade. In the construction of the labium and the maxillæ *Lepisma* agrees perfectly with *Blatta*; but the mandibles have this peculiarity—that although their whole external side is free, so that they cannot be called retracted, they are but imperfectly articulated with the skull, being destitute of condyli, and receive the necessary support during mastication from such an intervening chitinous piece as will be described hereafter in *Campodea*. In *Machilis* both mandibles and maxillæ are supported by such an inner piece. I admit that these and other peculiarities in the anatomy of *Machilis* and *Lepisma* render it difficult to draw the limit between Ulonata and Thysanura; and may be they will ultimately have to be united; but at any rate the two families of Campodeæ and Poduræ will always stand

* See, on this term, Prof. Schiödte's paper on Cerambyces, translated in the Ann. & Mag. Nat. Hist. ser. 3. vol. xv.

side by side, being far more closely related to one another than either of them is to Lepismæ.

Campodeæ.

Pedes cursorii, tarsis distinctis, elongatis, biungulatis.
Corpus elongatum, abdomine distincte decemarticulato.
Spiracula perspicua, saltem terna.
Abdominis laminæ ventrales septem priores appendiculatæ.
Cerci duo, e segmento decimo, ultimo, orientes.
Antennæ setaceæ vel filiformes.

This family comprises as yet only two genera (*Campodea*, Westw., and *Japyx*, Halid.), and therefore coincides with Japygidæ, Hal.; but I prefer to name it as I have done in obedience to the old rule that a family name is always to be derived from the oldest established genus in the family.

The legs are upon the whole well developed, and allow of rapid movement; a special apparatus for this purpose, such as the springing-apparatus of most Poduræ, is therefore superfluous. The tarsus consists only of one joint, but is otherwise well developed and of considerable length; whilst the Poduræ are without a distinct foot. In point of fact, I am most inclined to regard the part which carries the claw in Poduræ simply as an empodium, which sometimes may be almost evanescent, at other times sufficiently distinct, with or without an onychium, but with only one claw, whilst Campodeæ always have two true claws. Many Poduræ are certainly described as having two claws; but the supposed second claw is merely a claw-formed onychium, as may be seen from its place of insertion on the empodium, and its position relatively to the only real claw. It will be remembered that an analogous difference has been pointed out by Professor Schiödte in his paper "De Metamorphosi Eleutheratorum Observationes" (Naturhistorisk Tidsskrift, ser. 3. vol. i. pp. 207, 209; iii. pp. 150, 153, 194), between the larvæ of Carabi, Dytisci, and Gyrini on one side, and those of all other families of Eleutherata on the other side.

The body is upon the whole rather flat and elongated; the several rings are distinctly separated, particularly those of the thorax, in each of which separate prætergum, posttergum, præsternum and poststernum, are often observable, besides the ordinary dorsal and ventral shields. The spiracles are easily distinguished, and at least three in number on each side—namely, one for each of the thoracic rings. This latter peculiarity is unique among insects; for in other cases where three pairs are to be seen on the thorax, the hindermost pair belongs really to the segmentum mediale or to the metathorax and segmentum mediale in common, as in *Forficula* (*vide* my 'Anatomia Forficularum,' p. 51); but in this family the third pair of spiracles belongs unquestionably to the metathorax alone; and when the abdomen is furnished with spiracles (in *Japyx*), the segmentum mediale has, like the other abdominal rings, its own pair, independently of the one belonging to the metathorax. As yet, no spiracles have been discovered in Poduræ; but, according to my observations, their organs of respiration consist merely of an open canal along the underside of the head and the thorax, and it is in the fore end of this canal under the head that the tracheal system opens, whenever it exists, as in some of the larger Smynthuri*.

The abdomen presents three divisions, of which the segmentum mediale forms the first, the three following rings the second, whilst the remaining six rings form the third division; in *Japyx* the separation between the first and second division is less conspicuous than in *Campodea*. The number of abdominal rings is unquestionably ten, all furnished with muscles for independent motion, and all complete, having both ventral and dorsal shields. It seems, therefore, that every doubt as to ten really being the typical number of rings in the abdomen of insects must now disappear; and I believe a careful comparison between the structure of the abdomen in these animals and in *Forficula* will give to my interpretation of the structure met with in the latter genus any additional support that it may still lack †.

The first seven ventral shields of the abdomen carry in each of their hind corners a short appendage articulating with the abdomen, such as is also found in *Machilis*, but not in any of the true Poduræ. They possess two cerci, which, as in Ulonata, belong to the last ring of the abdomen, whilst the cerci of Po-

* I look upon the statements of Nicolet (Rech. p. s. à l'Hist. des Podurelles, p. 47, pl. 4. f. 3, 4) and of Von Olfers (Annot. ad Anatom. Podurarum, p. 11, f.) as entirely erroneous; and so far I agree with Lubbock (Trans. Linn. Soc. xxiii. p. 441).

† [It may be remembered by some that this question has been the subject of a prolonged controversy between the late Dr. Schaum and Dr. Meinert, the former having, in a paper "On the Composition of the Head, &c." in Ann. Nat. Hist. vol. xi. 1863, maintained that the typical number of abdominal segments in insects was nine, whilst Dr. Meinert, in his 'Anatomia Forficularum,' which appeared shortly after, maintained that the proper number was ten. The discussion was continued by Dr. Schaum in two papers in 'Archiv f. Naturgeschichte' (vols. xxix. & xxx.) and by Dr. Meinert in 'Naturhistorisk Tidsskrift,' vols. ii. & iii. It turned mainly on the correctness of Dr. Meinert's interpretation of the structure of the abdomen in *Forficula*, and this is strongly borne out by a comparison with *Japyx* and *Campodea*; but the former of them was then not yet described, and the latter Dr. Schaum does not seem to have known or taken into account.—Translator's *note*.]

duræ never belong to the last ring, but take their rise from the ventral shield of one of the preceding rings, both when they preserve their original plain form and when they are transformed into a springing-apparatus.

Neither in *Japyx* nor in any species of *Campodea* have I been able to discover eyes, though both Guérin and Nicolet assert that they have found eyes in the species of *Campodea* examined by them.

Japyx, Hal.

Cerci breves, inarticulati, cornei, forcipis instar.

Segmentum ultimum maximum, pænultimum breve, scuto ventrali fisso.

Mandibulæ paululum compressæ, serratæ.

Mala interior maxillæ lobis quinque laciniatis instructa.

Palpi maxillares biarticulati.

Labium verrucis (palpariis ?) duabus anticis permagnis instructum.

Palpi labiales conici, setis simplicibus muniti.

Antennæ setaceæ, articulo ultimo parvo, minore quam pænultimo, conico.

Oculi nulli.

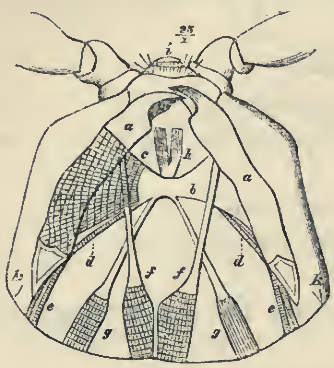
Unguiculi simplices, inæquales, onychio unguliformi.

Spiracula dena.

The following description of the mouth in this genus applies in all essential respects to the whole order of Thysanura generally :—

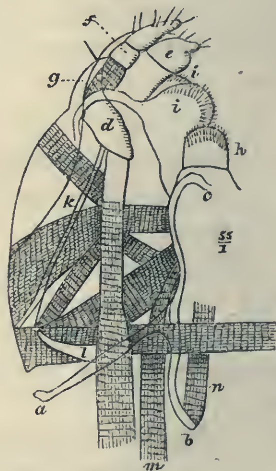
The mandibles (fig. 1 *a*) are elongated, flat, and their basal part attenuated into a point without any vestige of condyles. The proportion of their breadth to their length is as 1 to 6 or 7, and they are therefore comparatively much more robust than those of Antliata and Rhynchota, which are setiform or subuliform. But the principal peculiarity of the mandibles in *Japyx* and other Thysanura is that they are hollow, and that their great flexors (*c*) penetrate into their interior through a longitudinal slit or fissure along their inward edge, and fix themselves inside the mandible on the wall of the cavity opposite the fissure; whilst in other insects the mandibles are solid, and the muscles are all fixed to their outside by tendons. The opposite ends of the flexors of the mandibles, as well as of their tensors, in *Japyx* are attached to a chitinous plate (fig. 1 *b*) situated between the mandibles, and steadied by a double set of muscles (fig. 1 *g h*). Thus the mandibles can be approached to one another; but, in order to give this movement sufficient precision and strength, the mandibles must turn round some firm centre of movement; and as they do not articulate with the skull as free biting mandibles do, but are almost entirely retracted into the head, this centre of motion is supplied by a pair of conical protuberances (fig. 1 *k*) on the inner surface of the skull near the back

Fig. 1.



a a, mandibles; *b*, chitinous plate; *c*, principal flexor of mandible; *d*, tensor of mandible; *e*, muscles which keep the mandibles in place; *f*, second pair of flexors of mandibles; *g h*, muscles steadying, protruding, and retracting chitinous plate; *i*, labrum; *k*, protuberances serving as pivots for mandibles.

Fig. 2.



a b c, principal parts of inner framework on one side; *d*, inner lobe of maxilla (the lamellæ omitted); *e*, outer lobe of maxilla; *f*, palpus; *g*, palpiger; *h*, lingua; *i*, paraglossæ; *k*, stipes of maxilla; *l*, cardo maxillæ; *m n*, retracting and protruding muscles of framework.

of the head, against which the pointed basal ends of the mandibles are pressed when the flexors contract, and which then serve them as pivots. The drawing will explain this arrangement more clearly; only it is to be observed that the mandibles have been brought out of their ordinary position and slipped away from the protuberances just mentioned.

The maxillæ are connected with the lingua, and, together with the latter and the paraglossæ, supported by a peculiar internal framework (fig. 2 *a b c*) of thin chitinous pieces, of which the construction will appear more fully from figure 3. The most prominent part of the maxilla is the inner lobe (fig. 2 *d*), which is more strongly chitinized than the other parts, hooked or sickle-shaped, and carries on its concave inward edge five curved, deeply subdivided smaller lobes or lamellæ. The inner maxillary lobe is supported by the stipes (fig. 2 *k*), which is tolerably firm, elongated, and flat. From the basal extremity of the stipes a thin chitinous piece can be traced (fig. 2 *l*), connecting it with the outer branch of the framework just mentioned; and this I look upon as representing the cardo or hinge of the maxilla. The outer lobe (fig. 2 *e*) is membranaceous, and has near its anterior margin a small conical protuberance. There is a distinct palpiger (fig. 2 *g*) carrying a biarticulate palpus (fig. 2 *f*). The lingua (fig. 2 *h*) is in this genus proportionally very small, linguiform, and armed with short setæ. The paraglossæ (fig. 2 *i i*), on the contrary, are very large and bilobate. Of the muscles moving all these parts some are fixed to the inner surface of the skull, others to the oft-mentioned framework, which, in its turn, with all that is connected with it, can be pushed forward and drawn back by special sets of muscles, as shown in figure 2.

The labium reminds one somewhat of the same organ in Ulonata, and consists of a deeply bifid plate covering the mouth from beneath. Its most striking feature is the existence of two large retractile warts, clear as water, which I suppose to correspond to the inflations discovered by Latreille on the labium of *Machilis* (Nouv. Ann. du Muséum, 1832, i. p. 171). But for this analogy, one might be tempted to look upon them as a kind of palparia which these blind animals might well need, but which are wanting in both pairs of palpi. I regret that my scanty material did not permit a proper examination of their histological structure. On each side of the fissure in the middle of the labium two component pieces (centres of chitinization) may be distinguished, one behind the other, which perhaps correspond to the lobes observable on the third pair of appendages of the mouth in Ulonata. Further behind, a third pair of plates is observed, one on each side, which perhaps represent the stipites of the third pair of mouth-appendages; and in an emargination on each of these plates, the short, conical, sparsely haired, and strongly chitinized palpus is inserted.

There is no mentum. The hypostoma forms a rather large obversely cordate plate, placed near the posterior border of the underside of the head, between the inflected margins of the occiput.

The antennæ consist of many short joints furnished with verticillate setæ; the individual joints are inversely conical or almost spindle-shaped, so that the general outline of the antennæ becomes filiform or slightly moniliform. The last joint is smaller than the others and slightly conical. The antennæ are placed on a protuberance which is separated from the skull by a fine suture, but does not constitute a basal joint, as it is immoveable, the muscles of the antennæ inserting themselves only on the base of the following moveable division.

There is no vestige of eyes.

The skull is supported by a thin chitinous piece, which is placed under the suture in the middle, and bifurcates near the centre of the head, the two branches approaching the lateral margin of the head.

The three thorax-rings are well separated by double folds; and as some of these are chitinized both on the dorsal and the ventral surface, we observe in the prothorax a præsternum and poststernum, in the mesothorax a prætergum as well as præsternum and poststernum, and in the metathorax both prætergum and præsternum.

The legs are slender, with small conical coxæ; they are rather abundantly furnished with stiff hairs, particularly the feet, which articulate with the tibiæ by means of regular condyles, and which in length stand between the femora and the tibiæ. The claws are large, foliaceous, but of unequal length. The empodium is well developed and supported by a thin curved chitinous piece; between the claws there is a small cultelliform onychium, which might be described as a third claw, if such a thing was at all possible or reconcileable with the symmetry of the insect body*. The proportionate lengths of the two claws and the onychium are as 3 to 2 to 1, or, more correctly, as 15 to 10 to 4.

The moveable appendages on the underside of the first seven abdominal rings are in this genus (or, at any rate, in the only species as yet discovered) reduced to very short conical bristles, each bearing a fine hair on its side, and articulated with the ventral shield near its posterior corners. The first of these rings, the segmentum mediale, is, besides, distinguished by a small protruding wart, with five or six rows of impressed points bearing setæ peeping out from behind the middle of the posterior margin of its ventral shield; on each side of this wart there is a smaller flat protuberance furnished with rather longer bristles. The ventral and dorsal shields of all these seven rings cover almost the whole of their upper and under surface, whilst the sides only in part are covered by small pleural plates.

The three following rings are more closely united and more completely chitinized than any other part of the animal; but they are without the appendages described in the preceding rings.

The sexual orifice rests on the posterior margin of the ventral shield of the eighth ring, and the deeply bifid vagina of the female can be protruded from behind the latter. The next ring (ninth) is very short, and its ventral shield is divided into two perfectly separate triangular plates. The last ring is longer and

* Nor have the very young larvæ of *Meloë* been correctly described as possessing three claws (whence the name *Triungulinus*); they have in reality but one deeply trifid claw.

of greater consistency than any of the others; the colour is a dark yellowish brown, even in young individuals, where the rest of the body, or at any rate the greater part of it, is milk-white. The general shape is prismatic, and the section tolerably rectangular, the sides being formed by the perpendicular pleural shields, so that the skin connecting them with the ventral and dorsal shields does not appear in view. Connected with the dorsal shield of this segment, in the middle of its posterior margin, we observe the small, short and broad anal plate, under which the anus is situated. With regard to the term anal plate (*lamina analis*), I refer to my paper on *Forficula**: it is the same as L. Duthiers's *endecato tergite*; but I see no reason for interpreting it as the remains of an eleventh ring; and it has, of course, nothing to do with the entirely superfluous term *lamina supra-analis,* which is sometimes applied to the tenth dorsal shield in Ulonata.

Comparing the structure of the posterior part of the abdomen in *Campodea* and *Forficula,* the matter stands thus:—In *Campodea* all ten abdomen-rings are perfectly and equally developed; in *Japyx* the requirements of the forceps cause a disproportionate development of the tenth ring, whilst the ninth is somewhat reduced and its ventral shield divided into two triangular plates. In both these genera the anus opens at the extremity of the abdomen. In *Forficula* there are also ten distinct abdomen-rings, of which the first (segmentum mediale), as in most insects, is closely connected with the thorax; here, too, the last or tenth ring is disproportionately large; but whilst in *Japyx* the dorsal and ventral shields are about equally developed, the dorsal shield preponderates very much in *Forficula,* the anal plate is proportionally larger, the ventral shield divided into two triangular plates, and the anus is drawn back from the extremity of the body, and opens at the root of the tenth ring, instead of at its apex, between the two halves of the tenth ventral shield. Besides, the eighth and ninth rings are almost rudimentary in the female *Forficula.*

The short but powerful hooked branches of the forceps of *Japyx* possess regular condyles and corresponding sockets both in the ventral and in the dorsal shield, just as in *Forficula*; but I am unable to say with certainty whether the forceps present sexual differences, as is the case in *Forficula,* as I have not been able to sacrifice a sufficient number of individuals for dissection, but I do not consider it probable. The spiracles are situated in the side folds of the first ten rings.

The ganglia of the nervous system are large and round; each

* Nat. Tidsskrift, 3 ser. vol. ii. p. 446. [Comp. Ann. & Mag. Nat. Hist. ser. 3. vol. xv. p. 484.—Translator's *note.*]

of the rings of the thorax and the first eight abdomen-rings (including the segmentum mediale) have one each, so that there are eleven in all.

The digestive tube, of which the duodenum occupies the greater part, is quite straight. I have failed to discover Malpighian vessels, nor do I think they exist either in *Japyx* or in other Thysanura.

The ovaries consist of a pair of wide tubes, opening at the back of the eighth ventral shield. The eggs were, in the individual I examined, few, but very large (9 millims. long), the germinative cell large and easily distinguished from its neighbours.

Japyx solifugus, Hal.

Testaceus, abdominis segmentis ultimis atque forcipe præsertim obscurioribus.
Antennæ $\frac{2}{7}$ longitudinis corporis breviores, 18–31-articulatæ.
Forceps robustus, longitudine scuti dorsalis segmenti ultimi; lateribus interioribus dente instructis.
Long. 8·5 millim.

I am indebted for the specimens which I have been enabled to examine to the courtesy of Dr. V. Bergsöe, who collected most of them at Genezzano, in the Sabine Mountains, and at Mount Casino, near St. Germano, in the year 1862. It seemed to be a mountain species, as he had never seen it in the Campagna: his specimens were found singly, under large stones or dry moss on the rocks in dry places; they tried to escape by running actively about, and resembled a *Lithobius* in the character of their movements.

The present paper was ready for publication when Mr. Haliday's description of *Japyx*, in the 'Transactions of the Linnean Society,' vol. xxiv. p. 441, came to my hands; and I have therefore scarcely been able to refer to it, except so far, that I have substituted the name proposed by Mr. Haliday for the one I had myself intended for this remarkable animal. With regard to Mr. Haliday's figures, I would observe that the principal figure seems to have been made after a dried specimen, while mine had fortunately been preserved in spirit and thus retained their natural elegance of form. I also differ from Mr. Haliday in the interpretation of the organs of the mouth. What he considers to be labial palpi, I believe to be maxillary palpi; what he describes as labium (fig. 2) are, in my opinion, the maxillæ (without the inner lobes) together with the paraglossæ (but without the lingua). Mr. Haliday's maxillæ are, in my opinion, merely the interior maxillary lobes; and fig. *t* I suppose to be a part of the remarkable framework for the support of the organs of the mouth, which he has probably not observed, as he does not mention it. I have distinctly observed the appendages on the underside of the abdomen, corresponding to those of the Lepismæ, which Mr. Haliday failed to discover on his specimens; and I interpret the two chitinized plates on the underside of the tenth abdomen-ring as the separated halves of the ventral shield —not, with Mr. Haliday, as the inflected margins of the dorsal shield. Several minor points of divergence will appear from the above description.

CAMPODEA, Westw.

Cerci longi, multiarticulati, filiformes.

Segmentum pænultimum longitudine segmenti ultimi, scuto ventrali integro.

Mandibulæ apice compressæ, dentatæ, appendice lamelliformi instructæ.

Mala interior maxillæ in dentes octo incisa.

Palpi maxillares inarticulati.

Palpi labiales breves, fere membranacei, setiferi, duas longas setas ensiformes apice gerentes.

Verrucæ duæ setiferæ pone labium.

Antennæ filiformes vel submoniliformes.

Oculi nulli (vel seni congregati evanidi ?).

Unguiculi curvati, ad basin processibus binis longis tenuibus curvatis instructis.

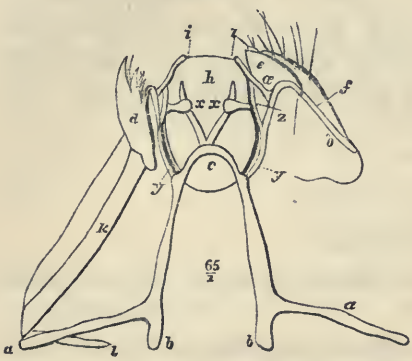
Spiracula terna.

The mandibles are shorter and more powerful than in *Japyx*; their apex is more compressed, almost cuneiform, with the anterior edge oblique, dentate, and a sort of grinding-surface along the inner edge of the apex. At the base of this grinding-surface a small, thin, triangular lobe, with deeply incised fore margin, articulates with the mandible. The muscles of the mandibles are also upon the whole more powerful than in *Japyx*, and they are disposed as in that genus.

The maxillæ are somewhat less complicated than in *Japyx*; the inner lobe is less elegant; the subsidiary lobes are more in number, but not themselves subdivided, the two outer ones being the most powerful, the others with thin foliaceous apices. The outer maxillary lobe is, as in *Japyx*, foliaceous, with a conical protuberance on the upperside. The palpus is inarticulate, and in a great measure united with the maxilla without distinct palpiger.

The lingua is large, oval; the paraglossæ large and flat; they cover the lingua almost entirely from above, and surround also its sides; when seen from beneath, they appear only as two small bodies at the sides of the lingua. The framework supporting the maxillæ and lingua is very complete (see the annexed figure), and in all essential points like that of *Japyx*.

Fig. 3.



a a, *b b*, *c*, principal parts of inner framework supporting the maxillæ and lingua; *d*, inner lobe of *right* maxilla; *e*, outer lobe, and *f*, palpus, of *left* maxilla; *h*, lingua; *i*, paraglossæ; *k*, stipes, and *l*, cardo, of *right* maxilla; *x x*, pieces of framework supporting lingua; *y ö*, similar pieces supporting outer lobe of maxilla; *z*, *æ*, pieces connected with the last, and supporting paraglossæ.

The labium covers the organs of the mouth almost entirely, so that ordinarily only their points are visible in front of it; but, as stated before, they are capable of protrusion to some extent, about so much that the lingua becomes visible. The labium is deeply bifid, and each half is divided into two pieces by a transverse groove (though less markedly than in *Japyx*); from the hindmost divisions rise the short conical, hairy, labial palpi, which near their apices each carry two long subuliform setæ. The palpus is much less chitinized than in *Japyx*, and it does not articulate properly with the labium.

Behind the labium appear two oval, transversely placed protuberances like warts, on which from six to eight rows of rather large depressions with small setæ are observed—probably an organ of sense affording a substitute for the absence of palparium on the labial and maxillary palpi.

There is no mentum. The hypostoma varies in size, but is generally only a small triangular plate near the posterior margin of the head.

The antennæ consist of numerous rather long joints bearing one or two circles of large setæ, besides many smaller scattered ones. In the Danish species I have counted from twelve to twenty-six joints, often different numbers in the antennæ of the same individual. The joints are cylindrical, or slightly fusiform; the last but one is always the smallest, and the last the longest, though the length of it varies so much that, in some individuals of the Danish species, it is less than that of the two preceding ones together, whilst in others it almost equals that of the four preceding ones.

In spite of careful search, I have failed to discover the least trace of eyes, though Nicolet describes his species as possessing six very small eyes on each side of the head, placed in two rows. Neither Westwood nor Gervais seem to have observed eyes on their specimens, which, however, probably were specifically different from those of Nicolet.

The occiput is along the middle divided by a fine, closely and minutely dentate suture, which is observed also along the dorsal shields of the thorax-rings. In the centre of the head the seam bifurcates; and the branches form the boundary between the occiput and the forehead, with the points of insertion of the antennæ.

The prothorax is considerably smaller than either the mesothorax or metathorax, which latter are of about equal size. The transverse folds which separate the dorsal shields are not chitinized in *Campodea* as in *Japyx*; and when the animal contracts itself, the dorsal shields are closely approximated to each other.

The legs are slender, calculated for running; the tarsus long, inarticulate, ending in two long, hooked and sharp-pointed claws, of which each carries on the outside a long, thin, curved appendage. This appendage looks like a seta, but is not placed in any depression; the concavity of its curvature is opposite to that of the claw, so that the points approach; and its apex is a little flattened.

The first abdomen-ring (segmentum mediale), when viewed from beneath, exhibits on each side a peculiar appendage, like a pocket, taking rise from the pleuræ, and furnished near its apex with two close rows of setæ. A row of stiff short setæ is also observed along the whole posterior margin of the ventral shield. The following six rings have no such appendage; but in the posterior corners of their ventral shields a conical or subulate appendage articulating with the body is observed, and inside this, on each side, a little sac, which is capable of being retracted inside the edge of the ventral shield, and thus hidden from observation. These sacs, which for this reason have hitherto escaped notice, consist of a thin membrane; and when pushed out, they present at their apex a glandular mass, and a retracting muscle is seen, which is fixed to their inside. They correspond probably to the sacs discovered by Guérin in *Machilis*, and interpreted by him as branchial sacs, analogous to those of the Crustacea, for which reason, amongst others, he would incorporate *Machilis* with Crustacea (Ann. d. Sc. Nat. 1836, sér. 2. tome v. p. 374, and Compt. Rend. 1836, tom. ii. p. 595). Separate pleural plates are not observable on any of these abdomen-rings; but the dorsal shields cover, as in *Forficula*, the whole of the back and sides, touching or even lapping over the lateral margin of the corresponding ventral shields. The last three rings are destitute both of these appendages and of the sacs. The sexual orifice is behind the eighth ventral shield, in a conical protuberance, which is simple in the male, but in the female almost bifid. The ninth and tenth rings are closely united, but have, as already stated, each its own independent set of muscles, the tenth ring accommodating besides the tensors and flexors of the long cerci. Behind the posterior margin of the tenth dorsal shield a triangular pointed appendage is seen protruding, which is the anal plate mentioned above in the description of *Japyx*, and which here, too, is too small to prevent the anus from opening through the extremity of the tenth ring. Below the anus two similar, but shorter, appendages are observed.

The whole animal, particularly the upper side, has numerous setæ, some of which are large, subdivided and disposed in rows round the body; each ring has one such row, and the last ring has two of them. On the fore part of the animal the laciniated setæ lie tolerably close to the body; but those on the last six rings stand out from the body almost perpendicularly.

The long many-jointed filiform cerci, which rise from the last abdomen-ring, possess round each joint, or at any rate round those nearest the base, a row of a few such laciniated setæ. The cerci break off very easily, wholly or in part, and the joints are not always very distinctly separated from each other; it is therefore difficult to indicate the number of joints and relative length of the cerci; in those of the Danish specimens, however, I have usually counted from eleven to fourteen joints.

Spiracles are only found on the thorax-rings; the largest are those of the prothorax, which are situated on the underside far behind, almost on the sides in the extreme margin of the prosternum. The two other pairs of spiracles are smaller, circular, and situated on the upperside behind the dorsal shields of the second and third thorax-ring.

The three ganglia of the thorax are proportionally narrow; but I have not had an opportunity of examining the rest of the nervous system sufficiently.

The digestive tube is straight; and the duodenum reaches from the second or the third thorax-ring to the middle of the eighth abdomen-ring. There are no Malpighian vessels; but the lower end of the duodenum is, in *Campodea*, surrounded by a circle of about sixteen rather large glandular cells.

The ovaries and testicles consist of two undivided, long and wide tubes, opening, as already stated, behind the eighth ventral shield.

Campodea fragilis, n. sp.

Nivea (vel lutea), densius pilosa.
Caput æque longum ac latum.
Antennæ longitudinem corporis dimidiam paululum superantes, sæpissime 18–20-articulatæ, articulo pænultimo brevi, ultimo longo, sæpissime articulos duos vel tres pænultimos longitudine æquante.
Cerci fere longitudine abdominis, 11–14-articulati.
Long. 5·5 millim.

As in the case of *Japyx solifugus*, the specific characters are chosen almost at random; for although several species of *Campodea* have been described, they have not yet been properly compared with each other. The synonymy is consequently altogether vacillating. If the descriptions and figures given by the different authors are correct, our species must be new. From *C. staphylinus*, Westw. (Trans. Entom. Soc. vol. iii. p. 231, pl. 8) ours would differ by much longer and slenderer cerci and antennæ, and by the different ratio of the lengths of the last the penultimate joints of the antennæ. Besides, Westwood describes the tarsus as articulated; but that the abdomen is figured with only nine rings is, of course, a mere oversight. Gervais's *C. staphylinus* (in Walckenaer, Hist. Nat. des Aptères, iii. p. 455, pl. 51) differs from our species by having the last abdomen-ring only one-third the size of the preceding one (whilst in our species they are of equal size), by having much longer and more attenuated cerci with many more joints, and by a proportionally narrower and more pointed forehead.

Nicolet's *Campodea staphylinus* is, like Westwood's, described as having biarticulate tarsi; it is stated, moreover, to possess eyes, and a peculiar rudimentary appendage on the back of the ninth ring—all of which, if really correct, of course would distinguish it specifically from *C. fragilis*, which, besides, has much slenderer and less robust body and appendages. Nicolet's *C. succinea* seems so little different from his *C. staphylinus* that it also cannot be identical with our species.

O. F. Müller's *Lepisma aptera flava* (Zool. Danicæ Prodrom. p. 183. n. 2160) may be the same as our *Campodea*; but as it may as well be some other apterous species, I have not thought fit to revive his specific name; and, for the same reason, I think it unsafe to attempt to carry our synonymy back to such old publications. Haliday has referred to *Podura ambulans*, L.; but this cannot have been a *Campodea*: if Linnæus had known the *Campodea*, he would have classed it with *Lepisma* or Myriapoda, but he would certainly not, as he does with regard to his *Podura ambulans*, first have placed it amongst Pediculi and then amongst Poduræ. The Linnæan species is, no doubt, a true *Podura,* probably an *Anura,* which also agrees with the habits of life which he ascribes to his species. Schrank's "Gehender Springschwanz" may be a *Campodea,* though now it would be impossible to say which; but in adducing as a synonymous name *Podura ambulans,* L., Schrank committed a mistake, which, of course, ought not to be imitated.

Campodea fragilis is frequent in the neighbourhood of Copenhagen, in moist black earth; under stones it is often seen in troops, which quickly disperse when the light is let in upon them. It lives, at least partly, on dead insects, as I have often found in its stomach scales of butterflies and other remains of insects which it could not have attacked or overcome alive.

BIBLIOGRAPHICAL NOTICES.

British Conchology. Vol. IV. *Marine Shells, in continuation of the Gastropoda as far as the Bulla Family.* By John Gwyn Jeffreys, F.R.S., F.G.S., &c. Van Voorst, 1867.

This is by far the most valuable volume of Mr. Jeffreys's work yet published. It contains descriptions of the most interesting and at the same time the most difficult families of Marine Gastropoda, including certain genera which the author has made peculiarly his own, and on which he is more competent than any other conchologist to treat; and there is not wanting evidence in this and in preceding volumes of the great advantage which the possession of immense series of specimens collected from all parts of the coast, for examination and comparison, gives him in the preparation of his work. Our first impulse was to turn to the genus *Odostomia,* in the hope of finding that the extreme and wholly insurmountable difficulty which every student of Forbes and Hanley has found in the discrimination of the members of that genus might be in some degree removed by a wholesome reduction in the number of so-called specific forms. It is satisfactory to find that this is the case. *Warrenii* is united with *obliqua; alba, dubia, nitida,* and *glabrata* take their place as varieties of *rissoides; rufescens* is joined with *scalaris*; *fulvocincta* with *rufa; formosa* is expunged altogether, as not being British; and *affinis* is regarded as a variety of *acicula,* as is also the form described a few years ago in the 'Annals' by the author under the name *Eulimella obeliscus.* With one exception, on which some doubt may be entertained, we fully concur in the justice of these elisions, and believe, moreover, that future observation will result in the process being carried yet a little further. It will be observed that *Chemnitziæ* and *Eulimellæ* have here been spoken of as *Odostomiæ,* the fact being that Mr. Jeffreys has discarded the former genera and grouped the species in *Odostomia.* Now it is true that there are certain osculant forms which create difficulties in the definition of the genera; yet at page 114 we find a division (a far more satisfactory division, to our mind, than that of Forbes and Hanley) of the species into three sections, for which the generic names might have been advantageously retained. The name *Odostomia* is altogether inappropriate to the toothless forms of *Chemnitzia* and *Eulimella*.

The volume contains descriptions of one hundred and eighty-two species; whereas Forbes and Hanley, in the same families, give only one hundred and sixty-nine; but, inasmuch as sixteen of the forms described by the latter are here struck out of our fauna, we find that an addition has been made to this section of our Mollusca of no less than twenty-nine species since the publication of the 'History of the British Mollusca.' The sixteen expunged forms are:—*Ianthina exigua*, Bruguière, and *pallida*, Harvey, as not having been found *alive* upon our coasts; *Scalaria grœnlandica*, fossil; *Natica Kingii*, Forbes, as an exotic freshwater species erroneously recorded; *Lamellaria tentaculata*, Montagu, as being the male of *L. perspicua*, Linn.; *Cylichna conulus*, S. Wood, and *strigella*, Lovén, as synonymous with *C. strigella*; together with the nine *Odostomiæ*, *Chemnitziæ*, and *Eulimellæ* already referred to.

The following are the twenty-nine species which are here described as inhabitants of the British seas, but which have no place in the work of Forbes and Hanley:—

Rissoa Jeffreysii, Waller. Shetland.

R. albella, Lovén. This is the *R. inconspicua*, var. *tenuis*, of Forbes and Hanley. It has been found at Southampton and on various parts of the western coast, and at Shetland.

Aclis Walleri, Jeffreys. Deep sea, Shetland.

Odostomia minima, Jeffreys. Guernsey, Falmouth, Hebrides, and Shetland.

Odostomia Lukisi, Jeffreys.
O. albella, Lovén.
O. diaphana, Jeffreys.
O. umbilicaris, Malm.
Each of these species has been found in several localities.

Eulima intermedia, Cantraine. Widely distributed.

E. stenostoma, Jeffreys. The Haaf, Shetland.

Torellia vestita, Jeffreys. A single dead specimen on east coast of Shetland.

Cerithiopsis Barleei, Jeffreys. Plymouth, Falmouth, Cork, and Galway.

C. pulchella, Jeffreys. Guernsey, Devon, Cornwall, and Antrim.

C. costulata, Möller. Deep water, Shetland.

Triton nodifer, Lamarck, and *T. cutaceus*, Linn. Guernsey. Two very fine Mediterranean forms.

Fusus Islandicus, Chemnitz. Two specimens from the Shetland Haaf and one from Wexford. This is the typical *Islandicus*, a much finer species than that described by Forbes and Hanley under that name, which in Mr. Jeffreys's work is called *F. gracilis*, Da Costa.

Fusus buccinatus, Lamarck. Allied to *F. propinquus*, with which it has hitherto been confounded. It is a much larger and coarser form;

and has a more southern range. It may be questioned whether the two are distinct. Is not this a case of exception to our author's favourite theory that our Mollusca attain larger development in northern latitudes?

Nassa nitida, Jeffreys. The Harwich *Nassa*, which has hitherto been regarded (and, we think, rightly) as a variety of *N. reticulata*.

Columbella haliæeti, Jeffreys. An interesting species from the Shetland Haaf.

Defrancia reticulata, Renier. Rare, but ranging from the Channel Islands to Shetland. A white variety of this species is the *Mangelia purpurea*, var. *asperrima*, of F. & H.; one of the loveliest of British shells.

Pleurotoma rugulosa, Philippi. Cornwall. Perhaps scarcely sufficiently distinct from *P. costata*.

P. lævigata, Philippi. Of southern and south-western range. Regarded by Forbes and Hanley as a variety of *P. nebula*.

P. nivalis, Lovén. A very fine Norwegian species, of which a few examples have been dredged on the Shetland Haaf.

Cylichna alba, Brown. A fine addition to our fauna from Shetland.

Utriculus ventrosus, Jeffreys. Only one specimen known, dredged by Mr. Barlee in the Sound of Skye.

U. expansus, Jeffreys. Another Shetland treasure; and the 'Annals' of last month records a third addition to this genus, also from Shetland, *Utriculus globosus*, Lovén, which has been discovered by the Shetland Dredging Committee, during the past summer, in St. Magnus Bay.

Philine angulata, Jeffreys. Antrim, Hebrides, Shetland, and Aberdeenshire.

P. nitida, Jeffreys. Skye and Haroldswick Bay, Shetland.

These are not inconsiderable additions to have been made to our fauna in this best-worked-up department of marine zoology during the few years which have elapsed since the publication of Forbes and Hanley's 'History.'

The observations which follow the descriptions of the species are always of value, and often very full and interesting. We are frequently astonished at the mass of information here briefly condensed. It has been Mr. Jeffreys's aim to popularize his subject and to make a readable book. In the former volumes there were to be found frequent digressions from the direct history of the species on which he was writing, and the pages were thickly strewn with poetical quotations. In the present volume such quotations and digressions, which were tiresome to the scientific reader, are much less frequent; and, the space thus gained being filled with yet larger stores of scientific information, the result is an increase, not a diminution, of interest. Such bibliographical and biological notes as we find, for example, on *Ianthina*, *Purpura*, or *Buccinum* require no extraneous accretions to set them off; they are replete with instruction and interest in themselves.

The following closing words of volume iv. are well worth quoting, since the issue of plates to illustrate the work was alone required to make it take its place as the standard authority on the British Mollusca. We trust that no pains will be spared in the execution of these drawings. The generic illustrations which have been published in the earlier volumes have in many instances fallen short of what they might have been; and even in the present volume, some of the engravings (for example, the figures of plate 7) are hardly worthy of that accurate artist, Mr. G. B. Sowerby:—

"And now, good reader, I should be sorry if you have complained of my being too voluminous. I never professed to make this a manual; nor have I yet quite done. Let me remind you of the advice given by Seneca (De Ira, lib. iii. c. 31. § 3), 'Age potius gratias pro his quæ accepisti: reliqua expecta, et nondum plenum te esse gaude. Inter voluptates est, superesse quod speres.'

"The next volume will complete the work, and contain an account of the few remaining Pleurobranchiata, the Nudibranchs (by Mr. Alder), the marine Pulmonobranchs, the Pteropods, and the Cephalopods, a Supplement to the volumes already published, and other useful matter, besides plates (plain and coloured) by Mr. Sowerby, to represent all the species and remarkable varieties of British shells. Most of these plates are engraved, and the colouring is in progress."

Mind in Nature; or, the Origin of Life and the Mode of Development of Animals. By Henry James-Clark, A.B., B.S., Adjunct Professor of Zoology in Harvard University, Cambridge, Mass., &c. Illustrated; pp. v–315. D. Appleton & Co., New York. 1865.

This work has scarcely met with the attention, in this country, which it seems to deserve. It contains much interesting information respecting the lower animals, which is expressed in a clear and pleasing style.

The Origin of Life is considered in the first five chapters, in the course of which the author adduces some experiments in defence of the hypothesis of *spontaneous generation*, and propounds his theory of the egg,—viz. that it is a "*bipolar animal*," . . . . "*a globular accretion of two kinds of fluids, albumen and oil, which are always situated at opposite sides or poles*," and separated more or less distinctly from each other. Amongst the most remarkable modes by which an individual existence arises cited, is the derivation of vibrioform bodies from the fibres of decomposing muscular and tendinous tissue. His assertion, at page 101, that "human digestion makes human flesh out of the *decomposed* meat of many different kinds of animals," requires some qualification, since the word *decomposition* is employed in the same paragraph somewhat in the sense of putrescence. The meaning of the word is wrested for the defence of spontaneous generation.

The speciality of the second part is his treatment of the Protozoa. "*The type of this division*," he writes, "*is found in its relation to* *a spiral; it is the oblique or spiral type.... What characterize them all are not only the oblique relations of right and left, but also the presence of one or more peculiar contractile bodies, the so-called contractile vesicles, and a diffuse digestive system.*" He describes, in the ninth chapter, how the sinuses of the digestive cavity in certain Infusoria came to be described by Ehrenberg as saccules or pouches. In treating of the Mollusca, he agrees with Oken in regarding as the rudiment of a left valve, homologous with that of a Lamellibranch, the operculum of the operculated Gasteropods. At the same time he makes no allusion to the absence of correspondence between these two organs in respect of the relative periods of their formation. The Articulata are briefly touched upon in the twelfth chapter. He there shows some good reason for the promotion of the Sipunculoids to the Worms. The Diptera are placed by him at the top of the branch, on account of the extreme concentration of their bodies and the versatility of their heads. It is questionable, however, whether this is their true position, notwithstanding these points in their organization, because the typical form of the Insecta proper seems upon the whole to be four-winged, from which the abortion of the posterior pair constitutes a marked deviation; and it would be quite an exceptional circumstance were an abnormal group to constitute the highest of its class, to say nothing of a branch. The division of the body into three groups of segments, and the versatility of the head, obtain to an equal extent in the Hymenoptera. Professor Agassiz's arguments in favour of the supremacy of the Lepidoptera are not yet shown to be fallacious; and though in some particulars their organization may seem to be inferior, in others (*e. g.* antennæ) it is of a grade decidedly superior to that of the Diptera.

The third part is devoted to the embryology of the five branches of the animal kingdom.

Many other details are worthy of notice; and, excepting some obtrusive claims to originality, and some personalities, the book is pleasantly written and well worth reading.

MISCELLANEOUS.

On the Organization of Cryptoprocta ferox. By MM. A. Milne-Edwards and A. Grandidier.

Cryptoprocta ferox was completely unknown when in 1833 the English zoologist Bennett received a specimen of it, to which he called the attention of naturalists; but this unique specimen was so young that it was impossible to ascertain its precise zoological affinities, the dental system having not yet acquired its definitive form. Bennett thought the species should be placed in the family Viverridæ, close to the *Paradoxuri*, although he indicated some points of resemblance to the Felidæ.

Blainville obtained a drawing of the skull of this young individual, which he figured in his 'Ostéographie.' He had the same opinion as Bennett with regard to its affinities.

M. A. Grandidier, in his travels in the south-east of Madagascar, obtained the skin and two skeletons of the animal; and the study of the adult dental system shows that *Cryptoprocta* cannot remain in the place assigned to it by Bennett. The Viverridæ are characterized by the existence of two tubercular posterior molars in the upper jaw, and one in the lower jaw. In *Cryptoprocta* the upper jaw has only one of these teeth, and the lower jaw has none.

The incisors are six in each jaw; in the upper jaw the outer ones are very strong, not so large as in the hyænas, but equal in proportion to those of the genus *Felis*. In the lower jaw the space occupied by the incisors is very narrow; and these teeth are arranged in two rows, the second clearly behind the others, as in the weasels and martens. This double row of incisors occurs also in some species of Felidæ; but in these the second row is in front of the others.

The canines are large, pointed, very firmly implanted in the maxillary bones, and both in form and direction resemble those of the Felidæ rather than those of the Viverridæ.

There are in each jaw five molars, placed as follows:—

$$\text{premolars } \tfrac{3}{4}, \text{ flesh-tooth } \tfrac{1}{1}, \text{ tubercular } \tfrac{1}{0}.$$

This dental formula differs from that of the cats only in the presence of one additional premolar in the upper jaw and of two in the lower jaw. But it is to be remarked that this difference tends to be effaced by the advance of age, as the first premolar in both jaws falls out soon after its appearance, and, its alveolus being obliterated, there is no trace of it in old individuals.

The flesh-teeth are trenchant and compressed so as to act like the blades of scissors, and thus have a perfectly feline aspect; the constant sharpness of their prehensile margin shows that they are employed only in cutting flesh. The upper flesh-tooth has a tubercle at its anterior inner part, much weaker and less marked than in the hyænas. The lower flesh-tooth has a lobe behind, analogous to but much smaller than that of the hyænas; nor does it present any trace of the inner tubercle which gives such a peculiar aspect to this tooth in the hyænas.

The characters of the remainder of the skeleton are in accordance with those of the dental system, and enable the position of the genus *Cryptoprocta* to be determined from the consideration of the whole. Its dentition separates it clearly from all the Viverridæ, and indicates an animal with more ferocious habits; with one premolar less in the lower jaw (leaving out of consideration the deciduous teeth), the cranium would differ in nothing from that of the cats.

But *Cryptoprocta ferox* is a perfectly plantigrade carnivore; and it must, therefore, be separated from the cats, notwithstanding the analogy of its dentition. The group of the Felidæ is one of the most natural in the animal kingdom, and constitutes rather one great genus than a family; and we should deprive it of its natural character and violate its limits, if we introduced into it an animal with so singular a structure as *Cryptoprocta*.

This animal must, therefore, form a peculiar group approaching most nearly to the cats; and in order to represent exactly the relations which it has to the genus *Felis*, it would seem necessary to unite it with those animals in a tribe which would then be subdivided into two families, one including the digitigrade, and the other the plantigrade Felinæ.—*Comptes Rendus*, August 5, 1867, pp. 232–235: abstract.

A way to determine Trichopterous Pupæ. By A. E. Eaton, Trin. Coll. Cam.

Having been asked in what way the pupa-skin described in the last June Number of this Magazine was ascertained to be that of *Brachycentrus subnubilus*, Curt., without rearing the insect, I will briefly indicate it, with a view to the removal of any doubt that may be entertained respecting the correctness of the determination. 1st, by observing what species is, or are, most abundant in a certain locality at a given time; 2ndly, by collecting from patches of weeds the sloughs of pupæ, and putting together those which correspond in size; 3rdly, by making a comparison between the leg-spurs, the neuration of the wings, and the palpi of the slough and those of the adult state of the most probable species, it is not difficult to refer a pupa-skin to the proper insect. This done, by dredging up occupied caddis-cases, the living pupa (and thus the case also) of the species can be discovered.

On the Spontaneous Movements of the Leaves of Colocasia esculenta *(Schott), and on the Ejection of Water from them in a continuous jet.* By M. Musset.

M. Lecoq has published *, in the 'Comptes Rendus' of the 22nd of last April, some very interesting observations on the spontaneous movements of the leaves of *Colocasia esculenta* (Schott).

"Several times he had the opportunity of witnessing violent fits of shaking, among others on the 20th of January and 2nd of March. On the latter day, in the morning, although the temperature of the stove was lowered to 7° C. (=45°·6 F.), the agitation was considerable in all the leaves, both old and new, without exception: it is an actual febrile movement, a very violent shivering."

These facts, except as regards intensity, are identical with those that I have sometimes witnessed, in observing the ejection of water by the leaves in vernation of *Colocasia esculenta* †. This was sometimes a sort of vibration impressed upon the convoluted and erected leaf, sometimes a waving of the expanded leaf, sometimes a rustling in the interior of the mass, which was composed of a hundred leaves of every dimension, from 0·1 to 1·10 metre in length.

* See Annals, ser. 3. vol. xix. p. 439.

† See 'Comptes Rendus,' tome lxi. p. 682, October 23, 1865, and my memoir in 'Ann. de l'Acad. des Sciences de Toulouse,' 1866.

These movements and these noises have often distracted me from my other observations, but without striking my mind, which was absorbed by the study of the ejection of water. I ascribed them, without accounting for them, either to the agitation of the atmosphere, to some of my own movements, to the hasty flight of some bird concealed in that impenetrable mass of foliage, or to an error of the eye produced by the fatigue which always follows too prolonged tension of the sight, &c. &c.

The observations of M. Lecoq are therefore to me a plain and genuine explanation of a very curious phenomenon which he has the merit of being the first to discover and to study with the sagacity which is habitual to him; my only aim is to confirm a new fact, and one which may appear extraordinary.

M. Lecoq says in his note that he had never been able to observe the fine drops that I have seen so often shoot from the vulvoid region situated underneath the apex. He himself gives the cause of it when he states that the membrane which covers that region is, in the leaves of his plant of *Colocasia*, imperforate. This imperforation (or, rather, this absence of large stomata, orifices of ejection) is extremely rare in the leaves of the species of *Colocasia* that I cultivate in the open ground; I have only detected it in the proportion approximately of 1 to 80. I am surprised that all the leaves observed by that learned naturalist should have presented this anomaly of the imperforation of the hymenoid membrane. Does this depend on the mode of culture, or on a difference of species? Eleven leaves of two plants of *Colocasia*, cultivated in a hot stove, have likewise never presented the least trace of gaping stomata. Be this as it may, M. Lecoq would perhaps see a certain relation of cause to effect between the spontaneous movements of the leaves and their imperforation. My own observations are not favourable to this hypothesis.

I take advantage of this opportunity to say that this year the leaves in vernation have furnished me with still more remarkable results than those referred to in my memoir. My observations date from the 1st of May to the 15th of November. Now it is in the month of June, at the period when vegetation is in all its vigour, that the ejection of the water is also most vigorous. I have seen some convoluted leaves which, during cool evenings, emitted a continuous jet. Careful watchings certainly betrayed a slight intermittence; but it was absolutely impossible to count the drops, the number of which constantly exceeded 200 per minute.—*Comptes Rendus*, May 13, 1867, pp. 979–980.

On two new forms of Plants parasitic on Man (Aspergillus flavescens *and* A. nigricans). By Robert Wreden.

From the 25th November, 1864, to the 25th May, 1867, I had the opportunity of observing the development of two new forms of

Fungi (of the genus *Aspergillus*) upon the tympanic membrane of ten persons, four of whom were attacked on both sides. Having been able several times to watch and study the development of these parasites from their first appearance to their final extinction, I can assert that this parasitic vegetation existed independently of any other disease, and constituted a peculiar and very obstinate affection of the ear, accompanied with great derangement of functions and much suffering.

The two species of auricular fungi found by me presented all the principal botanical characters of *Aspergillus glaucus* (Link), but differed therefrom in the coloration of their organs of fructification, which leads me to name one of them *A. flavescens* and the other *A. nigricans*.

We may ascertain, not only with the microscope, but even with the naked eye, the existence of a parasitic pseudomembrane in the ear, and decide beforehand whether it is produced by a vegetation of *A. flavescens* or of *A. nigricans*. In both cases the parasitic membrane, when extracted entire, bears the very recognizable impression of the tympanic membrane, and consists of an interlaced, lardaceous, white and shining tissue, easily torn and dispersed, covered in several parts with brownish-yellow (*A. flavescens*) or perfectly black (*A. nigricans*) spots (spores). These agglomerations of spores often form upon the white surface applied to the tympanic membrane an annular black space of 1–2 millims. in breadth, corresponding to the periphery of the tympanum. In general the arrangement of the layers in each parasitic pseudomembrane proves that the parasite grows from without inwards; that is to say, it tends to bury itself in the tissue of the tympanic membrane.

A. nigricans, of which the organs of fructification have exactly the same black colour as those of *A. nigrescens*, discovered by C. Robin, on the 19th February 1848, in the aëriferous sacs of a pheasant, must not be confounded with that species, because the receptacular filaments of *A. nigrescens* are formed by long cells articulated end to end, and presenting at their point of contact a distinct constriction: moreover the circlet of basal cells round the capitula is not complete as in *A. nigricans*.

A. flavescens closely approaches the fungus of the lungs, discovered by Virchow, and described by Fresenius from specimens received from Virchow as a distinct species, which he names *A. fumigatus*, and identifies with the fungus found by him in the bronchi of an *Otis tarda* in the Frankfort Zoological Garden. But the descriptions and drawings of Fresenius and Virchow, and especially the microscopic preparation which had been sent to Fresenius and declared by him to be *A. fumigatus*, shown to me by Professor Schenk at Würzburg, make me perfectly sure that my *A. flavescens* is clearly distinguished from *A. fumigatus*, which, moreover, has greenish-brown spores.

To ascertain positively whether *A. flavescens* and *nigricans* are really new species of *Aspergillus*, or whether they only represent new varieties, produced by the difference of the medium in which they grow, I undertook a series of experiments in cultivating my auricular fungi in different media. The lemon and the sweet orange proved to be especially favourable for these experiments. The result of these experiments, which were frequently repeated and modified, was very distinct and constant. Every time that I transplanted *A. flavescens* or *nigricans* from their animal soil to a vegetable one (a slice of lemon or orange), they infallibly returned to the same form of vegetable mould, namely *A. glaucus* (Link). Every distinctive character between *A. flavescens* and *A. nigricans* disappeared in consequence of their transmutation into *A. glaucus*, of which they are consequently only varieties, caused by the difference of the medium (animal or vegetable) in which they grow. When a slice of lemon or orange is sown with *A. flavescens* or *A. nigricans* . . . . . in 48 hours the surface of the slice is already covered with a layer of sterile filaments of mycelium, which are fine and white and like those of a spider's web. In three days this white layer of mycelium is covered with an innumerable quantity of spores. We may then detect, by means of the microscope, the presence of specimens of an *Aspergillus* the sporanges and free spores of which are distinctly of a brownish-green colour (*A. glaucus*, Link).

(After some remarks on the treatment of these fungi when growing in the human ear, from which it appears that the best agents for their destruction are hypochlorite of lime and arsenite of potash even in very dilute solutions, the author proceeds as follows :—)

The *Aspergillus* when vegetating in the ear of the human subject produces a very characteristic disease, which I have named *Mycomyringitis* or *Myringomycosis aspergillina*. It presents two forms, according as it is occasioned by *A. flavescens* or *A. nigricans*. The latter produces more serious morbid phenomena than the former. I should state that hitherto I have never seen *A. flavescens* and *A. nigricans* vegetating simultaneously in the same ear, nor could I discover the least trace of a mixture of *Penicillium glaucum* (Link) with the *Aspergillus*, although this mixture occurs ordinarily in the moulds which cover vegetable substances. Having learnt that Troeltsch of Würzburg had recently found in the auditory meatus of a patient a mould formed by an *Aspergillus penicellatus*, I went to the spot to examine the microscopic preparations of the parasite, and found that they only presented a mixture of *Ascophora elegans* and *A. mucedo*.

I have had an opportunity of ascertaining as a matter of fact how injurious the moulds growing in rooms are to man. In a case studied by me, I was astonished at the unusual obstinacy with which the vegetations of *A. nigricans* were renewed for three months in the patient, notwithstanding the employment of the best parasiticides. Being unable to explain this extraordinary circumstance except by continual infection, I went to the hospital where the woman was a superintendent. I found that in three rooms, in which thirty-four old women remained day and night, all the ceilings and windows, which were white-washed, were entirely covered with a green mouldy coat of *Penicillium glaucum*, whilst all the walls, which were painted in oil, were completely lined with a black and white mould, which presented the same *A. nigricans* as the patient's ear, only under the form of *Achorion* (according to Hallier). But a single cultivation in glycerine or on lemon sufficed to change it into a plant with well-developed sporanges. . . . . . . Washing the walls and ceilings with a solution of hypochlorite of lime, which was also employed in the ear, and the establishment of good ventilation, speedily put an end to the sufferings of the patient, upon whom all my therapeutical resources had previously failed.—*Comptes Rendus*, August 26, 1867, pp. 368–371.

The Theory of the Skeleton.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—Absence from town has prevented me from seeing the 'Annals of Natural History' since July.

I have but a few words to say in reply to Mr. Seeley's letter in your August Number.

Any one who chooses to be at the trouble of reading the two pages in the 'Medico-Chirurgical Review,' from which Mr. Seeley extracts seven lines, will find as definite an outline of the theory of mechanical genesis of vertebræ as could be put in the short space available.

If he is at the further trouble of referring to the 'Principles of Biology,' §§ 254–258, he will find what Mr. Seeley chooses to call "vague hypothesis." Where Mr. Seeley "did not notice that these 'incident forces' (producing vertebral structure) were defined," he will see specified and illustrated by diagrams the particular incident forces which produce differentiation of the vertebrate axis from surrounding tissues, the particular incident forces which cause segmentation of it, and the particular incident forces which cause ossification to commence at the places where it does commence.

If, once more, he turns to § 301 (which I suppose Mr. Seeley overlooked), he will find definitely specified the particular physiological actions through which pressures and tensions cause the formation of bone.

Here, so far as I am concerned, the controversy must end.

I remain, Gentlemen,

Yours, &c.,

Herbert Spencer.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

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XLVI.—*Observations on the Aëriferous Vesicles of the* Utriculariæ. By S. B. Schnetzler*.

The genus *Utricularia* consists of aquatic plants which we find in the stagnant waters of ditches, marshes, &c. The leaves are submerged, and divided into fine laciniæ furnished with vesicles or utricles (*asci*). The following is the function ascribed by De Candolle to these organs.

These utricles are rounded and furnished with a sort of moveable operculum. During the youth of the plant they are filled with a mucilage which is heavier than water; and the plant, held down by this ballast, remains at the bottom. Towards the period of flowering, the leaves secrete a gas which makes its way into the utricles, and drives out the mucilage by raising the operculum; the plant, then furnished with a multitude of air-bladders, rises slowly, and at last floats at the surface. The flowering takes place in the open air; and as soon as it is completed the leaves resume the secretion of mucilage, which replaces the air in the utricles; the plant again becomes heavier, and descends to the bottom of the water, in order to ripen the seeds in the very place where they have to be sown†.

Notwithstanding the investigations of Göppert‡, Benjamin§, Schleiden ||, Schacht ¶, Reinsch **, &c., botanists have not yet arrived at a complete agreement as to the origin and morpho-

* Translated by W. S. Dallas, F.L.S., from the 'Bibliothèque Universelle,' tome xxix. August 25, 1867, pp. 296–311.

† De Candolle, 'Physiologie végétale,' tome ii. p. 87.

‡ Botanische Zeitung, 1847, p. 721. I have not seen this work.

§ Ibid. 1848, p. 17.

|| Grundzüge der wissenschaftlichen Botanik, 4th edit. p. 388.

¶ Beiträge zur Anatomie und Physiologie, 1854, p. 28.

** Denkschriften der kön. Bayer. bot. Gesellsch. 1859, Bd. iv. p. 153 (I have not been able to procure this memoir); Reinsch, Das Mikroscop, 1867.

logical signification of the aëriferous vesicles of the *Utriculariæ*. Before the researches just referred to, most botanists regarded them as a modification of the parenchyma of the leaves, following the numerous ramifications of the veins in the form of a narrow band, dilating from time to time, and thus producing the utricles*.

Schleiden, who studied the development of these little organs, saw them make their appearance at the angle of the divisions of the leaves, in the form of small bodies which were supported by short pedicels and looked like little horns. The inferior side of the horn and the lower margin of its aperture, which itself scarcely increases in size, become much more developed than the rest, in such a manner that the perfect utricle forms a little rounded body, compressed laterally, prolonged on its upper surface on one side into the pedicel, and presenting on the other an aperture in the form of a funnel projecting into the interior of the utricle. The outer aperture of this funnel is closed by a garniture of hairs, which form a beard attached to the superior margin. The inner portion of the surface of the funnel is furnished with hairs of various and elegant forms, arranged in a perfectly regular manner. The whole inner surface of the utricle likewise bears hairs, composed of two cells, each of which is produced into two appendages of unequal length (Schleiden, *loc. cit.*).

Benjamin explains the formation of the utricles by assuming an arrest of development in some segments of the leaf. Instead of elongating, they extend in breadth; a constriction in the form of a narrow neck is produced at their base, and they then present the form of small globular bodies attached to the nervure of the leaf by a short pedicel. According to Benjamin, we may trace the different phases of the formation of the utricles upon a single leaf from the base towards the apex. The utricle, at first filled with cytoblastema (protoplasm), becomes, by the rapid absorption of that liquid, a true air-reservoir. By afterwards extending itself in all directions, the utricle by degrees acquires its definitive form, which nearly resembles that of a stomach, the pedicel being placed at the pylorus and the aperture at the cardia; the two laterally compressed walls unite, as in a suture, at the *curvatura major*. The aperture of the complete utricle is, according to Benjamin, provided with a valve directed inwards. This valve makes its appearance, even in the earliest phases of the utricle, as a dark transverse band (Schacht, Beiträge, p. 28).

Schacht (*loc. cit.*) shows that neither Schleiden nor Benjamin observed the first histogenetic phase of the utricles. The organs of the *Utriculariæ* called leaves by most botanists are regarded

* G. W. Bischoff, Lehrbuch der Botanik, 1834, Bd. i. p. 167.

by Schacht as foliaceous branchlets, which, when young, are rolled in, like a crozier, towards their apex, like the fronds of ferns; below this apex new leaves are successively formed, at the axils of which a little conical body is soon seen to make its appearance, composed of small cells, like the commencement of a bud. This little body soon presents, towards its rounded extremity, a small excavation produced by an arrest of development of the cells of the apex; the edge thus formed rises more and more, and the little cellular body, which was at first sessile, soon afterwards shows at its base a prolongation in the form of a pedicel.

The side walls of the young utricle become more and more developed, the aëriferous cavity which they enclose becomes constantly larger, the edges of the side walls become inclined towards each other and fold inwards, and the cavity, which was originally open, is closed. The old aperture, indeed, presents a valve formed by a fold of the margin of the opening. The beard which, according to Schleiden, closes this aperture is formed subsequently, upon its outer surface.

After this description of the formation of the utricles, accompanied by the beautiful figures to which one is accustomed in Schacht's works, this author mentions the changes of colour which are observed in these organs—a fact previously observed by Göppert. He likewise describes the singular hairs which occur on the inner utricular surface. These hairs consist of five cells, of which one forms the base, two spread out almost horizontally, whilst the other two project into the interior of the utricle. The basal cell of these hairs, as well as those which it supports, results from the division of a small cell, which, in the youth of the utricle, makes its appearance like a little stopper in the intercellular canals.

From what precedes, Schacht concludes that the utricles of *Utricularia* are a modification of the ramifications of the axis, and not of the leaves.

In the month of April 1867, I investigated the formation of the utricles in *Utricularia minor* collected in the marshes of Jogny above Vevey. Schacht, who studied the formation of the utricles in *Utricularia vulgaris*, assumes as the rule their formation in the axillæ of the leaves, and deduces therefrom their analogy with buds. We see, in fact, little bodies composed of cells make their appearance between the ramifications of the leaves; these present a conical form, with their free extremity slightly rounded. These little bodies, which are at first completely sessile, are soon raised upon a small pedicel, the cells of which are afterwards differentiated into an outer layer corresponding to the layer of parenchyma which follows the veins of the laciniated leaf, whilst the interior cells of the pedicel place themselves in communication with the tissue forming the veins, of which they subsequently appear to be a continuation. As the pedicel thus becomes a prolongation of a segment of the leaf, the little globular body which it supports appears to us to be a portion of the parenchyma of the same leaf. The walls of the little cellular body, of which the extremity first hollows into a cup, become developed, whilst the bottom remains stationary; these walls finally unite, and thus form a closed cavity. In the utricles thus formed in *Utricularia minor* we see towards the so-called mouth pinnatifid prolongations or appendages, similar to the capillary segments of the true leaves, in such a manner that the perfect utricle appears to be an expansion of the parenchyma of the leaf, supported upon a vein which is prolonged and ramified beyond the utricle. The extremity, which is at first open, becomes closed at length by two unequal folds of the walls. There is thus formed a sort of funnel, clothed with hairs, at the bottom of which the folds appear as two dark bands bearing linear hairs, whilst those which occur at the entrance are usually capitulate.

Although the utricles, at the commencement of their formation, make their appearance at the angles of the leaf-segments, this position is by no means constant when we examine them in more advanced phases, when the leaf itself is modified.

The pedicellate globules of Benjamin often occur far enough from the angle of the segments: in *Utricularia minor* we even see them sometimes at the extremity of the divisions of the leaf. We therefore cannot infer from their position their analogy to buds. It will be easily understood, from what precedes, that the pedicellate globules of Benjamin and the little horn-like bodies of Schleiden are nothing but intermediate phases between the first commencement of the utricle and its definitive form.

The anatomical examination of the perfect utricle further confirms us in this view. The walls of the utricle consist of two layers of angular cells, at first of a very bright green colour. In the intercellular canals we see at the earliest periods some small conical cells, which terminate within and without in a small rounded cell; the interior cell afterwards forms the base of the quadrifid hairs, the formation of which we have already described according to Schacht.

This author does not mention the exterior cells, which are always seen in great numbers, even on the young utricles of *Utricularia minor*, in the form of little flattened globules, often subsequently divided into two; these globules likewise occur on the other parts of the segmented leaf, where they appear in the form of little mushrooms, of which the stipes buries itself among the cells of the parenchyma. The exterior globule afterwards becomes filled with a brown matter. Schleiden (Grundzüge, 4th edit. p. 397) observed the flattened cells on the outside of the utricles, but does not mention them on the leaves; and yet their presence on the leaf properly so called seems to me to be precisely an additional proof that the utricle is only an expansion and modification of the parenchyma. The quadrifid hairs which line the interior of the utricles present a certain resemblance to the stellate hairs which occur on the inner surface of the aëriferous canals of the petioles of the Nymphæaceæ.

The intercellular passages of the leaves of *Utricularia* contain much gas, which causes them to appear black under the microscope; this black band is prolonged through the pedicel into the utricle. In plants exposed to light I have often observed a strong disengagement of gas (oxygen), the bubbles of which rose in the water for a long time, forming a nearly continuous gaseous thread; these bubbles of gas started from the angle of two segments of the leaf not far from a utricle. Similar bubbles are likewise evolved at the extremity of the capillary segments of the leaves.

As regards the mushroom-like cells, in which the pileiform part is slightly constricted in the middle, and often divided into two, these seem to me to occupy the place of the stomata, and to play the part of glands; in fact they present a great analogy to the glands which occur at the surface of the base of the viscous leaves of *Pinguicula vulgaris*. These glands likewise terminate superiorly in a little brown inflated hood, similar to that of a small mushroom, whilst the stem is colourless as in the corresponding organs of the *Utriculariæ*. The mucilage which covers the surface of the leaves of *Pinguicula* would correspond in its turn to that which fills the cavity of the young utricles.

We have already seen that the utricles at first present an extremely pale-green colour; subsequently the green colour becomes more strongly marked. *Utriculariæ* collected in the marshes of Jogny on the 18th of October, 1866, still presented a small number of green utricles; but most of them were of a violet or very dark blue colour.

In these coloured utricles the angular (usually hexagonal) cells of the inner layer contain a coloured liquid passing from lilac rose-colour to blue violet; these cells then resemble stained glasses surrounded by a slender thread of silver. The cells which close the intercellular canals were either red or dark blue; round them there extended, between the angular cells, a reddish tint. At this same period (October 1866) I found in the segments of the leaves, side by side with the green cells containing chlorophyll-granules, cells the contents of which were pale red.

The cells of the outer layer of the utricles contained chlorophyll-granules grouped towards the wall, whilst the interior was colourless. The mushroom-like cells had their pileus already coloured brown.

This change of colour which takes place in the cells of the utricular walls, in which we see the green passing to rose, lilac, violet, and blue, evidently depends upon a chemical action in relation to the contents and function of the utricles. We must, in the first place, remark that the coloration of the interior cells is due to a liquid, whilst the granules of chlorophyll have disappeared or do not exist. These granules appear to have undergone at the same time the action of a solvent and of a chemical agent which has changed their colour*.

The red colour of the cell-liquids is generally ascribed to the presence of a free acid, and their blue colour to the existence of an alkali. In the utricles of *Utricularia minor* all the transitions between bright red and deep blue may be observed.

At first the cavity of the utricles contains a mucilaginous liquid, of neutral reaction; it is in this liquid that we afterwards witness the appearance of a little bubble of gas, which gradually increases in volume, whilst the liquid diminishes. The presence of this mucilaginous liquid may be very easily ascertained by changing the position of the utricle; the bubble of gas always tends to gain the most elevated part, by making its way through a viscous liquid which opposes to it a certain amount of resistance. In June and July the vesicles are almost all filled with air. The plant then rises to the surface of the water; and the peduncle, which, in *Utricularia minor*, bears from two to five flowers of a pale-yellow colour, rises into the air, where the two unilocular anthers spread their pollen upon the stigma of the pistil, free from the contact of the water. The ascensional force thus produced is very considerable. Reinsch (Mikroscop) assumes that, on the average, the capacity of one utricle (in *U. vulgaris*) is equal to 2·57 cubic millims., and the weight of a utricle to 0·6 milligramme; the ascensional force of a single utricle would thus be equal to 1·964 milligr. About 597 utricles may be counted upon one main branch, the ascensional force of which amounts to 0·778 gramme; and taking an entire plant, Reinsch obtains a total force of 4·44 grammes: counting four branches, we obtain 3·112 grammes. Now the weight of a tuft of flowers which rises above the level of the water is

* M. Micheli, in an interesting work on the colouring-matter of chlorophyll, shows that acids destroy the colour of chlorophyll and render it yellow; sulphuric and hydrochloric acids, in larger quantity, reconvert this yellow into blue or green; and baryta acts in an analogous manner (Archives des Sci. Nat. May 1867).

0·295 gramme; consequently there is a very considerable excess of force, capable of maintaining the flowers out of the water through the whole time of fecundation. After this act, the utricles gradually become filled with liquid, the specific gravity of the plant increases, and it descends again slowly with its ripening fruits below the level of the water. The seeds, escaping from their unilocular capsule, fall into the mud, where they germinate*.

We find among authors a difference of opinion as to the position of the *Utriculariæ* in the water before flowering. Some regard them as attached to the bottom by slight roots; others (as, for example, Reinsch) regard them as floating plants. The *Utriculariæ* are really at first attached to the bottom; but the aëriferous vesicles which are developed upon their leaves gently draw them out of the mud in which their filamentous roots bury themselves; and it is in this that I find the true utility of the utricles—namely, that they pull up the plant from the bottom; for the plant alone, without utricles, floats very well in the water, and rises towards the surface†.

The *Utriculariæ*, however, are not the only plants in which we see such movements produced by an evolution of gas. In the *Hottoniæ*, *Aldrovandæ*, and *Trapa natans* we may discern, at the epoch of flowering, slow movements of displacement of the entire plant; whilst in other aquatic plants (*Nymphæa*, *Vallisneria*, *Ranunculus aquatilis*, &c.) only certain parts become elongated. In the *Utriculariæ* and *Aldrovandæ* it is by aëriferous vesicles that the specific gravity of the plant is diminished and it is caused to rise by being drawn out of the soil. In the *Hottoniæ* we find, in the leaflets, cells filled with air. In the petioles of *Trapa natans* aëriferous cavities are formed before the flowering (Reinsch, *loc. cit.*).

Sometimes the plant cannot perfectly detach itself from the bottom; the pollen-grains are then preserved in another manner from contact with the water. The following is a striking example, which shows us, as in the preceding cases, that at the approach of the flowering-season there is an evolution of gas, which, instead of producing a movement, plays a more direct part in fecundation.

* The seeds are usually sterile; but there are large reproductive buds which descend to the bottom of the water during the winter (A. de Candolle, Géographie Botanique, tome ii. p. 1003).

† I placed in a large glass vessel a tuft of *Utricularia* furnished with vesicles which were still green; the plants floated at the surface of the water. Some *Lymnææ* contained in the same vessel gnawed the plants, and especially devoured the utricles; the *Utriculariæ*, thus deprived of their vesicles, still maintained themselves at the surface.

In the lake of Escoubous, situated upon the summit of the Hautes-Pyrénées, at 2052 metres above the level of the ocean, there lives a very remarkable variety of *Ranunculus aquatilis*. It forms a sort of very extended turf, moored to the bottom of the water by the radicles which shoot out even at the extremity of its stems—side by side with broad carpets of a blackish-green colour, formed by Tremelloid Ulvæ. Here, in opposition to the laws which cause aquatic plants to seek the open air in order to flower and accomplish the act of reproduction, it remains constantly immersed, far from the margins, where the severity of the frosts might destroy it, and far from the great depths, where it would no longer find the light necessary for its vegetation*; here it expands its finely divided leaves and its white corollas with their golden bottoms, and here it is fecundated and reproduces itself without ever attempting to reach the surface. The possibility of fecundation is shown by a bubble of air produced during the work of vegetation and retained between the petals before their full expansion, in which the anthers project their pollen (Guérin, Dict. d'Hist. Nat. tome viii. p. 465).

The evolution of gas in closed cavities, which we observe in a certain number of aquatic plants before the expansion of the flower, is evidently in relation to what it has been agreed to call vegetable respiration. During this operation the plant not only takes carbonic acid from the air or water, but it also absorbs, through all its parts, oxygen, which combines with the carbon of certain vegetable matters to form carbonic acid. The chemical action of the solar light induces the decomposition of the carbonic acid absorbed, as well as of that formed in the plant. The carbon is fixed in the plant by combining with the elements of water, nitrogenous matters, &c. The oxygen is evolved. The stomata appear to play an important part in respiration; nevertheless, according to the investigations of Duchartre, there is no definite relation between the number and size of the stomata and the quantities of gas evolved by plants when exposed to the sun. In certain trees which have a dry and leathery texture there is an inverse ratio between the considerable number of the stomata and the weakness of the evolution of gas. Moreover what proves that the gases exhaled by plants are not evolved solely through the stomata is, that we see them issue from the cells of the epidermis of the upper surface of leaves in plants in which this surface has no stomata, when the leaves are immersed in water. We have already demonstrated a similar evolution from the immersed leaves of *Utricularia*. In entirely submerged aquatic plants the leaves are destitute of stomata, and absorption

* The plant in question does not occur either at the margin or at great depths, because it cannot exist in either of these positions.

and exhalation take place through the whole surface of the epiblema. Experiments made by MM. Cloëz and Gratiolet have demonstrated that the decomposition of carbonic acid by the green parts of submerged plants is only effected under the influence of light. In the dark no carbonic acid is produced, contrary to what occurs in aërial plants. A certain temperature is necessary for the production of the phenomenon. When the temperature is rising, it does not commence below 15° C. (=59° F.); when the temperature is descending, it may continue at 10° C. (=50° F.). Besides oxygen, the gas produced by the plant contains a certain quantity of nitrogen.

If we apply the preceding facts to the leaves of the *Utriculariæ,* we find them immersed in a water which is usually very rich in carbonic acid; this gas is absorbed by the leaves, and, under the influence of light, oxygen and a little nitrogen are evolved. In the segments of the leaves the gases occur in the aëriferous canals which traverse those segments; they are set free at different points in the form of little bubbles. We have not seen these bubbles issuing through the walls of the utricles, which appear to oppose a certain amount of resistance to their escape, and this may probably exert some action upon their own expansion. The utricles floating freely in the water become the seat of phenomena of endosmose and of chemical actions. This work goes on especially when the circumambient water presents a temperature of 10°–15° C. (=50°–59° F.). At first the utricles contain a mucilaginous liquid; soon a bubble of gas is seen to make its appearance in this liquid, and to increase in volume: this is oxygen, evolved under the influence of light and heat which have penetrated through the water to the utricles. The plant escapes from the mud and rises towards the surface; the secretion of gas becomes more abundant, and the flower-stalk is supported above the level of the water. The oxygen secreted in the utricles seems to exert a chemical action, in virtue of which the contents of the cells of the walls undergo a transformation and a change of colour, becoming rose, lilac, and blue. The envelope thus coloured reacts in its turn upon the interior work of the utricles. We know that, in fact, in organs coloured otherwise than green (for example, in the petals of the corolla), there is no longer any evolution of oxygen, but, on the contrary, absorption of oxygen and evolution of carbonic acid; the latter does not escape from the utricle, but is probably assimilated; the utricle becomes filled again either with a mucilaginous matter or with water absorbed by endosmose, and the plant increases in weight and descends again to the bottom of the water*.

* In the dark, for example in the utricles which are of a black-blue colour, carbonic acid is no longer formed.

We thus see the utricles play the part at once of organs of respiration and of a hydrostatic apparatus. These organs therefore do not appear at a given moment and for a particular purpose, but as a natural consequence of the anatomical structure of the plant and the action of the surrounding medium. I shall take the liberty of adding here a passage from a work by Schleiden, already cited (Grundzüge &c.), which relates to the idea that I have just expressed:—

"What is most interesting in the life of the plant," says Schleiden, "is its dependence upon the life diffused over the earth in general. It must be admitted that in the forces upon which depend meteorological phenomena and the formation of organs and of organisms (*Bildungstrieb*, &c.) we have already, as given in a necessary manner, the cause which makes a certain insect be produced during the flowering of a certain plant—an insect the life of which depends in its turn upon its nutrition by the nectar secreted by this plant; then, in absorbing this liquid, the insect transfers the pollen to the stigma, and thus assures the continuance of the vegetable species which furnishes it with its nourishment. When we consider the coincidence of phenomena for an isolated plant, it often appears to us to depend upon pure chance; for example, the coincidence of wind with the flowering of the Abietineæ, of the fall of rain with that of *Ambrosinia Bassii**, of the movement of the water with the expansion of the flowers of *Valisneria*; but these coincidences are only necessary consequences of the same primitive forces which manifested themselves in the evolution of our planet."

The totality of the forms in which life manifests itself upon the earth during a given epoch appears to us thus like a magnificent mosaic, of which the different pieces brought together mutually determine their nature.

* The spathe of *Ambrosinia Bassii* presents the form of a trough, and thus swims on the surface of the water. The spadix, which rises in this spathe, divides it into two parts by means of a membranous wing which surrounds the spadix and is attached to the spathe; the lower compartment contains the anthers, and the upper one a single ovary: between the two compartments there is a little aperture in the separating partition. Fecundation cannot take place unless at the period of flowering rain falls into the spathe. The water then fills the lower compartment, and its level gradually rises up to the ovary in the upper compartment; the pollen, which floats on the surface of the water, thus comes in contact with the organ which it has to fecundate.

XLVII.—*Descriptions of new or little-known Species of Asiatic Lepidoptera.* By Arthur G. Butler, F.Z.S.

[Plates VIII. & IX. figs. 1–10.]

The following species of Butterflies are chiefly from the collection of Lieut. H. Roberts, who has kindly lent them to me for description.

Genus Pieris, Boisduval.

Pieris figulina, n. sp. Pl. VIII. fig. 1.

Alæ supra plumbagineo-rufæ; marginibus externis, apice anticarum maculam quadripartitam rufam includente, lunula apud angulum analem et plerumque venis fuscis; areola basali, costa anticarum et margine interno posticarum grisescentibus; costa posticarum flavescente: corpus nigro-fuscum abdomine pallidiore, pilis viridescentibus vestitum; antennis nigris partim albo punctatis.

Alæ subtus pallidiores: anticæ aurantiacæ, ad basin costamque fulvescentes; area apicali fuscescente, extus fulvescente; macula subapicali magna velut supra, a venis autem vix divisa, roseo-albida; macula (quæ supra a fundo discali vix separata est) subovali, lunulaque velut supra, submarginalibus aurantiacis; margine interno luteo: posticæ roseo-albidæ; marginibus externo et interno fulvescentibus; fascia pone cellam irregulari, extus bisinuata, fuscescente; nebula submarginali cinerea undata colorem marginis limitante: corpus fulvum, abdomine albicante.

Exp. alar. unc. $2\frac{13}{16}$.

Hab. Singapore, ♂, Coll. Roberts. Borneo, ♀, Coll. Hewitson.

This beautiful and very distinct species is evidently allied to the blue *Celestina* of Boisduval: it may belong to the *Nelo* group; but the front wings differ considerably in form. I have recently seen a specimen of the female from Borneo.

Genus Terinos, Doubleday.

Terinos Robertsia, n. sp. Pl. VIII. figs. 2, 3, 4.

Alæ forma et magnitudine *Terpandri* (Hewits.).

♂. Alæ anticæ supra nigerrimæ, dimidio costali purpureo, hujus margine profunde hastato: posticæ purpureæ nitidissimæ, apice quadrate nigerrimo, margine interno olivaceo-fuscescente; lunulis duabus unaque valde indistincta niveis roseo tinctis submarginalibus; margine tenui nigro, ciliis flavis.

Alæ subtus velut in *Terpandro*.

Exp. alar. unc. $2\frac{7}{8}$.

♀. Alæ supra fuscæ; area basali, maculis sex anticis discalibus inæqualibus inter venas positis plagaque posticis discali purpureis nitidis: anticæ fasciis duabus obscurioribus æquidistantibus fus-

cis transversalibus: posticæ maculis albis velut in mari, lunulisque alteris contiguis marginalibus albidis.
Alæ subtus velut in *Terpandro*.
Exp. alar. unc. $2\frac{11}{16}$.

Hab. Malacca (Ayerpanas). Coll. Roberts.

This beautiful and very distinct species is most nearly allied to *T. Terpander* of Hewitson (Proc. Zool. Soc. 1862, p. 90), which I consider to be the insect figured inadvertently in the 'Genera of Diurnal Lepidoptera' (pl. 21. fig. 3) as the *Clarissa* of Boisduval, the latter being a much larger species, with more strongly falcated fore wings. My species only differs from *Terpander*, on the underside, in the narrower and darker yellow discal band and smaller white spots of the hind wings.

Genus Neptis, Fabricius.

Neptis Charon, n. sp. Pl. IX. fig. 1.

Alæ supra nigerrimæ: anticæ stria triangulari discoidali, macula contigua cuneata, maculis tribus subapicalibus inæqualibus, tribus subanalibus oblique positis punctisque octo submarginalibus niveis; punctis octo marginalibus striaque valde indistincta irregulari discali subcinereis: posticæ fascia subbasali et altera septemmaculari discali niveis; stria submarginali maculari subcinerea, fascia media fuscescente indistincta: corpus nigrum, virescens; antennis nigris, flavo acuminatis.
Alæ subtus pallidiores, striis discali anticarum et media posticarum violaceis, stria submarginali canescente; stria marginali cinerea; costa basali posticarum nivea; aliter velut supra: corpus cæruleo-albidum; pedibus ochreis; antennis ferrugineis.
Exp. alar. unc. $2\frac{9}{16}$.

Hab. Singapore. Coll. Roberts.

Near to *Duryodana* of Moore, but quite distinct.

Genus Charaxes, Ochsenheimer.

Charaxes Echo, n. sp. Pl. VIII. figs. 5, 6.

Alæ supra nigro-fuscæ, ad basin paulum viridescentes: anticæ serie macularum septem decrescentium fulvarum discali; maculis duabus pone cellam oblique positis punctisque tribus marginalibus analibus fulvis: posticæ fascia tenui media, punctis septem ovalibus submarginalibus undecimque angularibus marginalibus fulvis; margine interno fusco-grisescente: corpus thorace nigro-fusco, abdomine fusco: antennis nigris.
Alæ subtus roseo-albicantes, extus paulum fuscescentes: anticæ lineis tribus discoideis duabusque infra cellam nigris; maculis discalibus velut supra, intus autem nigro limitatis; macula superna pone cellam extensa fasciolam formante; maculis submarginalibus serie positis (apud angulum ani solum distinctis), omni-

bus flavis; maculis duabus tribusve, cum iis subanalibus junctis, ovalibus, nigris, anali geminata: posticæ areola basali et fascia media albidis nigro limitatis, hac quoque argenteo intus marginata; maculis septem lunulatis ferrugineis, tribus inferioribus majoribus magis rufescentibus, omnibus intus cyaneo-albo cinctis et nigro limitatis; linea subanali nigra; maculis septem marginalibus cæruleis nigro lineatis extus fulvo et intus albo limitatis: corpus ochraceum, thoracis medio palpisque albicantibus; antennis nigris.
Exp. alar. unc. $2\frac{13}{16}$.

Hab. Singapore. Coll. Roberts.

Allied to *Lampedo,* Hübner (Samml. exot. Schmett. Band 2. taf. 52. figs. 3, 4), but smaller, the fore wings more angular, the hind wings with short obliquely placed tails, the bands narrower and differently placed.

Genus Clerome, Westwood.

Clerome gracilis, n. sp. Pl. VIII. fig. 7.

♂. Alæ supra ferrugineo-ochraceæ, colore fere *Menadonis*: anticæ costa subrecta, magis productæ.
Alæ subtus paulum pallidiores et subolivaceæ, lineis duabus mediis nigris irregularibus unaque submarginali angulis alternis undata (anticis indistincta) pallidiore: anticæ punctis quatuor ochreo-albis serie recta digestis ocelloque parvo, nigro, fulvo cincto, fusco marginato, albo pupillato submarginalibus: posticæ ocellis quinque, primo et quinto magnis distinctis, aliis intermediis punctiformibus albidis: corpus ochraceum.
Exp. alar. unc. 2.

Hab. Malacca. Coll. Roberts.

The smallest *Clerome* I have yet seen.

Genus Mycalesis, Hübner.

Mycalesis cinerea, n. sp. Pl. VIII. fig. 9.

♂. Alæ supra cinereæ obscuræ, omnino sed præcipue anticæ sericeo-canescente marmoratæ; fascia ejusdem coloris valde indistincta obliqua media: corpus cinereum.
Alæ subtus coloribus fere *Hesiones,* sed cinereo-fuscæ, fascia alba abbreviata, linea marginali cinerea nec albida, fascia marginali latiore ad angulum ani posticarum dilatata, linea submarginali magis albicante; ocellis minoribus, iride brunnescente tenuiore, cincturis omnibus magis conspicuis partim niveis.
Exp. alar. unc. $1\frac{15}{16}$.

Hab. Singapore. Coll. Roberts.

Nearly allied to *Hesione,* but grey, not brown, and with paler marblings above, and different marginal lines below; the ocellus-zones also brighter and varied with white.

Mycalesis Polydecta. Pl. IX. figs. 5, 6.

Papilio Polydecta, Cramer, Pap. Exot. ii. pl. cxliv. figs. E, F.

Alæ supra fuscæ, marginibus minime pallidioribus: anticæ ocello magno: posticæ duobus minoribus interno majore.
Alæ subtus pallidiores fascia media albida, area apicali ocellos ferente, anticarum quinque, posticarum septem; margine externo pallido, nigro lineato.
Exp. alar. unc. $2\frac{1}{8}$.

Hab. Borneo (Butler). Celebes; var., Sumatra. B.M.

Cramer gives the locality of this species as Tranquebar; but I have a specimen, exactly agreeing with his figure, from Borneo. In the National Collection we have it from Celebes, and a variety, without ocelli on the upperside of the hind wings, from Sumatra.

Mycalesis Cepheus, n. sp. Pl. IX. figs. 3, 4.

Alæ supra fuscæ, margine externo, stria media et iride ocelli anticarum pallidioribus: anticæ ocello discali obscure fusco cæco; linea ejusdem coloris marginali; margine ipso nigro: corpus fuscum.
Alæ subtus fere velut in *Mineo* Linn., fascia autem media tenuiore et obscuriore; serie ocellorum posticis magis arcuata.
Exp. alar. unc. $1\frac{7}{8}$.

Hab. Penang. Coll. Roberts.

Closely allied to *Mineus,* but paler on the upperside, with a brown blind ocellus in the front wings; below with a narrower and straighter central band, and the row of hind-wing ocelli much more arched; the marginal lines also pale ochreous.

Mycalesis nautilus, n. sp. Pl. IX. fig. 7.

Alæ supra dilute fuscæ: anticæ ocellis tribus nigrescentibus vix iridatis, albo pupillatis, horum duobus subapicalibus parvis, tertio discali: posticæ lineis duabus marginalibus undatis fuscis; ocello parvo subanali subnigro, fulvo iridato: corpus cinereo-fuscum.
Alæ subtus pallidiores, marginibus velut in *Mineo* Linn.; fascia media argentea, intus fusco limitata, extus diffusa; linea subbasali subintegra fusca: anticæ ocellis quinque distinctis, quinto multo majore, serie directa: posticæ ocellis septem, primo et quarto majoribus, quinto maximo, septimo minimo, serie arcuata positis: corpus ochreo-fuscum.
Exp. alar. unc. circ. $1\frac{7}{8}$–$2\frac{1}{8}$.

Hab. Malacca, India. ♂ ♀, Coll. Roberts.

Closely allied to *M. Janardana* of Moore, but differing in many essential characters. The sexes differ only in size.

Genus Lethe, Hübner.

Lethe Whitelyi, n. sp. Pl. IX. fig. 8.

Alæ supra fuscæ: anticæ fasciola discali pallidiore pone cellam posita; ocello subapicali valde indistincto, fusco, flavo cincto: posticæ ocello subanali nigrescente, brunneo cincto, indistincto: corpus olivaceo-fuscum.

Alæ subtus fere velut in *L. Diana* Butl.: anticæ autem fascia magis angulari, ocellis tantum duobus, superiore multo majore: posticæ areola discocellulari latiore, partim violaceo micante; ocellis majoribus: corpus cinereo-fuscum.

Exp. alar. unc. $2\frac{7}{16}$.

Hab. Nagasaki (North Japan). B.M.

This is probably the Nagasaki representative of the Hakodadi species *Diana*; it differs in its much greater size, broader and less angular wings with regularly convex costal margins, larger and less regular ocelli, &c.

Lethe manthara. Pl. IX. fig. 9.

Debis manthara, Felder, Reise der Fregatte Novara, part 3 (1867).

Alæ supra olivaceo-fuscæ: posticæ maculis quinque ocellaribus nigris ochreo cinctis.

Alæ subtus fere velut in *mekara* Moore, sed pallidiores minus flavido variegatæ; linea discali multo rectiore, ocellis omnibus pallidis, distinctis, cincturis nigris tenuibus, striola submedia albida, obsoleta.

Exp. alar. unc. $2\frac{11}{16}$.

Hab. Java. ♂, B.M.

This is of course the Javan representative of the North Indian *mekara*; it is a smaller and more elegantly formed insect, is of an olive-brown colour, with coppery reflexions, and has five instead of four ocellate spots on the upperside of the hind wings; on the underside the discal band is straighter, the ocelli paler and delicately margined.

Genus Cœlites, Westwood.

Cœlites humilis, n. sp. Pl. VIII. fig. 8, & Pl. IX. fig. 2.

♀. Alæ supra fuscæ, area externa anticarum paulum obscuriore, posticarum dilutiore; linea marginali obscura: posticæ ocello subanali valde indistincto cæco, pallide ochreo cincto; margine interno dilutiore: corpus fuscum, antennis ferrugineis.

Alæ subtus pallidiores, ochraceæ, fascia media et altera submarginali ocellos ferente diffusis violaceis; fascia discali nebulosa fusca; lineis duabus marginalibus irregularibus distinctis fuscis: anticæ ocello parvo subapicali: posticæ quinque, tertio et quarto parvis, quinto maximo, omnibus nigris, fulvo cinctis, fusco circumcinctis et minute albo pupillatis: corpus ochraceum.

Exp. alar. unc. $3\frac{1}{16}$.

Hab. Malacca (Ayerpanas). Coll. Roberts.

A local form of the Bornean *C. euptychioides* of Felder.

Genus ELYMNIAS, Hübner.

Elymnias lutescens, n. sp. Pl. IX. fig. 10.

♀. Alæ supra fuscæ obscuræ: anticæ fascia lata indistincta obscuriore, disco partim rufescente, angulo anali albicante: posticæ disco albicante ochraceo, fusco liturato; ocellis sex distinctis, extus nigris, intus fuscis, albido pupillatis: corpus fuscum, abdominis medio albido.

Alæ subtus area basali obscuriore, area discali magis albicante; ocellis tribus parvis anticis, ocellisque posticarum multo majoribus; aliter velut in *dusara* Horsf.

Exp. alar. unc. $2\frac{15}{16}$–3.

Hab. Borneo (Lowe); Malacca, Singapore, and Penang. Coll. Roberts.

I have figured this species from a large and very imperfect specimen, with the assistance of a fresh and good example, from which I take my description: it is closely allied to *dusara* of Horsfield.

All the species from Malacca were taken close to the Government bungalow at Ayerpanas, about sixteen miles from the town of Malacca.

XLVIII.—*Description of a new Genus and Species of American* Satyridæ *from the Collection of Mr. H. W. Bates.* By A. G. BUTLER, F.Z.S.

[Plate IX. fig. 11.]

THE species upon which I found the present genus was taken by Mr. Bates on the River Amazons; and I am much indebted to him for the pleasure of describing it.

This genus is most nearly allied to *Taygetis*, which it closely resembles in neuration; in general aspect it more nearly approximates the genera *Dædalma* and *Oxeoschistus*, whilst on the underside it somewhat reminds one of *Corades*.

Genus AMPHIDECTA (ἀμφὶς, δηκτὸς), gen. nov.

Alæ mediocres: antice forma omnino *Dædalmæ* (Hew.): posticæ margine costali subrecto; apice oblique abscisso; margine externo quadrisinuato; angulo anali obliquo; margine interno apud angulum ani distincte excavato, aliter directo; venis omnibus fere velut in *Taygetide*. Caput oculis nudis; palpis elongatis, extrorsum paulum porrectis; antennis tenuissimis, vix clavatis.

Amphidecta pignerator, sp. nov. Pl. IX. fig. 11.

Alæ supra fuscæ, area apicali anticarum et margine apicali posticarum obscurioribus; costa anticarum et angulo anali posticarum roseo-rubris: anticæ costa basali nigro liturata; maculis tribus discalibus albidis triangulum formantibus: corpus fuscum.

Alæ subtus pallidiores: anticæ minime violaceo tinctæ; apice fuscescente; area apicali et costa nigro lituratis; maculis velut supra, quartaque intermedia cuneata submarginali, albidis, plaga purpureo-fusca inclusis: posticæ albidæ roseo tinctæ, omnino fusco striatæ; apice niveo; angulo anali ferruginoso; lineis duabus mediis male definitis irregularibus; margine externo fuscescente; punctis sex discalibus albis nigro punctatis, serie undata positis: corpus ochreo-cinereum.

Exp. alar. unc. $2\frac{9}{16}$.

Hab. Ega. Coll. Bates.

Taken in the depths of the forest. Flight low and weak. Only a single specimen found. (Bates's MS.)

XLIX.—*The Method of Geology; being an Account of the introductory part of a paper on "The Laws which have determined the Distribution of Life and of Rocks," read before the Cambridge Philosophical Society, Nov.* 12, 1866. By Harry G. Seeley, F.G.S., of the Woodwardian Museum in the University of Cambridge.

In their distribution over the world, the materials of rocks which are accumulated under water, and the materials of organized bodies, obey the laws of physics. The forces that these laws relate to, in this subject, are:—in the first place, those inherent in the earth itself, such as gravity and attraction, on the one hand, and motion in the earth's crust; and, secondly, those acting on the earth from without, such as the heat received from the sun, and attractive forces which determine the earth's relations to the solar system. That is, everything is kept in its place by gravity, out of which it is moved by heat and the forms of energy into which heat is changed; while the area over which these forces operate in a given way is changed by movements in the earth's crust producing changes of land and water.

2. The motion of matter visible on the land is for the most part due to the sun's heat—hence being derived those distributing powers the winds and rain and rivers, in their various

forms, discharging rock-matter into the sea; while the settling-down of these materials upon the sea-bottom is the work determined by gravity. The motion of matter around the land is for the most part due to the tide-generating power of the sun and moon; but the arrangement of this matter on the sea-bottom is due to gravity.

3. The motion of living things on land is due primarily to the sun's heat distributing the individual species in zones of uniform temperature, modified by movements in the earth's crust producing distribution irrespective of temperature. The distribution of living things in water is due primarily to movements in the earth's crust, modified subsequently by the form of coasts, the abundance of life, and by temperature.

4. On the hypothesis of the earth having cooled from a fiery state, the surface-rocks would be uncrystalline granitoid substances, the denudation of which would furnish clays. But, as a matter of fact, everywhere beneath stratified formations some rock of a granitic character is found. Therefore, assuming all stratified rocks to be derived from the denudation of plutonic rocks, it is necessary to consider what stratified deposits such denudation can result in.

5. If the plutonic rock is crystalline, a granite may be taken as the type. It consists of quartz, felspar, and mica—speaking roughly, in the proportions of 25 per cent. of quartz, 55 per cent. of felspar, and 20 per cent. of mica. The quartz is heavy, and washes out in grains, which, left behind, form a deposit of sand. Hence, if granite were the only source of water-formed rocks, and only denuded by the sea, one-quarter of all known stratified rocks would be sands and sandstones. And therefore the quartz-grains (the sandstone to be, or that is) will form a belt near to and around the shore, and will always be indubitable evidence of near vicinity to land. And supposing the mica not to be decomposed, from its fine flaky character it will, according to circumstances of slope of sea-bottom, currents, &c., be carried either to the limit of the sand, and go to form a micaceous sandstone, or go beyond the limit of the sand, and form a micaceous clay (slate).

The felspar readily decomposes into a clay, setting free in addition a quantity of silica and potash or soda; and, from the extreme fineness of its particles, this clay is carried out to sea further than the sand, and surrounds the land as an outer belt, at least twice as broad as the sand-belt.

But if the denudation takes place on the land-surface by the agency of rain and running water, the major part of the sand will be left behind; and the detritus poured into the sea by the river will be chiefly the mud (*i. e.* the felspathic detritus) of the watershed.

If both forms of denudation go on together (as is often the case), the visible result is that the clay-band, as it approaches the river-mouth, extends out in a fan-shaped form, thinning off the further it is removed from the land; the great difference between the two sets of clays being that, whereas the coast-clay has its greatest extent in the line of the coast, the river-clay has its greatest extent in the line of the river, *i. e.* in a line at right angles to the coast.

Since all plutonic rocks are not granites, it may be that, in place of mica, there will be a more easily decomposed hornblende. Many forms of amphibole, like some kinds of mica, contain much iron. There can be no doubt that many ferruginous sandstones owe their iron to the decomposition of mica after deposition, just as it seems probable that many clay-ironstones were formed partly from the decomposition of hornblende at the time of deposition. Two other important constituents are lime and magnesia; and I know of no origin for these substances in nature except the plutonic rocks. Lime is to a great extent soluble in water, under sea-shore conditions, and is not precipitated by evaporation in an appreciable form where there are other deposits forming; hence it is that we usually find limestones near to shores where there is no denudation, and far out at sea beyond the limits of sedimentary deposits.

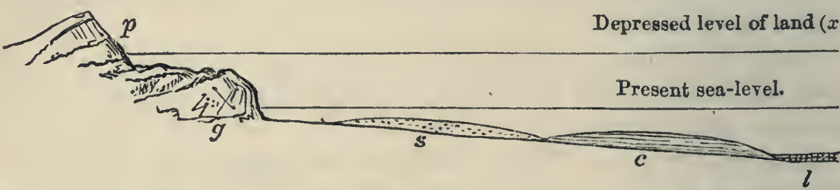
6. If, therefore, we find a magnesian limestone, it will be a reasonable inference that, if it could be followed over the old sea-bottom, it would merge into a clay on approaching land, that the clay would probably pass into a clay-ironstone, and this latter into a sandstone, beyond which must be an area without any deposit synchronous with these, which, however, would coexist in the same geological time, though of such different mineral characters, and these retained only under such limiting circumstances.

7. If beds have been already arranged in this order, which may be called the *necessary sequence of rocks*, and a cliff of them comes to be denuded, they are once more resolved into their elementary substances, and spread out as before. The reconstruction, however, may be generally detected by the pebbles and, it may be, extraneous fossils that it will contain.

8. Under ordinary circumstances the river-clay is distinguished from the shore-clay by its immense thickness; for, concentrating to a point the clay of a large area, it accumulates more rapidly than that resulting from tidal denudation; moreover it is more likely than any other kind of deposit to be continuous in the same area through several geological periods. The river-sand

is usually finer than shore-sand, and extends over a more limited area.

9. Sand, clay, and lime forming the sequence of rocks in horizontal order (*i. e.* in space), it must also follow that there will be a similar sequence in vertical order (*i. e.* in time). Thus, therefore, it follows that if (*g*) a syenitic coast is denuded, and the result is (*s*) sands, (*c*) clays, and (*l*) limestones, and the land (*g*) is depressed so that high-water mark stands at *x*, then, the



point from which the deposited materials are derived being carried further inland (*p*), they will not be carried so far out to sea; hence a sand will be deposited near shore and continuous with the old sand (*s*); a new clay will be deposited on top of the old sand (*s*), and a new limestone on the old clay (*c*). But if the land were to rise again, the place of origin for the deposited matter would go further out to sea, the new deposits nearest shore would be denuded, and sand be spread over the clay. If, then, there is a sequence of rocks like the Secondary series, it becomes extremely easy to determine all the changes in physical geography that took place while they were accumulating, while it is no less easy to predict what must be the representative of a formation in a district where the mineral characters have changed.

10. Of course, organic causes and evaporation may accumulate limestones without their having any relation to sands and clays, just as denudation of quartzites and sandstones may form sands which are not succeeded by clays, and as the denudation of volcanic rocks may form clays quite unconnected with sands and limestones.

11. The thickness of deposits in relation to time is to a large extent dependent on climate. In tropical regions where evaporation and the resulting rain are great, deposits of immense extent are formed. In cold countries, though of small extent, the deposits are liable, from the nature of the seasons, to a similar alternation of characters with those of tropical countries.

12. Every great *fault* changes the form and area of the sea-bottom, and therefore modifies the sequence of deposits within the disturbed area, producing unconformability if the fault is formed rapidly. There is every reason to believe that faults were as numerous in old geological times as in more recent pe-

riods; and therefore it is necessary to fix the ages of the faults to interpret accurately the sequence of rocks, and to discover therefrom the old physical geography.

13. From these considerations it follows that no deposit can be traced over a large area. And when the mineral character changes in a succeeding deposit, it follows that, at one end or the other, there will be no change of mineral character. Hence deposits cannot be identified or correlated over wide areas by this means. But this limitation of kinds of rock-material is evidence of change in physical conditions; and if uniformity of physical conditions can be determined, then it follows that there is a wider means than mineral character at command for co-ordinating water-formed rocks. Hence *strata can be identified and correlated by discovering the physical conditions which limited, determined, and changed their mineral characters, and changed the distribution of the fauna and flora of the given geographical area that they occupy.*

14. Nothing can be known of climatal conditions of the earth in past time, except from physical evidence. Such is the existence of coal; for, judging from the analogy of peat, there is strong reason for inferring that coal was formed under conditions of temperature not warmer than our English climate.

15. The most important physical phenomena for the elucidation of past physical geography are the thickness of the deposit over a wide area, the number of beds of which it consists, the relative sizes and characters of the constituent particles at different depths and in different districts, the amount and direction of the false bedding &c., the exact vertical and geographical position of fossils, &c. &c.

16. Just as the phenomena of water-formed rocks all owe their existence directly or indirectly chiefly to the sun's energy, so also do the phenomena interwoven with life. This has long been recognized by various eminent British and foreign physicists; and, in 1854, Prof. Huxley, in his memoir on the method of palæontology, asserted that organisms were but manifestations of applied physics and applied chemistry. Prof. Tyndall puts the generalizations of physicists in a few words: when speaking of the sun, it is remarked, "He rears. . . . the whole vegetable world, and through it the animal; the lilies of the field are his workmanship, the verdure of the meadows, and the cattle upon a thousand hills. He forms the muscle, he urges the blood, he builds the brain. His fleetness is in the lion's foot; he springs in the panther, he soars in the eagle, he slides in the snake. He builds the forest and hews it down, the power which raised the tree and that which wields the axe being one and the same."

Translated into other language, this means that since the sun is the chief appreciable source of energy on the earth, without which little or no motion would be manifested, it follows that organisms are storehouses in which the sun's energy has been accumulated in the form of work, and therefore that what are called grades of organization in classification are only ways of expressing the different degrees of energy that organic structures have stored up.

17. The manifestation of life on the earth is in every way most abundant in the tropics, plentiful in the temperate zone, and poor in genera and poor in species near the frigid poles of the earth. The exuberance of life, whether in individuals or species, over the whole earth, or upon one district in different seasons, coincides with the preponderance of heat. Heat acts indirectly for the most part; for when applied to an egg, it is partly converted into motion, causing the particles of the egg to move, and it enables them to enter into new chemical combinations, differentiating parts until the entire organism is formed. The energy which differentiates the individual egg is greatest at the tropics, where the differentiation of life is greatest.

18. Every organism is subject to two series of modifying agents:—1st, the external changes produced by the stimulus of the circumstances of existence; 2ndly, the chemical changes set up by contact of food with the viscera. Both of these sources contribute energy. When a mammal, for instance, moves, its work in part takes the form of motion; but the succession of falls which constitute walking or running convert a part of that motion into heat; this heat induces an expansion of the structures, enabling the nutritive fluid to permeate and circulate more rapidly, nourishing most the structures most used. Hence the development of parts with use. The development of the skeleton is chiefly due to differentiation of external functions; the development of the viscera is chiefly due to different functions imposed by food.

The viscera, therefore, are more liable to vary than the muscles; but their variation depends on the power of muscle and nerve in obtaining food. Therefore external changes are accompanied by internal changes. And since changes are inherited, they accumulate.

19. The individual being only liable to motion over so limited an area as to be practically fixed, yet experiences some results of enormous migrations from the change of seasons.

20. Since the heat of the earth may be assumed to be distributed approximately in zoned gradations of latitude, it will follow, from the preceding considerations, that if species were left to themselves for ever, the most highly organized would be at

the equator, the least organized at the poles. And since species diffuse themselves in the direction of least resistance, it will be along lines where the heat is uniform; so that homozoic belts (but for disturbing causes) will correspond with parallels to the equator.

The present distribution of land and water, and the geological evidences of its mutations, show that species are compelled to migrate north and south (as well as east and west), and so become subject permanently to different degrees of the sun's energy (and its product food), which, as was seen, cannot but produce permanent changes in their organization. Hence it follows that the same set of causes which introduce new rocks is also an instrument in introducing new species and new types, by changing the area of life.

21. When a portion of the sea-bottom is elevated so as to become land, the life which covered that area is displaced; that is to say, the group of life, from being continuous over an area, comes to surround a space which, so far as marine life is concerned, is a desert. The method by which this is accomplished is, that mountain ridges make divisions in the life-province; and then, just as the waters drain down the valleys of the land converging to an estuary, so also do the organisms drain off and converge with the separation of the waters: hence, but for disturbing causes, life will always be most abundant in species around the seaward terminations of the great areas of drainage. But, by the division of a group of life in this way, it happens (if the elevation is carried to a great extent) that each part of the old life-group becomes mixed with the new group on which it is compelled to encroach. If land already existing is still further upheaved, it can only happen that the life will migrate further away; so that the fauna which in one age occupied a given sea-bottom comes in a succeeding age to occupy an adjacent area.

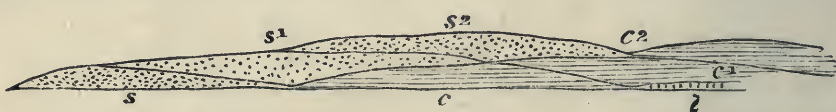
22. If a portion of the sea-bottom is depressed, the life that covered it migrates away, following the shore as it recedes. And also if a portion of land is depressed so as to become sea-bottom, the life that covered the adjacent area migrates over it, and life of the present age becomes diffused in the succeeding age over an adjacent area without admixture with any new forms, except such as may be produced by the changed conditions.

23. If elevation occurs so that a land-surface is enlarged, then the species already upon it migrate over the newly added area and down the mountain-sides, always diffusing most rapidly in the direction of least resistance.

24. If depression of a land-surface is going on, then the species are converging in space and becoming numerous relatively to their area, while they also ascend the mountains. If while the land sinks to the north it rises to the south, the fauna and flora come to occupy a more southern area*.

25. There being much reason for thinking that the deep waters of the ocean have a comparatively uniform temperature, it follows that the distribution of life in those regions will be less dependent on temperature than it is at the surface of the earth. Therefore the life of deep-sea limestones will have a wide range.

26. No elevation of land can take place without (as was seen in § 9) the deposits that were forming being continued over each other out at sea. Thus *s* is the sand formed near to the shore, and *c* the clay further out at sea; by elevation s^1 is formed over *s* and *c*, and c^1 is formed over *c* and *l*. By further elevation, s^2



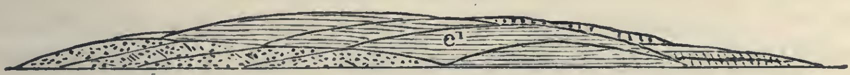
is formed over s^1 and over c^1, and of course a c^2 would be formed over c^1 and l^1, so that the *s*, s^1, s^2, s^3, &c. would appear to the observer of sections to form one deposit (for the divisions here marked would not exist in nature) extending uniformly over another deposit, *c*, c^1, c^2, which would therefore appear to be an older one; and as this deposit would extend over the *l* series, it would be inferred to be newer than that group. But, although that inference is correct in regard to the vertical section, obviously the *s* is older than the c^1, and much older than the c^2, though it appears to rest on the top of those deposits. And since by elevation the sea-area is changed, the fauna and flora continue to move in the direction of least resistance, which in this case being determined by uniformity of conditions, it happens that the fauna of *s* will migrate into s^1, and similarly will afterwards move into s^2; so that it will be impossible to identify the ages of these beds by fossils in the usual rough-and-ready way, or by superposition. Here identification of the strata can only be accomplished by the method given in § 13.

Often by elevation a fauna is compelled to migrate; and then the extension of a group of life assists greatly in connecting deposits in an adjacent area with those formed under other physical conditions, when we have discovered where the group came from.

* The migratory habits of birds are probably due to old changes in physical geography of this kind.

27. Under certain circumstances, when a group of life is driven to a new locality by elevation, it happens that the conditions of least resistance determine its course either over or under the group which previously occupied the ground; so that a gradation of life in zones of depth comes to result from the distribution of life in provinces.

28. No depression of land can take place without the deposit which was forming furthest out at sea appearing to be newer than the others. Thus here, *s, c, l* represent the typical sand-



stone, clay, and limestone. By depression s^1 is formed nearer to shore, and c^1 is deposited over *s* and *c*; and so the succession is continued, if the depression goes on, till the stratum s^3, s^2, s^1, *s* is formed under the *c* series, the *c* series in its turn being under the *l* series. Yet this apparent superposition gives a very erroneous idea of the age of the beds; and since the life follows the receding shore, it happens that the fauna of *s* is also found in s^3.

Hence it follows that neither in the rocks produced by elevation nor depression can the age of the beds be determined by superposition or by fossils.

29. Whenever a sandstone is superimposed on a clay, in some portion of the area the older stratified rocks will be denuded, if they were ever deposited there. Hence if such a sandstone contains extraneous fossils, they came from rocks which existed beyond the sandstone area, and on which the sandstone was not then being accumulated.

If the sea-shore is stationary, the majority of the fossils, accumulated from the life of the time, will be much worn.

30. The fauna and flora of the British Isles is not the only known fauna and flora. From the phenomena of elevation and depression, it follows that no fauna or flora can cover more than a fraction of the earth's surface at the same period of time; though it is quite possible for a fauna to migrate during a long period of time over a far larger area. And this is usually the significance of the correspondence between distribution of life in time and in space; and by a worldwide fauna is usually understood a fauna that has been split up by physical changes, so that at a few widely divided points a less or greater proportion of fossils (usually few) are found like those of the typical locality, but almost invariably mixed with others unlike those pre-

viously known (see § 21). There is no evidence that any fauna or flora ever was universal; physical considerations such as those detailed show that such a thing is impossible.

31. The life on the earth is conveniently divided into a number of groups called provinces, which have been produced by changes in physical geography modifying the natural distribution in zones of varying organization. They are the evidence of these physical changes and the means by which they may be discovered. Every life-province, whether on land or in the sea, is only a geological fauna or flora which has not become fossilized. Species have not been rooted to the area where found since their creation. Every geological fauna is only a life-province of the old sea in which the rock-material accumulated. If there is a change of life between two deposits, it indicates that a new life-province has migrated over the old one, and not necessarily that there has been any denudation or any break in time.

32. Since no life-province extends over a large area of the earth, it is impossible to identify distant geological formations by the similarity of their fossils.

33. Since much disturbance may occur in an area adjacent to that where deposition is going on, it may happen that two or three groups of life succeed one another in one place, while, near by, the first group of the three remains stationary. This is one of the many difficulties that render it impossible to get any definite results from percentages in fixing the age of beds. Nothing is known of the duration in time of either recent or extinct species; and for the percentage method to give accurate results, it must be assumed that every species has exactly the same duration in time, stopping at a given point; whereas it seems, from the case of some species sent to the antipodes for instance, that under changed conditions they may flourish better than ever. It is probable, too, that the distinctions at present in use between species add to these difficulties. And it is worth note that many genera survive from old palæozoic times; so that those periods, in a truer sense than that usually given to the term, might be called Eocene.

34. Palæontology is the zoology of past times. But stratigraphical geology is, as it seems to me, the only means by which either the past or the present distribution of life can be understood. Both these powers for research need to be used to discover the past mutations of the earth's physical geography, by coordinating which changes it is possible to correlate strata over wide areas, and to obtain materials for their classification.

35. No satisfactory classification of rocks can ever be made by fossils, for the reasons which have been given. Nor can a

classification true for any large area be made on mineral character.

But since the mutations in physical geography determine both the rock-material and the distribution of life, there is in them a philosophical basis for classification, which indicates the value alike of mineral character and of fossils. Yet classifications, though made on the most fundamental considerations, can never be carried from a typical locality all over the world, because the world has neither life, nor mineral character, nor stability of physical geography in common with the typical locality.

The proof, extension, and practical application of the cosmogeny here sketched will be given in the first volume of the 'Principles of Palæontology,' which is devoted to the dynamical geology of Britain.

L.—*Synopsis of the Species of American Squirrels in the Collection of the British Museum.* By Dr. J. E. Gray, F.R.S., V.P.Z.S., &c.

The species of American Squirrels are more difficult to define distinctly than those of Asia or Africa, arising from the various colours which the same species presents, even in individuals of the same family; thus Bachmann states, "Nothing is more common than to find the same litter composed of grey, black, and fox-coloured young."

Dr. Spencer Baird, in his well-studied essay on the Squirrels of North America, has shown that some species of the larger North-American Squirrels (as *Sc. vulpinus*) have a tendency to run into ferruginous varieties, and to have red bones, while other species (as *Sc. carolinensis*), of a yellow-grey colour, are very commonly affected with melanism, and have more or less black fur.

Both *Sc. vulpinus* and *Sc. carolinensis* vary, on the under surface of the body, from pure white to rufous or black.

Dr. Spencer Baird observes, as a general rule, that, where a squirrel exhibits any annulations of the hair on the fur of the throat or belly, it is a variety of some species which, in its normal form, has the under part either of a uniform white or reddish colour to the base, or only plumbeous at the roots.

The hairiness of the soles of the feet varies, especially in the species which inhabit the northern region of America, or which have an extensive geographical range there. Dr. Spencer Baird describes specimens of *Sciurus vulpinus* "with (1) the soles naked, (2) the soles hairy between the pads nearly to the end of the metatarsus, (3) with a small patch of hair only in the centre of the sole." (Mamm. N. A. 247.)

It has been observed that in the species which have an extensive geographical range there is a difference in the average size of the species, agreeing with the latitudes which it inhabits. Thus several of the North-American Squirrels become smaller as they extend southward, until, on the sea-coast of Georgia, Florida, and the Gulf, they reach the minimum size.

There are some species and some local varieties that appear constant, and present very little variation in outer appearance; and I have no doubt the difficulties which we experience in studying the specimens in museums would immediately vanish if we could study the animals in their native haunts.

The colour of the back is very liable to vary, especially in the larger species. In *Sc. vulpinus* it varies from pale iron-grey to nearly black, and, on the other side, to fulvous brown grey. *Sc. carolinensis* varies from pale iron-grey to fulvous; and a melanic variety of a nearly uniform black colour is common.

The colour of the underside is quite as variable in some species. *Sc. vulpinus* and *Sc. carolinensis,* which have the underside normally of a pure white colour, sometimes have it deep black, and at others reddish or reddish white. Several species, especially of the smaller kind, which have the underside of a reddish colour, have it sometimes much paler, and at others white with a yellow tinge, or nearly white.

Many species have a tuft of soft hair at the base of the ears: this is usually white or yellow, according to the species; but I have seen it white on one side and yellow on the other in the same specimen.

The colour of the tail is generally characteristic of the species; but in some kinds it is variable, though the variations are confined within certain limits in each species. The size of the dark band on the hairs of the tail and the general colour of the hairs constitute a pretty permanent specific character; but it sometimes varies: the base-colour changes from grey to deep yellow or white; and the black band is sometimes diffused so as to make the tail almost, and sometimes entirely black, or black with a minute pale tip.

It is almost impossible to give a definite character for the species in a few words; each individual requires to be described.

2. Sciurus.

Gray, Ann. & Mag. Nat. Hist. 1867, xx. pp. 271, 272, 325.

Ears tufted. Head broad; muzzle short. Feet hairy at the heels. Front upper molar small or often wanting.

Some of the North-American squirrels which have tufted ears in winter are said to have smooth ears in summer; but I have not seen any specimens showing this peculiarity. Many species, indeed most, have a tuft of soft hairs at the outer base of the ears, and the ears themselves are covered with short close-pressed hairs; and this tuft may be more distinct at certain seasons.

I. *Large-sized, grey.*

* *Lateral streak black, dorsal streak red.* No. 1. Sc. Alberti.

** *Lateral or dorsal streak none.* No. 2. Sc. cinereus.

II. *Middle-sized; fur soft.*

* *Lateral streak distinct, lead-coloured; beneath white.* Nos. 3, 4.

** *Lateral streak distinct, black; beneath red.* No. 5.

*** *Lateral streak none; beneath red.* No. 6.

I. *Large-sized, grey.*

* *Lateral streak distinct, dorsal streak red.*

1. *Sciurus Alberti.*

Sciurus dorsalis, Wood, Proc. A. N. S. Philad. 1852, vi. 110 (not Gray).
Sc. Alberti, Woodhouse, Proc. A. N. S. Philad. 1852, v. 220; Selgrave's Zool. Exped. 1853, p. 53, t. 6; Audub. & Bach. Quad. N. Am. 1854, iii. t. 153. f. 1; S. Baird, M. N. A. 267.

Fur finely grizzled black-grey and black; beneath and feet white; a dark line on each side of the belly; back with a pure chestnut streak; tail black and white mixed, beneath white; ears tufted.

Hab. New Mexico, San Francisco Mountains (Dr. Woodhouse). Mus. Smithsonian Institution.

See also *Sc. castanonotus*, Baird, M. N. A. 266, t. 65. f. 81, 82. *C.* (*castanotus*). Similar, but with the ears without tufts. Perhaps a *Macroxus*.

** *Lateral or dorsal streak none.*

2. *Sciurus cinereus.*

Sciurus cinereus, Linn., Aud. & Bach. Q. N. A. i. 145, t. 17; Baird, M. N. A. 248, t. 48. f. 2.
Sc. vulpinus, Schreb. iv. t. 215 B.
Sc. virginianus, Kerr.
?*Sc. hyemalis*, Ord.

Fur light grey above, beneath white; head broad, muzzle short; ears grey, short, scarcely longer than the adjacent fur, never white, covered with hair and fringed with longer hairs.

Hab. North America, Pennsylvania. B.M.

Var. 1. Blackish, very minutely punctulated with white; hairs lead-coloured at the base, brown above, with a narrow black subterminal band and white tip; crown blacker; underside reddish grey, slightly grizzled; tail black (or brown), hairs black or brown, with slender white tips to some. North America. B.M.

Var. 2. Hairs black, with a very small narrow subterminal grey ring. B.M.

Var. 3. Hairs black, shining, uniform. B.M.

II. *Middle-sized; fur soft.*

* *Lateral streak lead-coloured; tail narrow, shorter than the body.*

3. *Sciurus hudsonius.*

Sciurus hudsonius, Pallas, Baird, M. N. A. 269, t. 46. f. 2.
Sc. carolinus, Ord.
Sc. rubrolineatus, Desm.
Tamias rubrolineatus, Schinz.
Tamia hudsonia, Lesson.

Fur black and greyish rusty; back often washed with ferruginous; tail beneath and towards the tip uniform ferruginous, with roots of the hairs not annulated.

Carlton House (male, large): B.M. Fort Simpson, Mackenzie River (Ross): B.M.

See *Sciurus Fremontii,* Aud. & Bach. Q. N. A. iii. 237, t. 149. f. 1. "Fur above black and greyish rusty yellow, without any tinge of ferruginous; tail black or greyish white, without any ferruginous visible externally, glossy black near the tip." (S. Baird, M. N. A. 246, 272.) Rocky Mountains, Sawach Pass. Mus. Smithsonian Institution.

4. *Sciurus Richardsonii.*

Sciurus Richardsonii, Aud. & Bach. Q. N. A. t. 5; Baird, M. N. A. 273.
?*Sc. lanuginosus,* Aud. & Bach. Q. N. A. t. 25 (immature).
Sc. hudsonius (part.), J. K. Lord, Report.

"Fur reddish brown and black finely mixed; back not washed with ferruginous, beneath white; tail dark reddish brown toward the base of the hairs, the exterior portion of the sides and entire tip glossy black."

Hab. Vancouver Island (J. K. Lord): B.M. Cascade Mountains (J. K. Lord): B.M. West Slope, Rocky Mountains (J. K. Lord): B.M.

** *Lateral streak black; underside rusty or reddish.*

5. *Sciurus Douglasii.*

Sciurus Douglasii, Gray, P. Z. S. 1836, p. 88; Aud. & Bach. Q. N. A. ii. t. 48; Baird, M. N. A. 275, t. 20. f. 1, t. 45. f. 2.

Sc. Townsendii, Bach.
Sc. Belcheri, Gray, Ann. & Mag. Nat. Hist. 1842, x. p. 264; Zool. Sulph. t. 12. Var., *S. Suckleyi*, Baird, M. N. A. t. 7.
Sc. mollipilosus, Aud. & Bach. Q. N. A. t. 19.
?*Sc. Fremontii*, Aud. & Bach. Q. N A. t. 149. f. 1; Baird, M. N. A. 272, t. 6.

Fur rusty and black mixed, beneath clear bright buff; tail dull chestnut centrally, darker above, then black and margined all round with rusty white; hairs of the tail black, except at their extremities.

Hab. California (Douglas, Gray, type in B.M.). Vancouver Island, ♀, dark brown (November, J. K. Lord, B.M.). Cascade Mountains (J. K. Lord, B.M.). British Columbia, edge of the Prairie (J. K. Lord, B.M., young).

Var. *Fremontii.* Paler, beneath reddish white; feet reddish brown, rather larger.

?*Sciurus Fremontii*, Aud. & Bach. Q. N. A. t. 149. f. 1; S. Baird, M. N. A. 272, t. 6.

Hab. Scott Mountains, Trinity Country, 500 or 600 feet above the sea-level (Brydges). B.M. Called *Pine-Squirrel.*

*** *Lateral streak none; belly red.*

6. *Sciurus hyporrhodus.*

Sciurus æstuans, Gray, List. Mamm. B. M.

Fur very soft, abundant and long, above reddish olive, minutely punctulated with bay and black; hairs lead-coloured, with short yellow ends and a narrow subterminal black band; side of nose, cheeks, chin, throat, underside of the body, and inner side of the limbs red bay; hair black at the base, with red ends: tail black, indistinctly yellow-ringed, reddish-washed; hairs yellow, with three black bands, the upper broadest, and a reddish tip.

Hab. Santa Fé de Bogotá.

Known from all the other South-American squirrels by the softness and length of the hair and hairy ears.

3. Macroxus.

Gray, Ann. & Mag. Nat. Hist. 1867, xx. pp. 271, 275.

Ears generally have a small tuft of short woolly hairs at the outer hinder part of the base. This is not to be observed in *M. æstuans.* Soles of the feet generally bald; but some of the northern species have the soles covered with short hair, except on the long pad on the inner edge, and near and on the pads at the bases of the toes.

The species may be divided geographically as those found north or south of the Gulf of Panama: the northern species are generally iron-grey and of larger size; and the southern are olive, more or less punctulated with yellow, of middle size or small. There are one or two of the olive species found in the north as well as the south part of the isthmus.

I. *Fur thick, soft, iron-grey, white- or yellow-washed, rarely entirely black; of a large or middle size.* Inhabiting North America to Panama.

A. *The fur iron-grey, or grey yellow-washed, or black; hairs black, often with white tips; tail blackish, grey-edged.*

a. *Belly white.* Nos. 1, 2, 3.
b. *Belly red or reddish white.* Nos. 4, 5.
c. *Belly black.* Nos. 6, 7, 8, 9, 10.

B. *The fur pale grey; hairs grey, black-ringed: or black, the hairs being entirely black.*

a. *Belly white.* Nos. 11, 12, 13.
b. *Belly yellow.* Nos. 14, 15.
c. *Belly red.* No. 16.

II. *Fur short, soft, olive-brown, black- and yellow-punctulated, rarely red-washed; hairs black- and yellow-ringed. Moderate-sized or small.* Inhabit South or Tropical America to Panama.

A. *Tail black; fur very short, belly nakedish. Middle-sized.* No. 17.

B. *Tail black, red-washed; fur moderately soft.*

a. *Belly red; cheeks red.* Nos. 18, 19, 20, 21.
b. *Belly red or reddish; cheeks grey.* No. 22.
c. *Belly white; cheeks grey.* No. 23.

C. *Tail blackish or grizzled, grey-washed, or more or less annulated.*

* *Middle-sized. Belly white.* No. 24.
** *Middle-sized. Belly reddish.* No. 25.
*** *Middle-sized. Belly dark grey.* Nos. 26, 27.
**** *Middle-sized. Belly yellow.* Nos. 28, 29, 30.
***** *Very small. Belly grey or lead-coloured.* Nos. 31, 32.

III. *Fur rather harsh, short; sides with a narrow reddish streak.* No. 33.

I. *Northern species, of a large or middle size. Fur soft, iron-grey, white- or yellow-washed, sometimes entirely black.*

A. *The fur iron-grey or black; hairs black, often with a white tip; tail blackish, grey-edged.*

1. *Macroxus vulpinus.*

Sciurus vulpinus, Gmelin, S. Baird, M. N. A. 246.
Sc. niger, Linn.
Sc. capestratus, Bosc.

Var., *Sc. texianus*, Bach. B.M.
Sc. rufigaster, Mac Murtrie. B.M.

Fur coarse and harsh, iron-grey, black, or rusty-coloured black-varied; ears and nose white.

Hab. North America, Southern States, Florida, Georgia, Louisiana: B.M. Texas: B.M.

Var. 1. Pale iron-grey; crown of head and cheeks black; beneath white; hairs of tail white, with a very broad subterminal black band and grey tip.

Var. 2. Blackish iron-grey; head, neck, shoulders, thighs, legs, and feet black; tail blackish, beneath white, lateral streak between the two colours black; hairs of tail dark grey, with a very broad black end.

Var. 3. Like var. 2, dark iron-grey; head, throat, underside, and body and limbs black; nose and ears white; feet white-varied; hair of tail white, with a subterminal black band.

Hab. Northern States.

Var. 4. Yellow, iron-grey-grizzled; crown blackish; sides of throat yellowish; belly white-yellow; hairs of tail yellow or reddish yellow, with a black subterminal band.

Hab. Texas: B.M. Louisiana: B.M.

2. *Macroxus Colliæi.*

Sciurus Colliæi, Richardson, Zool. Blossom, 1839, p. 8, t. 1; Aud. & Bach. Quad. N. A. 1853, iii. 21, t. 104; S. Baird, M. N. A. 280.
Sc. variegatoides, Ogilby, P. Z. S. 1839, p. 117; S. Baird, M. N. A. 283.
Sc. griseocaudatus, Gray, Zool. Sulph. 1834, t. 13. f. 2, t. 18. f. 7–12 (skull); S. Baird, M. N. A. 283.

Fur harsh, rather rigid, nearly uniform grey, more or less varied with black from the derangement of the hairs; hairs black, with a subterminal white band; cheeks and chin grey; tuft behind ears yellow, often very large; chest and belly white or deep yellow: tail black, washed with white; hairs yellow, with a black subterminal band and a white tip.

Hab. Central America.

Var. 1. Under surface yellow; ear-tuft red; feet reddish.

Sciurus variegatoides, Ogilby, P. Z. S. 1839, p. 117.
Sc. griseocaudatus, Gray, Zool. Sulphur, t. 12. f. 2.

Hab. West coast of America (Belcher, Ogilby, type in B.M.; Gray, type in B.M.).

Var. 2. Sides of the body and neck and outer and inner sides of limbs bright rufous; throat, chest, and the middle of the belly white.

Sciurus intermedius, Verreaux.

Hab. Guatemala (Verreaux). B.M., type.

Var. 3. Under surface white; ear-tuft white or yellow; feet grey, black- and white-punctulated.

Sciurus Colliœi, Richardson, *l. c.*

Hab. California (Richardson, type in B.M.). Guatemala, West Coast (O. Salvin): B.M. Mexico: B.M.

Var. 4. Under surface pure white; ear-tuft large, red; feet black (not punctulated).

Hab. Mexico, province of "Amoa" (Amoea?).

3. *Macroxus dorsalis.*

Sciurus dorsalis, Gray, P. Z. S. 1848, p. 138, t. 7.

Black; crown, sides of neck, and body and limbs white; ear-spot large, white; chin, throat, sides of neck, underside of body, and inner side of limbs white, yellow-white, or reddish brown; hair black; fur white- or yellow-varied, with a white tip.

Hab. Costa Rica.

Var. 1. Sides and underside pure white.

Hab. North America, Nicaragua.

Var. 2. Underside yellowish white; chin and throat white, sides white, black-varied.

Hab. Santa Fé, Veragua (O. Salvin). B.M.

Var. 3. Underside and chin, cheeks, sides of body, and limbs pale yellow.

Var. 4. Back more or less brown-varied, especially behind; outer sides of legs reddish-washed; cheek, throat, and sides of the body white-varied; chest, belly, and inner sides of limbs rufous.

Hab. Costa Rica, Nicoya (O. Salvin). B.M.

Var. 5. Like var. 3; but the lower part of the sides of the body with a broad, reddish, black-and-white-dotted streak (like the outer sides of the limbs) under the white on the sides of the body; chest with a short white central streak, and the circumference of the teats grey.

Hab. Costa Rica, Nicoya (O. Salvin). B.M.

Var. 6. Head, sides, limbs, feet, and beneath uniform rufous; middle of the back black; tail black, with white tips to the hairs.

Hab. Nicoya? (O. Salvin). B.M.

There is a young specimen in the British Museum, said to come from *Honduras,* which is like the adult; but the fur is black by the length of the black tips to the hairs; the tail is black, white-washed, with long white tips to the hairs.

4. *Macroxus nicoyana.*

Fur rather thick and abundant, yellowish iron-grey; hairs black, with a broad subterminal white band; shoulders, thighs, legs, and sides of the body rufous-washed; tail black, very slightly punctulated; head white iron-grey; cheeks and chin pale grey; ear-tuft large, white; throat, underside, and inner sides of the legs bright red brown, varied with large white subsymmetrical blotches: tail black, white-washed, hairs black (those of the underside of the tail more or less brown at the base), with a long white tip. Head and body 12 inches long.

Hab. Costa Rica, Nicoya (O. Salvin). B.M.

The white on the underside is perhaps an individual peculiarity.

5. *Macroxus aureogaster.*

Sciurus aureogaster, F. Cuv. Mamm. Lithog. lxx. t.; Geoff. Voy. Venus, Zool. 1855, p. 136, t. 10, 11.
Sc. leucogaster, F. Cuv.; Sp. Baird, M. N. A. 282.

Dark iron-grey; crown of head, nose, and feet blacker; sides of the body, throat, chest, belly, inner sides and edges of the limbs red brown; hairs black, mixed with grey or red tips: tail bushy, black, white-washed; hairs red yellow at the base, then black, with long grey tips.

Hab. Columbia.

Var. 1. Red, darker chestnut on the shoulders and front part of the back; hairs of tail black at the base, with a yellowish ring, and then black, with grey tips.

Var. 2. Fur with a redder tinge; hair lead-coloured, then rufous, with black rings and grey tips; nape, shoulders, rump, and outer sides of thighs reddish; tail-hairs red at the base, then black, with grey tips.

Sciurus aureogaster, I. Geoff. Voy. Venus, t. 11, ♀.

Hab. "Mexico" (F. Cuvier). South America (Verreaux): B.M. Columbia (Parzudaki): B.M.

These squirrels were received from Parzudaki and Verreaux as the *S. aureogaster* of F. Cuvier. The last variety is somewhat like I. Geoffroy's figure of the female in the Voy. of the Venus, t. 11.

I have not seen any specimens like those figured as varieties of the same species in tab. 10 of that work, which appear to be nearly white, with reddish nape and rump, the colour of the underside not being shown.

See also—

1. *Sciurus hypopyrrhous,* Wagler, Isis, 1831, p. 510; Baird, Rep. 282. *Hab.* Mexico.

2. *Sciurus variegatus,* Erxl. Syst. 1777, p. 421; Baird, Rep. 282. (*Coquallin,* Buffon.) *Hab.* Mexico (Erxl.).

6. *Macroxus morio.*

Fur very abundant, long, soft, black; head, middle of the back, rump, and outer side of thighs very minutely white-dotted; under-fur brownish, longer; hairs black to the base, those of the head, rump, and thighs with a minute white tip: cheeks and chin greyish; throat, inner side of limbs, front edge of thighs, and hinder part of the belly red-washed; hairs of these parts red to (or nearly to) the base: tail black, slightly white-washed; hairs black, some of them with an elongated white tip; hinder part of the base of the ears grey.

Hab. ——? In Zoological Gardens, where it lived several years, and remained always of the same colour. B.M.

The red-brown front of the thighs and the very general punctulation of part of the body give it a very peculiar appearance.

7. *Macroxus Boothiæ.*

Sciurus Boothiæ, Gray, List M. B. M. 139.
Sc. fuscovariegatus, Schinz, ii. 15.
Sc. Richardsonii, Gray, Ann. & Mag. Nat. Hist. 1842 (not Bachmann).

Fur soft, black-grey, minutely punctulated with white; ear-tuft small, grey; fore legs, feet, and end of tail black; underside rather pale, black-grey-punctulated; hairs of body black, with a grey subterminal band; hairs of tail black, with a subventral broad grey band and a short grey tip.

Hab. Honduras (Dyson). Gray's type in B.M.

The three preceding species are very nearly allied.

8. *Macroxus nigrescens.*

Sciurus nigrescens, Bennett, P. Z. S. 1833, p. 41; Aud. & Bach. Q. N. A. iii. t. 117; S. Baird, M. N. A. 280.

Black iron-grey; hairs black, with a small white tip; nose and ears pale grey; chest and belly like back, but with shorter brownish hair; feet black: tail black, grey-varied; hairs whitish grey at the base, end black.

Hab. California (Bennett, type in B.M.).

This specimen is in a bad state. It may be only a small variety of *M. vulpinus,* or a bad state of *M. variegatoides,* or distinct. The ears are in a bad state; but they appear as if they might have been more hairy than those of the usual *Macroxi.*

9. *Macroxus maurus.*

Fur very short, rather rigid, black; sides and sometimes the front of the back red-washed; head and rump minutely punctulated with white; tail black, white-washed; feet and fore legs black; hairs entirely black to the base, or black with a more or less wide red, yellow, or white subterminal band; the throat, chest, and inner part of the body rufous, more or less grizzled with black hairs; tail-hairs black, some with more or less distinct grey tips.

Hab. Mexico, Oaxaca (Sallé). B.M.

The two specimens vary considerably in colour; but they agree in the shortness, rigidity, and shining nature of the fur.

They are named *S. lanigerus*; but this must be a mistake, for they have a very small quantity of lead-coloured under-fur.

See *Sciurus* (*Macroxus*) *Peladii,* Lesson, Rev. Zool. 1842, p. 130; S. Baird, M. N. A. 282. *Hab.* Mexico, Realejo (Lesson).

10. *Macroxus melania.*

Fur uniform, rather rigid, close-pressed, polished black; hairs uniform black to the base, under-fur black, the longer hairs striated, polished; nape, back, and some spots on the sides of the hinder part of the back washed with brown, as if stained. Tail, feet, and underside of the body black.

Hab. West coast of America? Point Berica (Kellet & Wood). B.M.

This squirrel differs from all the black squirrels in the Collection by the shortness and rigidity of the fur, which has the polished appearance of the fur of the otter and other water-animals. The brown colour of the back may have been occasioned by the animal having been kept in confinement, or the skin having been stained.

B. *The fur pale grey; hairs grey, black-ringed: or black, the hairs being entirely black.*

11. *Macroxus neglectus.*

Fur pale iron-grey, nearly uniform; sides of nose, chin, inner sides of limbs, and underside of body, ears, and feet white; under-fur lead-coloured; hairs of back pale grey, with a black subterminal band and white tip: tail pale, white, black-varied and white-washed; hairs white, with two broad blackish bands and a long white tip; soles bald. Length of body 14 inches.

Hab. North America? ♀, B.M.

A heavy animal, as large as *Sc. vulpinus* and *Sc. cinereus,* very like the latter; but the ears are covered with short closely adpressed hairs. It differs from *Sc. vulpinus* in the hair not being black.

12. *Macroxus fossor.*

Sciurus fossor, Peale; S. Baird, M. N. A. 264.
Sc. Heersmanni, Leconte.
?*Sc. leporinus*, Audub.

Fur soft, abundant, pale iron-grey, minutely black- and grey-punctulated; hairs lead-coloured, with a small subterminal black band and grey tip; chin, underside of body, and inner sides of legs white: tail broad, grey, black-edged; hairs grey, with a broad black subterminal band and grey tip.

Hab. California (Bridges, B.M.; Gurney, B.M.).

See also *Sciurus Nebouxii*, I. Geoff. Voy. Venus, t. 12. Very pale grey-grizzled, with black feet.

13. *Macroxus carolinensis.*

Grizzled light yellow, with occasional washes of rusty grey or blackish; hairs lead-coloured at the base, upper half yellow, with a subterminal black band; tail broad, pale iron-grey, black-varied and white-washed; hairs yellowish, with a broad subterminal black band and a long white tip.

Var. *minor*. Southern States:—

Sciurus carolinensis, Gmelin, S. Baird, M. N. A. 256, t. 45. f. 2.

Var. *major*. Northern States:—

Sc. cinereus, Desm. *Sc. cinereus*, Schreb.
Sc. leucotis, Gapper, Z. Jour.
Sc. migratorius, Audub.
Sc. pennsylvanicus, Ord.

Var. *niger*:—

Sc. niger, Godman, Gray.
Sc. fuliginosus, Bachmann.

Var. Blackish.

Hab. North America.

14. *Macroxus ludovicianus.*

Fur soft, yellow iron-grey; cheeks, chin, and beneath yellow; head narrow; ears high, never white; tail yellow iron-grey, yellow-edged or washed; hairs yellow grey, with three black bands and a yellow tip.

Sciurus ludovicianus, Curtis, S. Baird, M. N. A. 251.
Sc. rufiventer, Desm.
Sc. macroura, Say.
Sc. macrourus, F. Cuv.
Sc. macryourus, Godman.
Sc. magnicaudatus, Harlan.

Sc. Sayi, Aud.
Sc. subauratus, Bach. Type in B.M.
Sc. rubricaudatus, Aud.
?*Sc. limitis*, Baird.
?*Sc. Lewisii*, Ham. Smith.

Hab. Louisiana (Bachmann): type in B.M. Missouri: B.M.

Var. Dusky.

Sciurus Audubonii, Bachmann.
Sc. occidentalis, Bachmann.

Hab. Illinois.

See 1. *Sciurus limitis*, Baird, M. N. A. 256, t. 64. f. 81. f. 1. *Hab.* Texas. Much smaller than *S. ludovicianus*, and the prevailing colour cinnamon.

2. *Sciurus lanigerus*, Aud. & Bach. Quad. N. A. 1849, i. 27; S. Baird, M. N. A. 280. *Hab.* Northern California.

15. *Macroxus griseoflavus.*

Fur abundant, rather thick, nearly uniformly coloured yellowish grey, yellow, white, and black mixed; nose and front of crown whiter; cheeks and chin greyish white; ear-tuft dirty white; throat, chin, belly, and inner side of the limbs yellow red; feet white and black equally mixed; hairs of back lead-coloured, upper half brown, with a black subterminal band and a white tip; tail pale brown, white-washed; hairs grey, with three blackish bands, the last subterminal with a long white tip.

Hab. Tropical America, Guatemala (Salvin). B.M.

Somewhat like *M. leucops*, but paler, more uniformly coloured, and the colour of the hairs quite different; orbits not white; chest yellow red.

16. *Macroxus leucops.*

Fur abundant, very soft, yellowish grey, minutely yellow-, white-, and black-varied; crown, nape, and rump yellow-washed; hairs long, lead-coloured at the base, brown above, with a narrow black band and white tip; nose and cheeks grey; ear-tuft, orbits, chin, throat, and feet white; chest, belly, and inner sides of the limbs bright red; tail very bushy, black, white-washed, with irregular black rings; hairs slightly yellow at the base, with a very broad black band and long white tip.

Hab. North America, Mexico, Oaxaca (Sallé). B.M.

Var. The lower half of the hairs of the tail orange-yellow.

Hab. New Granada? B.M.

Wagner (Abh. K. Bay. Akad. ii. 500) describes two squirrels from Oaxaca as *S. albipes* and *S. socialis*, the first $10\frac{1}{2}$ inches long, with rigid hair, the second $8\frac{1}{2}$ inches long, with softer hair: he gives an uncoloured figure of the latter; but it will do for any squirrel; the latter can scarcely be the one here described. The Museum specimens are much larger, the body and head being 11½ or 12 inches long.

See also:—

1. *Sciurus varius*, Wagner, Suppl. Schreb. 1843, iii. 168; S. Baird, M. N. A. 283. *Hab.* Mexico, Oaxaca.

2. *Sciurus albipes*, Wagner, K. B. Akad. iii. 500; Schreb. t. 213 D.

?*Sc. variegatus*, Erxleben, Syst. 1777, p. 421; Baird, M. N. A. p. 282.

Above mixed white, black, and ferruginous; beneath ochrey ferruginous, feet and shoulders brown; ears white; tail centrically ferruginous, on sides banded with black and white. *Hab.* Mexico.

3. *Sciurus socialis*, Wagner, Abh. K. Bay. Akad. ii. 504, t. 5; S. Baird, M. N. A. 283.

Above mixed white, cinereous, and yellowish; beneath pale rusty yellow; ears fulvous; feet white; fur soft, a tuft of snow-white hair behind the ears; tail rusty red beneath, then black, and bordered with white. *Hab.* Mexico.

II. *Fur short, soft, olive-brown, black- and yellow-punctulated, rarely red-washed; hairs black- and yellow-ringed. Moderate-sized or small.*

A. *Middle-sized. Tail black; fur very short, of the belly sparse; hairs black at the base, with a pale ring.*

17. *Macroxus fumigatus.*

Fur short, soft, black, very minutely punctulated with yellow; hairs black, with a small yellow subterminal band; crown, feet, and tail black; hairs of tail black to base; sides of nose, cheeks, and temple brown, punctulated with black; throat and underside only slightly covered with short, soft, distant blackish hairs.
Hab. Brazil, Upper Amazons (Bates). B.M.

Known from all the other species by the shortness of the soft black hairs.

B. *Moderate-sized. Tail black, red-washed or -varied; fur moderately soft.*

18. *Macroxus Langsdorfii.*

Sciurus Langsdorfii, Brandt, Mém. Acad. Pétersb. 1835, ii. 425, t. 11. f. 1.

Fur olive, black-and-grey mixed; hairs black, with an orange subterminal band: tail very full, clavate, black, washed with red, especially near the end, base blackish; hairs blackish, with long red tips.

Hab. Brazil: B.M. Rio Negro: B.M.

Var. *α*. Throat and belly paler. Bolivia. B.M.
Var. *β*. Throat and belly white. Bolivia. B.M.

19. *Macroxus brunneo-niger.*

Sciurus brunneo-niger, Castelnau, MS. B.M.

Fur blackish olive, very minutely and closely punctulated with red yellow; hairs short, close, black, yellow-ringed; cheeks, chin, underside of body, and inner sides and front edges of the legs rufous; feet red, more or less black-varied: tail full, elongate, black, the hinder two-thirds red-washed; hairs black, those of the end with a long red tip.

Hab. Brazil (Castelnau). B.M.

Smaller than *M. Langsdorfii*, the fur shorter, much darker, and more minutely punctulated.

20. *Macroxus xanthotus.*

Fur soft, close, dark olive, very minutely black- and yellow-punctulated; sides of head and throat yellower; chin, throat, breast, belly, and inner sides of the limbs red; spot at the back of the ears bright yellow: tail grizzled like the back at the base, upper surface red, lower black, red-margined; hairs black, with a red tip.

Hab. Costa Rica, Veragua, Cordillera de Tale (O. Salvin) B.M.

Very like the former, but smaller; perhaps, from the slenderness of the tail, young; but the chin and front of the throat are yellow red, and not grey.

21. *Macroxus ignitus.*

Fur soft, abundant, dark olive, closely and minutely black- and yellow-punctulated; the head and outer sides of the limbs rather yellower; back of the ears bright red bay; cheeks, chin, and throat white; sides of the throat, chest, belly, and inner sides of the limbs reddish yellow grey: tail grizzled like the back at the base, black at the hinder half, red-washed; hairs yellowish or reddish, with two black rings, the upper one broad, and those of the hinder half of the tail with long red-bay tips.

Hab. Bolivia (Brydges). B.M.

22. *Macroxus griseogena.*

Sciurus ferrugineoventris (not Bachmann). B.M.

Fur olive-grey, minutely punctulated with black and yellow;

nose, cheeks, chin, and upper part of throat, and a small spot behind the ear pale grey; throat, chest, belly, and inner sides of the legs red; tail bushy, black, red-washed, with a black tip and black under surface; hairs of tail pale brown at the base, with a broad black ring and red tip.

Hab. Honduras, Venezuela (Dyson): B.M. Santa Fé de Bogotá (Argent): B.M. Mexico (Parzudaki): B.M. Isthmus of Panama (Salvin): B.M. Costa Rica, Volcan de Cartago: B.M.

Var. Middle of the back black; spot behind the ears yellow on one side and grey on the other.

23. *Macroxus Gerrardii.*

Sciurus Gerrardii, Gray, P. Z. S. 1861, p. 92, t. 16.

Crown, back, rump, thighs, and base of tail dark, black- and yellow-grizzled; cheeks, chin, sides of neck and body, fore legs and front of thighs, and middle portion of the tail bright red-bay; middle of throat, chest and belly, and inner side of thighs pure white.

Hab. New Granada. Gray's type in B.M.

C. *Tail black, grey-washed, or more or less annulated.*

24. *Macroxus leucogaster.*

" *Sciurus guerlingus*, Castelnau," not Shaw.

Fur soft, full, dark olive, very closely and regularly punctulated with yellow; hairs lead-coloured, upper half yellow, with a subterminal black band and yellow tip; sides of nose and head grey, yellow-washed; chin, throat, underside of body, and inner side of limbs white; hairs white to the base: tail olive, underside black- and yellow-ringed on the hinder half; hairs elongate, yellowish, with a narrow central and very broad subterminal black ring, with a long grey or yellowish tip.

Hab. South America, Bolivia, Santa Cruz de la Sierra (Bridges): B.M., 1846, 1847. Brazil (Castelnau): B.M.

The female has six teats, far apart and nearly equidistant.

25. *Macroxus Fraseri.*

Fur black, reddish-washed; head, ears, feet, and tail black; upper part of the nose slightly varied with white hairs; hairs black, with reddish tips; hairs of the front of the back, shoulders, and outer side of the fore legs black, with a reddish-grey, narrow, subterminal band; cheeks, throat, and inner sides of limbs pale red brown; chest and belly rufous, with grey rings; hairs lead-coloured, with a red-brown tip or subterminal ring; hairs of tail black, with some intermixed grey ones, of the base of the tail black, with red ends.

Young similar, but hairs longer and underside redder; hairs red to the base, without a grey tip or subterminal ring.

Hab. Republic of Ecuador (Fraser). B.M.

The adult male has a small tuft of opaque white hairs on each side of the nape, and a similar tuft on the middle of the right side of the body; but, as there is no similar spot on the left side, I am inclined to believe they are an accidental individual variation.

26. *Macroxus tephrogaster.*

Fur soft, rather short, close, dark olive, very minutely punctulated with yellow; middle of the back blacker; hairs lead-coloured, with a yellow and black ring and a yellow tip; cheeks pale; chin, throat, underside of body, and inner sides of legs whitish grey; hairs lead-coloured, with white tips; tuft at back of ears yellow grey: tail black, whitish-washed, underside reddish, with a black border; hairs yellowish, with a very broad band and white tip.

Hab. Mexico (M. Sallé): B.M. Guatemala (O. Salvin): B.M. Bogotá (H. E. Strickland): B.M. Honduras (Dyson): B.M.

27. *Macroxus tæniurus.*

Fur dark olive, closely and minutely punctulated with reddish yellow, the middle of the back rather blacker; the sides of neck and body yellower; hairs black, with minute yellow tips; cheeks yellow; chin, upper part of throat, and inner sides of the the limbs grey; hairs black, with white tips; hinder part of throat, chest, and belly grey, red-washed: tail depressed, expanded, black, white-washed; under surface red brown, with black margins and grey edges; hairs reddish yellow, with two or three indistinct narrow bands, a broad subterminal black band, and a grey tip.

Hab. Guatemala (O. Salvin). B.M.

28. *Macroxus irroratus.*

Fur olive, closely, uniformly, and minutely punctulated with yellow; hairs short, close, lead-coloured at the base, black above, with a yellow tip; nose, cheeks, chin, throat, belly, and inner sides of the limbs yellow or reddish yellow; hairs lead-coloured, with yellow tips; ear-tuft small, reddish: tail depressed, black, washed with reddish yellow; hairs rather long, yellow brown, with two narrow inferior and a broad subterminal black band, and a reddish-yellow tip.

Hab. Brazil, Upper Ucayali (E. Bartlett). B.M.

Like *M. æstuans*, but rather larger, cheeks redder, tail broader, depressed, and reddish-washed. There are three specimens: the one marked "a female" is much redder beneath than the other two, which also appear to be of the same sex.

29. *Macroxus flaviventer.*

Sciurus flaviventer, Castelnau, MS. B.M.

Fur very close, blackish olive, very closely and minutely punctulated with yellow on the head and sides of the body; middle of back blacker; hairs very short, close, black, with a yellow tip; cheeks, nose, chin, throat, and chest scarcely punctulated; under part of the body and inner side of the limbs reddish yellow, hairs yellow to the base; ear-tuft small, yellow: tail depressed, narrow, blackish, yellow-washed, especially near the end; hairs yellow at the base; upper half black, with a yellow tip.

Hab. Brazil (Castelnau). B.M.

Like *M. æstuans*, but smaller and darker, especially on the middle line of the back; the cheeks and chin yellow, like the underside; the tail depressed, pennate, very narrow.

30. *Macroxus æstuans.*

Sciurus brasiliensis, Marcgr. B. 230; Seba, i. 78, t. 48. f. 8.
Sc. æstuans, Linn. S. N. i. 88; Kuhl, Beitr. 68; Pr. Max, Abbild. t.
Myoxus guerlingus, Shaw, Z. ii. 171, t. 156.
Macroxus æstuans, Lesson.
Le grand Guerlinguet, Buff. H. N. Suppl. vii. 261, t. 65.

Fur soft, close, dark olive, very minutely punctulated with yellow; hairs very short, lead-coloured, with a narrow yellow subterminal ring and a black tip; cheeks, chin, and upper part of throat greyish; chest and beneath, and inner sides of limbs yellow or reddish yellow: tail cylindrical, black, grey-washed; hairs yellowish, with two narrow inferior and a broad black subterminal ring and more or less grey tips. Ear-tufts none.

Hab. Brazils, Para (Graham): B.M. Bay of Honduras (Warwick): B.M.

Var. 1. Chest and belly yellow in the middle, grey on the sides. Para (Graham). B.M. Female's teats four on each side, surrounded by a fulvous spot.

Var. 2. Chest and front of under surface yellowish; belly whitish grey. Brazil. B.M.

Var. 3. Chest, underside, and the inner sides of the front legs whitish grey; inner sides of hind legs and middle line of the belly slightly yellow-washed. Brazil. B.M.

Var. 4. Throat, central line of chest and belly, and inner sides of limbs white; sides of the body and belly grey. Brazil? B.M.

31. *Macroxus pusillus.*

Sciurus pusillus, Geoff., Desm. Mam. 337; Gray, List Mam. B. M. (part.).
Macroxus pusillus, Lesson.
Le petit Guerlinguet, Buffon, H. N. Supp. vii. 261, t. 66.

Fur soft, dark olive, yellow-grey-washed; head redder; hairs blackish from the base, with yellow-grey tips; cheeks, chin, throat, chest, and belly yellowish grey; hairs dark lead-coloured, with yellow-grey tips; ear-tufts none or very small: tail slender, cylindrical, black slightly varied with yellow; the hairs of the base yellow, with a basal and subterminal black band and a yellow tip, those of the tip black, with a yellowish base.

Hab. Tropical America: B.M. Cayenne (Buffon).

A very small species: body and head 4½ inches long. The front of the shoulders and thighs yellower than the rest of the body.

32. *Macroxus Kuhlii.*

Sciurus leucotis, Castelnau, MS. (not Gapper).
Sciurus Kuhlii, Gray. B.M.
Sc. pusillus, Gray, L. M. B. M. 139 (not Geoff.?).

Fur soft, nearly uniform olive, slightly washed with yellowish; chin and underside rather paler and yellower; a white spot above the base of each ear; tail blackish, whitish-washed; hairs yellow, with a broad subterminal band and white tip.

Hab. Brazil (Castelnau). B.M.

See also:—

Sciurus (*Macroxus*) *Adolphei,* Lesson, Rev. Zool. 1842, p. 130. South America.

Sciurus gilvigularis, Wagner, Münch. Akad. 1850, v. 283. Brazil, Rio Madeiro (Wagner).

Sciurus igniventer, Natterer, Wiegm. Arch. 1842, i. Rio Negro (Natterer).

Sciurus pyrrhonotus, Natterer, Wiegm. Arch. 1842, i. Brazil, Borba (Natterer).

Sciurus variabilis, I. Geoff. Mag. Zool. 1832, t. 4; S. Baird, M. N. A. 283. Columbia (I. Geoff.).

Sciurus stramineus, Eydoux, Zool. de la Bonite, t. 9. Peru.

Sciurus tricolor, Tschudi, Fauna Peru. 156, t. 11 (Wagner). North Peru (Tschudi).

Sciurus aurocapillus, Denny, P. Z. S. 1847, p. 38, of Jamaica, is a bird, and should have been called *Seiurus.*

III. *Fur rather harsh, abundant; sides with a narrow reddish streak.*

33. *Macroxus dimidiatus.*

Sciurus dimidiatus, Waterhouse, P. Z. S. 1840, p. 21; S. Baird, M. N. A. 283.

Fur rather harsh, abundant, reddish iron-grey; hairs short, close, black at the base, with a broad pale-brown ring, a dark-brown subterminal ring, and a white tip; upper part of head, shoulders, legs, thighs, and feet, and a streak along each side of the body rufous; sides of the head, chin, and beneath yellow: tail reddish, black-varied; hairs reddish brown, with a broad black subterminal ring and reddish end, and grey base.

Hab. South America? (Waterhouse's type, not in a good state.) B.M.

This specimen was purchased at a sale with some South-American squirrels; but it has much more the appearance of an African squirrel. No other specimen of this squirrel has occurred to me; so the true habitat is still doubtful.

LI.—*Synopsis of the Species of Burrowing Squirrels* (Tamias) *in the British Museum.* By Dr. J. E. Gray, F.R.S., V.P.Z.S.

The Ground-Squirrels form a very natural group, and are marked very similarly externally, so much so that it is very difficult to distinguish them from each other. But when you have a series of specimens from the same country, and from different localities, you can have no doubt that they are very distinct species, though it is very difficult to record the difference in words; for no sooner do you think that you have hit upon a distinctive character that can be written down than you find it in some of the other specimens.

The different species vary somewhat in size; but then the specimens from the same country vary a little in this respect; yet there is an average size that is characteristic of the species. *T. striatus* of Europe and North Asia is the largest; and then follow *T. Townsendii, T. americanus,* then *T. Hindsii* and *T. quadrimaculatus*; and *T. quadrivittatus* is the smallest.

A. *Tail as long as the body; back with five longitudinal equidistant black streaks, separated by four pale streaks; face with a white streak extended behind, above, and under the eye.*

a. *The pale streaks wide, wider in the middle. Larger.*

Tamias striatus, Linn.

Pale ash-grey, yellowish grey in the middle, grey on the sides.
Hab. Europe: B.M. Asia, Altai: B.M.

b. *The pale streaks narrow, linear, well-defined. Smaller.*

Tamias quadrivittatus.

Sciurus quadrivittatus, Say, in Long's Exped. 1823, ii. 45; Richardson, F. B. A. t. 16.
Tamias minimus, Bachmann.

Fur pale ash-grey, sides reddish; underside of the tail reddish yellow, black and grey on the sides.

Hab. West coast of North America (Lord): B.M. California, Scott Mountains (Brydges): B.M.

Tamias Hindsii.

Tamias Hindsii, Gray, Ann. & Mag. Nat. Hist. 1842, x. 264; Zool. Sulph. t. 13. f. 1.
? *T. Cooperi*, Baird, Proc. Acad. N. S. Philad. 1855, vii. 334.
T. Townsendii, var., Baird, M. N. A. 300.

Fur dark ash-grey, reddish on the sides; the pale and dark streaks elongate, well marked; the underside of the tail orange-red in the middle, blackish on the sides.

Hab. California (Hinds), B.M.; Vancouver Island (Lord), Cascade Ranges (Lord), and British Columbia, Sunago Range (Lord), B.M.

Tamias Townsendii.

Tamias Townsendii, Bachmann, J. A. N. S. Philad. 1839, viii. 68; Baird, M. N. A. 300.

Fur dark mouse-coloured, minutely punctulated with white; the four pale streaks grizzled grey and white, indistinctly defined, broad, short; three of the black streaks short; the lateral dark streak brown, very short, and indistinctly marked; hinder part of the base of the ears grizzled: tail blackish-grey grizzled; underside orange, with black edges.

Hab. California. B.M.

Larger than *T. Hindsii*, with the grey dorsal streak indistinctly marked, grizzled like the back.

Tamias quadrimaculatus.

T. Townsendii, Gruber.

Fur dark grizzled; shoulders and sides reddish; the pale dorsal streaks broad, indistinctly marked, grizzled; outer one narrow and more marked; the dark streaks broad, short, the outer ones scarcely defined; neck with a large white spot on each side of the nape, behind the ear, and with a large black spot beneath it at the end of the very distinct dark under face-streak; tail black, white-washed, beneath orange, blackish-edged. Young like adult, but dark streaks more marked. Same size as *T. Hindsii.*

Hab. California, Michigan Bluff (Gruber). B.M.

These three may be varieties of the same species. There are two or three specimens of each species in the Museum, and they appear very distinct.

B. *Tail shorter than the body; back with five dark streaks, the side ones far from the vertebral, and edging a pale lateral streak; face-streak indistinct, white.*

Tamias americanus, Kuhl.

Tamias striatus, S. Baird, M. N. A. 293.
Sciurus striatus, L.
Sc. striatus americanus, Gmelin.
Tamias Lysteri, Richardson.

Eye with a white streak above and below.

Hab. Canada, United States of North America, New York, Washington, Western Missouri. B.M.

C. *Tail shorter than the body, bushy; back with a distinct dorsal streak and an indistinct lateral one on each side.*

Tamias dorsalis, Baird, Proc. A. N. S. Philad. 1855, vii. 332; Mam. N. A. 300.

Hab. New Mexico (Webster).

LII.—*Descriptions of two new Fossil Cowries characteristic of Tertiary beds near Melbourne.* By FREDERICK M'COY, Prof. of Nat. Science in Melbourne University, and Government Palæontologist for Victoria.

Cypræa (*Trivia*) *avellanoides* (M'Coy).

Sp. Ch. Very thin, ovato-globose, transverse sections nearly three-quarters of a circle from the outer lip, the remainder of the inner lip curving more rapidly, obtusely rounded behind, slightly tapering in front to the short, scarcely notched canal; aperture narrow, of nearly equal width throughout (about seven times as long as wide), the outer and inner lips nearly parallel, terminating in a very short, straight channel in front, but abruptly curved to the right, with the thickened outer lip behind; spire not prominent, of three turns and a half; surface crossed by very narrow, sharply defined, very prominent, thread-like ridges, varying from thirty-five at 1 inch long to twenty-three at 4 lines long, very rarely dichotomizing irregularly or stopping short, more often turning abruptly out of their course with a branch-like bend to one side, so as to intercalate short ridges, between a longer pair, separated by sharply defined, broad, flat spaces usually three or four times as wide as the ridges, faintly indented with transverse, broad, scarcely visible marks; the ridges are usually interrupted by a narrow, shallow, longitudinal, depressed, smooth space along the middle of the back; five, six, or seven pass vertically over the spiral whorls, and on the inner lip they are inflected angularly at the edge of the aperture to form a concave inner lip as wide as the mouth, and terminate in tubercles on its inner edge; the dorsal ends not swollen, sometimes, though rarely, joining from each side, effacing the dorsal sulcus, which, when present, varies irregularly from half a line to a line in width in a specimen of the ordinary size of 10 lines. Greatest length of very large specimen, from anterior canal to most posterior part of outer lip, 1 inch 2 lines, (in proportion thereto) to end of spire $\frac{95}{100}$, width $\frac{85}{100}$, height $\frac{75}{100}$, width of mouth $\frac{10}{100}$. A very small specimen, $4\frac{1}{2}$ lines long, has length to end of spire $\frac{95}{100}$, width $\frac{90}{100}$, height $\frac{80}{100}$, width of mouth $\frac{15}{100}$, showing the great uniformity of the proportions through all sizes, the very young being slightly more globose.

The greater number of specimens have a very distinctly marked, smooth, longitudinal dorsal scar, half the length of the shell, interrupting the transverse ridging—one specimen, however, having the scar as distinct as usual for a great part of its length, has it obliterated at one point by the alternate extensions of a few ridges from each side a little beyond the middle line; and one large specimen has it entirely absent from some of the ridges alternating with each other and stretching beyond the middle, and others of them joining continuously from side to side; when the outer layer of shell bearing the ridges is absent, the surface is faintly cancellated by narrow, obtuse, obsolete lines, the spiral or transverse ones about as far apart as the ridges of the surface, the longitudinal ones finer, less regular, and rather closer.

This species is so much more globose and has so much fewer and more distant ridges than the *T. australis* living on the Victorian shores, that it is not necessary to make any further comparison. It is an exact representative of the *Trivia avellana* of the European Tertiary beds of the same age as those containing the present species, but is clearly distinguished by its uniformly shorter and more spheroidal form, the nearer identity of length and width, the shorter and wider dorsal sulcus almost always interrupting the transverse ridges, and the greater curvature of the mouth, which is nearly straight in the middle in *T. avellana*, but much arched in the present species, in which the margin of the outer lip is consequently less inflected; the sulcus is also characteristically shorter than in the European *C. avellana* or *C. affinis* of the Suffolk Coralline Crag and Touraine beds, with which latter it agrees better in its usually naked sulcus; but the ends of the ridges are never dilated, and, in addition to the same differences of the more arched mouth and less inflected outer lip of the Australian species, the shell in it is larger, thinner, and the ridges more elevated, thinner, and further apart.

Very common in the blue Tertiary clays and limestone between Mount Eliza and Mount Martha in the Bay. Very rare, but of large size, in the blue clays of Muddy Creek near Grange Cwm, five miles from Hamilton.

Cypræa gigas (M'Coy).

Sp. Ch. Shell very large, thick; form ovate, back very gibbous, somewhat spheroidally irregularly rounded; base flattened oval, much thickened, extending slightly in thick obtusely rounded margins on each side of the anterior and posterior ends of the shell (not in the middle); inner lip rounded, smooth within, flattened near the anterior channel, slightly concave before joining the tumid outer margin; outer lip inflected, tumid, broad, and the edge smooth in the middle, with nine or ten nearly obsolete obtuse teeth near the anterior end, and a few still fainter near the posterior end. Aperture narrow, moderately curved, widest towards the anterior end, terminating in deep narrow channels at each end, the anterior one reflected at an angle of about 70° from the base, projecting upwards, forming a reentering angle of 65° with the back, the posterior channel reflexed at upwards of 140°, obliquely subtruncate, inclining forward, and adherent to the spire. Spire exposed, of two whorls; apex obtuse, large; surface smooth. Length of large specimens 8 inches, proportional width $\frac{67}{100}$, height $\frac{55}{100}$, height of anterior channel $\frac{32}{100}$, of posterior one $\frac{25}{100}$, diameter of spiral suture at base of spire $\frac{15}{100}$, width of middle of mouth $\frac{7}{100}$.

This gigantic species far exceeds any known cowry in size, and, like the large Eocene Tertiary *C. tuberosa,* is so completely destitute of teeth on the inner lip as almost to belong to *Ovula.* With the very oblique light of a candle, or by a delicate sense of touch, faint indications of teeth may be detected, but scarcely more than, under similar circumstances, may be found in the recent *Ovula ovum.* The flattened base and thickened inner lip forming an obtuse lateral projection at each end of the shell, as well as the strong reflection of the channels, induce me to place the present fossil in *Cypræa.*

In blue clay of Muddy Creek, ten miles south of Hamilton, and in similar beds between Mount Eliza and Mount Martha on the shores of Hobson's Bay.

LIII.—*Notulæ Lichenologicæ.* No. XVIII. By the Rev. W. A. Leighton, B.A., F.L.S.

Dr. Th. M. Fries has, in his latest published work, 'Lichenes Spitsbergenses,' 4to, 1867, furnished us with a comprehensive enumeration and description of all the Lichens detected in those northern regions up to the present time. In the preface he describes the country as consisting of lofty mountains rising immediately from the shores of the icy sea, having their summits clothed with eternal ice and snow, no woods or grassy meadows decorating their precipitous sides. The marine beaches and very bases of the mountains alone present any vegetation. Of flowering plants ninety-five species have been gathered, of which the Saxifragæ constitute a tenth part. (See Malmgren in Vet. Ak. Förhandl. 1862, pp. 229–268.) These inhospitable regions, however, appear to have afforded in ages long past herbs and trees, as is evident from their vestiges preserved in the rocks, and whose determination Heer has attempted in Vet. Ak. Förhandl. 1866, n. 6.

Wahlenberg says, "Lichenes ultimam vegetationem in ultima terra constituunt." Accordingly these comparatively lower organisms have not been overlooked by the voyagers and naturalists who have explored these coasts. Solander (in Phipps's Voyage towards the North Pole, 1774) mentions eleven species of lichens. Rob. Brown (in Scoresby's Arctic Regions, 1820) enumerates nineteen species. Sir W. J. Hooker (in Parry's North Pole, 1828) names twenty-three species, with localities.

In 1827, B. M. Keilhau collected in Beeren Island, Stans Foreland, and around Sydcap, thirty-two lichens, which Chr. Sommerfelt described in Mag. Naturvid. And. Række 1st B. 2nd H. pp. 232–252 (1833), and the specimens of which are preserved in Sommerfelt's Herb. in the Bot. Mus. of Christiania.

In 1838–39 Vahl, attached to Gaimard's French Expedition, collected in Bel Sound and Magdalena Bay sixty-three species of lichens, besides certain varieties now regarded as species, which A. E. Lindblom described in Bot. Not. 1839–40, pp. 153–158.

Since then, in 1857–1861 and 1864, A. E. Nordenskiöld, K. Chydenius, and A. J. Malmgren have, in three successive explorations, collected a large amount of lichens, which form the basis of the present work.

The explorations have been limited chiefly to the northern and western shores, the southern and eastern ones having been scarcely searched.

There are no species entirely peculiar to the Spitzbergen islands, the lichens being similar to those of northern Scandinavia, with the single exception of *Usnea sulphurea*, which occurs in Arctic America, and from which a connexion between the vegetations of the two regions may be conjectured.

Nevertheless there are marked differences, the chief of which is the absence or very partial occurrence of the larger fruticulose and foliaceous lichens. Those which do occur assume an abnormal aspect of dense cespitose pulvinuli, without apothecia.

The absence of trees and wood causes the corticolar species to be found in a masked form on mosses, old cottages, crosses, &c., in company with many which ordinarily grow on mosses and rocks.

The lichens which, in northern regions, usually cover the marine rocks are, through the intense severity of the climate, altogether absent or of very rare occurrence.

A comparison of the number of the Spitzbergen lichens with those of Arctic Scandinavia shows that the former are very deficient. But, on the other hand, the Spitzbergen lichens far exceed in number and abundance those which have been detected in analogous Antarctic regions.

Malmgren has collected in Spitzbergen lichens 2300 feet above the level of the sea, from which he deduces that, contrary to former opinion, the line of perpetual snow does not here descend to the sea; but, on the contrary, that wherever in these lands there are localities which at times are denuded of snow and ice, there lichens will fix themselves and flourish. He also shows that, as in flowering plants, so also in lichens, there is a decided difference between those of the northern and western sides and those of the other sides—doubtless arising from the different geological formations.

With much satisfaction we observe that the learned author has overcome his prejudice against the application of chemical tests in lichens, and has made ample use of them with very satisfactory results. He, however, still appears to labour under a misapprehension that the advocates of chemical tests wish to inculcate that species may be distinguished by chemical means alone ("hac sola nota"). All that has ever been ascribed to them is that they are most useful and indispensable aids, as affording confirmatory characters and in discriminating doubtful or externally allied species. In the Cladoniæ he has almost uniformly confirmed the results of our own examination of this tribe (see Ann. & Mag. Nat. Hist. Nov. 1866 and Feb. 1867). But it may be well here to correct a doubt which seems to exist, in consequence of the chemical test producing in certain species a slight degree of fuscescence only, by explaining that when the proper reaction takes place, it does so instantly, and that that fuscescence which is in some instances observable is not to be regarded as reaction at all. He gives a most interesting tabular arrangement of parallel forms in which the reaction does and does not occur :—

K luteo tinctæ colore.	K non coloratæ.
Cl. endiviæfolia.	*Cl. alcicornis.*
Cl. cervicornis.	*Cl. verticillata.*
Cl. cariosa.	*Cl. pyxidata.*
Cl. lepidota.	*Cl. degenerans.*
Cl. ecmocyna.	*Cl. gracilis.*
Cl. pungens.	*Cl. furcata.*
Cl. delicata, var. *subsquamosa.*	*Cl. squamosa.*
Cl. macilenta.	*Cl. bacillaris.*
Cl. rangiferina.	*Cl. silvatica.*

Under *Cl. lepidota, bellidiflora,* and *cornucopioides* respectively two species would appear to be comprised, distinguishable by a different reaction, as we have also ourselves remarked in our testings among the large collections of the Hookerian Herbarium.

The work is arranged according to a modified Massalongo-Koerberian system. It includes 246 species and varieties, which, if classified after Nylander's system, may be thus distributed :—

Collemei	8	*Brought forward*	44
Caliciei.	1	Peltigerei	12
Sphærophorei . .	2	Parmeliei	17
Stereocaulei	3	Gyrophorei	9
Cladoniei	17	Lecanorei	61
Usneei	1	Lecideei	76
Ramalinei.	5	Graphidei	3
Cetrariei	7	Pyrenocarpei. . . .	24
		Total	246

Of these the following are described as new :—

Lecanora coriacea, Gyrophora discolor, Lecidea (*Toninia*) *conjungens, Lecidea* (*Biatora*) *collodea, L. pullulans, L. scrobiculata, L. impavida, L. associata, L.* (*Sporostatia*) *tenuirimata, L.* (*Buellia*) *vilis, Arthonia excentrica, Verrucaria extrema, V. rejecta, V.* (*Arthropyrenia*) *conspurcans.*

The learned author has detected a useful chemical criterion of allied species of *Lecidea* by the application of the solution of iodine to the stratum medullare of the thallus, which by reaction it turns of a blue colour in some species, whilst in others there is no reaction. Of this discovery he thus speaks :—" Hanc notam accuratis lichenologorum studiis enixe commendamus, Nondum quidem illam undique satis examinavimus, ut de illius vi atque pretio certi aliquid audeamus prædicare; verisimile vero nobis visum est, adminiculum haud minimi ponderis hanc notam præbere ad species affines dignoscendas." The application of iodine also manifests a long-desired distinction between *Sphærophoron coralloides* and *fragilis,* tinging the stratum medullare of the thallus of the former of a violet or intense blue, and that of the latter of a yellow colour.

LIV.—*On a new Species of Victorian Honey-eater.* By Frederick M'Coy, Prof. Nat. Sc. Melbourne University, and Director of the National Museum, Victoria.

Ptilotis Leadbeteri (M'Coy).

The Subcrested Honey-eater.

Feathers of the crown of the head suberect, so as to form a slightly marked subcompressed crest. Bill strong, moderately arched. Colours (male):—Crown of head and nape dull greenish yellow; back, wings, and tail dull greenish black, the outer edge of the wing- and tail-feathers narrowly edged with dull greenish yellow; lores, or wide space from the gape over and under the eye, the ear-coverts, and extending to the shoulder, intense glossy black; the ear-plume large, and of the most intense pure golden yellow; cheeks below the black bright yellow; chin dull black; breast and abdomen and under tail-coverts dull yellow tinged with olive, particularly at the sides; under wing-coverts blackish, with a narrow bright-yellow edge near the shoulder; the middle of the inner edge of the primaries margined with dull whitish; all the outer tail-feathers tipped with yellowish white, chiefly on the inner circles. Bill and feet brownish black.

Total length 9 inches; bill from gape $\frac{11}{16}$ inch, from forehead $\frac{9}{16}$ inch; wing $4\frac{1}{4}$ inches, tail $4\frac{3}{8}$ inches, tarsi 1 inch.

Female: total length $7\frac{1}{2}$ inches; with the back, wings, and tail of a dark brownish olive, where the male is black.

This splendid new Honey-eater is most allied to the *P. auricornis,* from which its greater size, subcrested head, blackish upper colouring, shorter and thicker bill, and the larger and more intensely coloured ear-plumes, relieved on the intense black extending to the shoulder, easily distinguish it. The subcristate head, and the female differing in colour from the male, suggest a new subgeneric section for this fine bird, which I have great pleasure in naming after my able and zealous taxidermist at the Melbourne National Museum, whose great ability and diligence well deserve the compliment.

BIBLIOGRAPHICAL NOTICE.

Letters Home, from Spain, Algeria, and Brazil, during past Entomological Rambles. By the Rev. HAMLET CLARK, M.A., F.L.S. London: Van Voorst. 1867.

To notice this volume from merely a scientific point of view would be an injustice to its lamented author, by whom its contents were not intended to convey accurate information available for the purposes of science. The series of Letters which it embraces were addressed principally to an aged father, who had but little scientific knowledge, and who probably entertained no special desire to increase what he already possessed. But there is a truthfulness and buoyancy about their style which at once attest the good faith of the writer, who it is impossible not to perceive is a genuine lover of Nature in all her phases; whilst his keen appreciation of everything that he saw, and the strong dash of the ridiculous, often so graphically expressed, which permeates the whole, will more than compensate, in the minds of many readers, for the want of that conventional dryness which is the rule rather than the exception in so-called "scientific" publications.

In his friend John Gray, Esq., who has contributed some interesting sketches to the present volume, Mr. Clark found, through many years, and on several different occasions, a kind and invaluable companion; and it was in his yacht the 'Miranda,' while visiting Spain, Portugal, and the north of Africa, that about half of these 'Letters' were composed. The other half were written during a trip with Mr. Gray to Brazil, when, instead of being accompanied by the yacht, they took the mail steamer to Rio Janeiro. And on all these various expeditions their one common point of interest (apart from the pleasure of visiting strange countries and enjoying new scenes) appears to have been centred in entomology, and especially in Coleoptera.

It is scarcely possible in a short notice like this to do more than call attention to the general plan of Mr. Clark's volume. He writes enthusiastically of the different spots which were visited by himself and Mr. Gray; and nothing could be more true to nature, or more genial, than some of his humorous descriptions of the places touched at in the north of Spain. But it is in Brazil that he is the most graphic—when let loose as it were for the first time under a tropical sun. "I cannot describe to you," says he, on landing at Bahia, "the beauties of scenery like this. At some moments I could fancy that we had jumped right out of this dirty world, and had found ourselves all at once in the old Hesperides—the islands of the Blest —where the fruits are ever ripe, the sun is always bright, and the shadows invite repose; and where plants, and birds, and insects, and all created things, are in the perfection of beauty: but as for *man*, as soon as I think of him, I am back again in my natural existence" (p. 105). And again, on reaching some famous falls near Constancia, in the virgin forest of the Organ Mountains, none but a genuine student of nature would have written thus:—"We rested for an hour on the rock; we did not talk, hardly spoke a word to each other, but drank-in in silence the scene in all its wonderful details—a scene the like of which neither of us probably will ever see again in this life. My thoughts were those not only of delight and admiration, but also of inquiry and wonder: here, on this spot (to speak of it alone), has all the exuberance of creative power and matchless beauty been manifesting itself, not for a generation or two, but for thousands, it may be millions of years, and manifesting itself not for the teaching of blind error-loving mortals, but in solemn everlasting silence and loneliness. What a subject for contemplation! the love of the Creator for all His works; the satisfaction of Him in their beauty, as the incarnation of His ideas of beauty, to-day just as much as at their first creation. 'Behold, it was very good;' that makes it all clear and intelligible; and I say to myself, as I desire to know more of laws and of His scheme of creation, the student of nature is a happy man. It is enough for the disciple that he be as his Master" (p. 125).

Like many travellers before him, Mr. Clark seems to have had a peculiar aversion to snakes; and no wonder, in a country like Brazil, where they may be said to abound *ad nauseam*: "As for snakes, I have said nothing about *them*; but I can sum them up in a line,—they are, with the exception of yellow fever, the only really bad things in all Brazil. Combine your ideas of an incarnation of treachery, of malice, of cunning, of cruelty, of ugliness, of everything that is mean and grovelling and wicked, and you have the combination to perfection in one supreme effort of nature—a snake's head" (p. 144). And, again, "I saw, the other day, a really large specimen of a snake: we were riding along, very early in the morning, by moonlight, to avoid the midday heat, when, between my mule and the side of the road, under a bank, I was conscious of a body on the ground moving past me; and it was light enough to see that our mules had edged in between themselves and the bank a large snake, I should think, about twelve or fifteen feet long. The beast had no difficulty in getting ahead of us and disappearing on the other side of the road. It seemed about as thick as one's knee-joint, and to progress, not, as I had supposed, by a wriggling eel-like movement, but as if impelled by some inner machinery, almost without wriggling its body at all. It was an ugly sight to see in the cold moonlight; and I was as glad as the beast was to part company" (pp. 162, 163).

There are many other passages which we should have been tempted to quote, did space permit. We feel sure, however, that any little imperfections which may seem to attach to this volume, on account of the light and often comical style in which some of the Letters are written, will be generously allowed for when the circumstances of its publication are taken into account. A painful and protracted illness had, for some four or five years before his death, been gradually undermining Mr. Clark's powers for more than the most desultory work; and feeling, therefore, that his end was fast approaching, it is not unnatural that he should have conceived a desire to place on record, in connexion with the name of so true and valued a friend as Mr. Gray, a few of the former impressions of some of the brightest moments of his life; while the fact that he did not live to see this parting effort fully realized, but died as the last sheet was passing through the press, will more than suffice to ensure a charitable judgment from even his most captious readers. Harder and more enduring work than this Mr. Clark did, and he did it well. From his earliest years he had been a patient student of Nature, and, catholic-minded, had delighted in *all* her works; and he was not only a careful describer, but likewise (which is even more important still) a genuine and enthusiastic *collector*—gaining his knowledge, perhaps, more from the woods and streams than from books. His earliest partiality was for plants; he then took to birds; then, with considerable energy, to spiders; afterwards to butterflies and moths, of which he formed a large and valuable collection; and, last of all, and most successfully, to beetles. It was, indeed, to the Coleoptera that the best labours of his life were devoted; and with the great departments of the *Phytophaga* and the water-beetles his name will be associated (in connexion with many admirable papers, catalogues, and monographs) as long as entomology continues to be studied, and cultivated as a science. Like many before him, he has passed from among us; but he has left a record behind which will, and must, endure.

MISCELLANEOUS.

Mermis nigrescens. By William Mitten, A.L.S.

The garden-hairworm has received so much attention this year and so much has been written respecting it by various observers since the past summer, without, however, clearing up some obscure portions of its history, that I have been tempted to contribute my mite in aid of its elucidation.

After showers, in the month of June, the hairworm has been repeatedly brought to me as a curiosity for the microscope; but my own practical acquaintance with it commenced about eight years ago, when, having grafted a number of small plants of whitethorn, about a foot high, with pears, I was continually annoyed by finding the bursting buds eaten off during the night. On visiting them with a lantern, after a showery evening, when I expected to catch the depredators, I was somewhat startled to see on several of my grafts the hairworm, which, adhering to the top of the scion by, I presume, the posterior portion of its body, supported the remainder in the air; and all were moving freely in a kind of gyrating motion, as if ready to seize a prey. No trace of the creatures could be found by daylight; and I did not impute to them the destruction of my buds. I have since seen the hairworm, in the very early morning, on the wet leaves of bushes four feet above the surface of the earth. I have also dug it from about eighteen inches below the surface in the early spring: in this instance I found two individuals coiled together in the hole made by the common earthworm; these were of a paler, somewhat dirty cream-colour; and I kept them alive for a time in a bottle, but they eventually dried up.

Since this, whilst carrying on in my garden that seemingly unavoidable slaughter of slugs, I have on two occasions extracted the *Mermis* from the bodies of the common white slug (*Limax agrestis*). The last instance was in May 1865, when, while killing a small slug about three-quarters of an inch long, with a piece of stick, I saw that I had another worm, and extracted it entire, without injury; it was more than three inches in length, cream-coloured, with a faint dark line, firm and rigid as usual: it surprised me that it could have been carried about in so small a compass. This individual I kept alive some time in a small phial, with a drop of water to keep it moist.

It is easy to speculate on the object the hair-worm has to attain in climbing during or immediately after a shower; possibly it may be the deposition of ova.

Hurstpierpoint, Nov. 1867.

Experiments on the Axolotl. By M. Auguste Duméril.

Since I had the honour of informing the Academy that the Mexican Urodelous Batrachia with external branchiæ, called axolotls, which had never previously been seen living in Europe, had reproduced in the Menagerie of Reptiles, and that many of those born there had undergone metamorphoses *, numerous births have taken place there, and other transformations like the former have occurred. Thus, up to the present time, we have seen sixteen of these animals become covered with yellowish-white spots contrasting with the darker general tint, then lose their branchial apparatus completely, as well as the membranous crest of the back and tail. At the same time the internal organs have undergone changes comparable with those which are observed in the Urodelous Batrachia in passing from the larval to the adult state. Of the four arches supporting the branchiæ which float outside, three have disappeared; the outermost one alone remains, and constitutes the posterior joint of the thyroidean horn. The anterior surface of the bodies of the vertebræ has become less concave. As in all the other Salamandriform Batrachia, a modification has taken place in the arrangement of the dental apparatus of the vault of the palate, the vomerine teeth having changed their place. They were united on each side behind the intermaxillary bone into a small band slightly oblique from in front and within, backwards and outwards; but after the metamorphosis they form, beyond the inner orifices of the nasal fossæ, a nearly transverse row—an arrangement which, with the absence of the posterior palatine teeth, occurs only in the North American tritons called *Amblystomi*, of which the axolotls consequently appear to be the tadpoles. In the lower jaw, to the right and left of the symphysis behind the marginal row, there was a group of small teeth which is no longer to be seen.

Such is a very summary general account of the characteristic facts of a metamorphosis never previously observed, and which possesses

* Comptes Rendus, tome lx. p. 765, and lxi. p. 775: see Annals, ser. 3. vol. xvii. p. 156.

a peculiar interest inasmuch as it confirms the justice of Cuvier's supposition when he said, without having been able to obtain any direct proof of it, that the axolotl, although regarded as a Perennibranchiate Batrachian, would prove to be a larva.

I have not time to enter upon an examination of the different questions which arise from these unexpected observations, which have been made for nearly two years at the menagerie, the most important of which, in a physiological point of view, is, undoubtedly, that which demonstrates the development of the generative power in animals which have not yet arrived at their definitive form. These observations have been published in the 'Nouvelles Archives du Muséum' (tome ii. pp. 265–292, pl. 10).

I now take the liberty of submitting a summary account of some experiments to which I was led by the study of the facts just indicated. The atrophy of the branchial tufts and their gradual disappearance being the first signs of the metamorphosis which is going to take place, I have endeavoured to provoke a change in the mode of respiration by obliging the animals to make use of their pulmonary organs. I made at first some fruitless experiments, consisting partly in gradually diminishing the quantity of water in which the axolotls were kept, so as to leave them, after a certain time, nothing but a layer of damp sand, and partly in arranging in their aquarium a broad shelter, which enabled them to live alternately immersed and out of the liquid.

To obtain any result there was another experiment to be made. It was necessary to destroy the branchiæ, in order to ascertain whether, when rendered compulsorily animals with a pulmonary respiration, the axolotls would undergo the modifications which I have enumerated.

Accordingly, on the 4th of July 1866, I completely removed the three branchial stalks on the left side in two axolotls, and those of the right side in a third; then, from the 14th to the 28th, I cut off every week one of the branchial stalks of the opposite side. At this last date the axolotls would have been entirely deprived of the branchiæ if, during the twenty-four days which had elapsed since the first operation, the astonishing power of regeneration with which the Urodelous Batrachia are endowed had not caused the commencement of a reproduction of the organs which had been removed. Therefore, in order to keep the axolotls in the state in which I wished to place them, so that I might appreciate the results of the experiment, I cut away successively, on either side, the new branchial stalks as soon as they began to project sufficiently to be removed by the scissors. From the 28th of July 1866 to the 24th of May 1867 (that is to say, a period of ten months), I was obliged to operate, either on the right or left side, three, four, or even five times. During the winter the reproduction was much slower.

On the 10th of August 1866, I cut off the three branchial stalks of the right side of six axolotls, and, wishing to exert a more general and rapid action, on the 17th also the three branchiæ of the left side. As in the other cases, there was scarcely any hæmorrhage, nor did any ill event supervene; the cicatrization was rapid, and the power of reproduction soon manifested itself. The following amputations were made at once on the six animals—on the right on the 21st, and on the left on the 28th of September.

The branchiæ, after the second removal, were scarcely developed; and several of the animals operated upon began to acquire a new aspect in consequence of the appearance of some yellow spots on the skin. Two of these individuals became more and more spotted, lost their crest, and finally became like the axolotls which had previously been transformed. The four other axolotls of the same series, but especially two of them, presented some spots, without any trace of metamorphosis; their branchiæ having acquired a slight development, I amputated those of the left side on the 8th of March, and those of the right side on the 5th of April.

One of these axolotls continued spotted, but without any other marked change; there was scarcely any regeneration of its branchiæ. In the three others it was rather more evident; and on the 24th of May I cut off the branchiæ on each side, and again on the 22nd of June, little buds having been developed.

Thus of six axolotls deprived of their branchiæ, and in which care was taken to oppose the regeneration of the lost parts, two became completely metamorphosed in from four to five months; and a third at the end of nearly a year seems to have undergone the same changes; whilst the other three, after the same lapse of time, are in a state which leaves the observer still uncertain as to the definitive result of the experiment. It even seems probable that, like the three axolotls of the first series, they will not be transformed, and that, consequently, three only, out of nine deprived of their branchiæ, have passed from the larval to the perfect state.

Such a proportion is much greater than that observed among the individuals which have undergone no amputation. I indicate the facts, without, however, wishing to draw the conclusion that the loss of the branchial tufts is a condition very favourable to the accomplishment of the metamorphosis. Moreover most of the transformations were not preceded by functional disturbances resulting from the mutilations.

Reverting now to the immediate results of the removal of the branchiæ, I may add that their resection, which would seem to imply the production of formidable effects, and even to compromise existence, may be practised without inconvenience in a more expeditious manner. On the 7th of June 1867, I removed the whole of the branchial tufts from both sides at once of eight axolotls. Nothing particular was afterwards observed; and on the 22nd of June and 6th of July I effected the removal of all the buds of new formation, which are already beginning to be reproduced.

These mutilations appear to me to have some interest. Here we have, in fact, animals which, when deprived in a short space of time, or even suddenly, of their organs of aquatic respiration, do not experience, at least as far as six out of nine of them are concerned, any disturbance, and continue to live as if the branchiæ had not been removed. Coming no oftener than axolotls which had not been operated upon to take air at the surface of the water, they neither presented in their movements nor in their mode of life any apparent modification, the cutaneous respiration replacing the branchial.—*Comptes Rendus,* August 5, 1867, pp. 242–246.

Note on my former Communication on a supposed New Species of Planarian Worm.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—In the October Number of the 'Annals' I drew your attention to what I believed to be an undescribed species of a Rhabdocœl Planarian worm, which I proposed to call *Typhloplana nigra.* Living as I do in the country, I am in a great measure dependent on my own library for books of reference. Since writing to you, I have procured a copy of Oscar Schmidt's work 'Die Rhabdocoelen Strudelwürmer,' and on Taf. 4. fig. 10 I find an excellent figure of my Planaria, which appears to be not a *Typhloplana,* but a *Mesostomum,* and the *M. personatum* discovered by Schmidt. From what Dr. Schmidt says, it appears that the adult animal is possessed of eyes, which, however, are concealed in the black pigment; young individuals just emerging from the egg have two distinct eye-specks. The chief difference between the genera *Mesostomum* and *Typhloplana* is the absence of eyes in the latter. Hence, as I could discover none in the specimens I examined, I referred the creature to the genus *Typhloplana.* It is, however, clearly identical with the *Mesostomum personatum* of Schmidt, and I cancel my former conjecture, and add this species of Rhabdocœl planaria to the British fauna. *Hab.* Reedy pond near Preston.

I remain, Gentlemen,
Yours sincerely,
W. Houghton.

Preston Rectory, Wellington, Salop.
Nov. 15, 1867.

On the Development of Sepiola. By E. Mecznikow. (Notice by E. Claparède.)

As M. Mecznikow's memoir is published in Russian, we give a rather detailed notice of it.

Besides the old writings of Bohadsch and Delle Chiaje, we possess on the development of the Cephalopoda an unsatisfactory memoir by M. Van Beneden, and a more important work by M. Kölliker. The latter, although more complete, still leaves some gaps to be filled up.

The ova of the *Sepiolæ,* investigated at Naples by the author, resemble the eggs of the common fowl in their form, although not in their size (they are only 4 millims. in length); they are contained to the number of fifteen together in a colourless mucilage. Each ovum is furnished only with a single envelope; this chorion does not appear to correspond with the outer membrane of the ova with double envelopes of other Cephalopoda (*Sepiæ,* Squids), but rather to their inner envelope, which M. Kölliker and others have regarded as the vitelline membrane. This latter denomination seems to be incorrect; at least, in the *Sepiolæ* this membrane is furnished with a micropyle, and must therefore be considered a chorion.

The ova of the *Sepiolæ* are completely transparent. Their development lasts from thirty-four to thirty-five days. The chorion undergoes modifications in proportion as the fœtus is developed: it increases in size and its thickness diminishes; moreover it changes its form, and, from being ovoid, becomes spherical towards the close of the development.

The author distinguishes three periods in the embryogenic development of the *Sepiolæ*: the first, which extends to the completion of the blastoderm, lasts ten days; the second, during which the organs appear, lasts only five days; and the third, during which the organs previously formed are gradually developed, lasts nineteen or twenty days, and terminates with the exclusion.

First period.—The phenomenon of partial segmentation has not been studied from its commencement by the author. The youngest ova which he had under his hands already had the pointed pole of the vitellus covered with embryonal cells. Between this first rudiment of the blastoderm and the chorion some drops of protoplasm seem to correspond to the supposed directive cells (*Richtungsbläschen*) of the Gasteropods, Insects, &c. The nucleated cells of the blastoderm form at first a single layer; they seem to multiply by division. Towards the end of the second day, the blastoderm is extended so as to cover two-elevenths of the vitellus.

On the third day the blastoderm divides into two superposed lamellæ. This stratification seems to be the result of a transverse division of the primitive cells. The two lamellæ are similar in thickness, but in each of them the thickness diminishes towards the margins of the blastoderm.

In the latter part of this period the edges of the blastoderm gradually extend over the vitellus. They envelope the half of it by about the eighth day, and on the tenth they meet at the superior pole of the ovum, enveloping it entirely. The rapidity of the growth in the last two days is explained by the difference of thickness of the different parts of the blastoderm. In fact the lower region, corresponding to the future embryo, presents a much greater thickness than the upper part, which is to become the vitelline or umbilical vesicle. During the whole of this first period each of the lamellæ of the blastoderm is formed only by a single layer of cells. These are capable of executing very marked amœboid movements.

Second period.—From the commencement of this period the cells of the outer lamella of the superior part of the blastoderm become covered with vibratile cilia, the movement of which causes a rotation of the embryo. At the same time the blastoderm (especially the inner lamella) thickens in its lower region, and the fœtus begins to be distinguished from the vitelline vesicle placed above it. Soon a thickening of the blastoderm with an oval outline makes its appearance on each side of the body, a little below the equator of the vitellus. These inflations, which belong essentially to the outer lamella, and which from the second day are very distinct, are the rudiments of the eyes. At the same period there appears on one side of the ovum a small fold of the outer lamella, which speedily extends all round the embryo, and constitutes the rudiment of the mantle. On the second day, also, the mouth shows itself on the ventral surface as a depression in the form of a horseshoe. Then the branchiæ originate, and the first two pairs of arms and the organs of hearing. All these organs are formed chiefly at the expense of the inner lamella, the outer lamella serving them only as a protective envelope. On the third day of this period, the rudiment of the mantle presents on the dorsal side a partial thickening of the outer lamella, corresponding to the point which will subsequently serve for the secretion of the *os Sepiæ*.

At this period the embryo is constricted in its middle by a line of demarcation which divides it into two parts: the lower one is the fœtus properly so called; the upper one includes the arms and the vitelline vesicle. The two lamellæ of this vesicle separate from each other, although still united by very fine fibres, which are probably prolongations of the cells of the inner lamella.

On the fourth day the anal tubercle and the rudiment of the siphon (infundibulum) make their appearance. This last is formed of two distinct bands, inclined 45° towards the equator and diverging from above downwards. These bands are thickenings of the inner lamella; the outer lamella simply covers them, without taking part in their formation. The intestinal canal, the acoustic sacs, the eyes, and the mantle appear with increasing distinctness; so that towards the end of the second period the fœtus already presents the characteristic form of the Cephalopoda. At this period, also, appear the fins, the third pair of arms, and the nervous and arterial centres.

On the fifth day the constriction between the fœtus and the vitelline vesicle has become much deeper. The vitelline vesicle begins to perform alternate movements of contraction and expansion of its two lamellæ. These movements are due to very delicate fibres, similar to those which M. Mecznikow has described in the amnios of the scorpion. Below the vitelline vesicle the two cylindrical parts which form the true lateral parts of the embryo (that is to say, the *cephalic sinuses* of M. Kölliker) become prominent. Their outer region is divided into two parts, of which the upper contains the eyes and the ophthalmic ganglia, whilst the lower contains the cartilages and the lateral branches of the vitellus of nutrition. Further back the mantle and the parts of the body clothed by it are seen. The fœtus terminates below in the two projecting fins. On the fifth day, when the number of arms is still only three pairs, none of these appendages is yet furnished with suckers.

At the end of this second period the two halves of the siphon approach and become united to form an unpaired organ; the posterior part of the intestinal canal (independently of the anterior) divides into two cavities, the rectum and the ink-bag, the walls of which are formed at the expense of the outer lamella; the two pericardia appear at first as solid masses immediately below the branchiæ; the eye becomes surrounded by a layer of pigment, in which, when strongly magnified, numerous colourless nuclei are detected; lastly, the mantle becomes covered with small tubercles furnished with vibratile cilia. By means of these cilia and of the ciliary coat of the vitelline vesicle, the embryo executes continual movements of rotation, which persist until the end of its embryonic development.

In its anterior part the vitellus of nutrition presents a projection corresponding to the mantle; it also gives off two prolongations into the cephalic sinuses beneath the optic ganglia. The author denies that this vitellus is surrounded by the proper membrane described by M. Kölliker.

Third period.—During this period the apparition of new organs plays quite a secondary part. The essential phenomenon is the development and change of proportions of the organs already existing in a rudimentary state. In fact we have hardly anything to indicate except the appearance of the fourth pair of arms towards the commencement of the second half of this period, and that of the fifth pair towards its end. The vitellus of nutrition passes by little and little into the body of the fœtus, and finally only represents a sort of wart upon the head between the bases of the arms. This external vitellus communicates with that of the interior of the body by a delicate band which passes through a small orifice situated below the mouth. At the moment of exclusion, this last vestige of the external vitellus passes entirely into the interior of the body.

In this last period occurs the organization of the skin, formed at first of two layers of cells, one representing the dermis, the other the epidermis. In the former the chromatophora soon make their appearance; they are at first immobile, but afterwards change their form under the influence of muscular fibres, which are developed about the middle of this period. It is also at this epoch that we witness the first appearance of small very refractive granules, which, by their union, will subsequently form the dorsal bone. During this third period the cartilages are formed at the expense of the inner blastodermic lamella. The ocular cartilages are the first formed. This is also the period of the formation of the sucking-disks on the arms. The nervous system becomes more differentiated, and the stellate ganglia appear.

On the first day of the third period, the envelope of the eye divides into two laminæ, the outer of which alone presents a central orifice. The crystalline has at first the form of a small rod attached to the rudiments of the ciliary body. It is a homogeneous body, originating by the hardening of the secretions of the ciliary body (as has already been shown by M. Hensen). Towards the end of this period a kind of cornea is formed; at the same time we see a great number of very fine fibres, producing the characteristic phenomena of interference, make their appearance in the silvery coat. The author refutes the opinion of M. Kölliker, according to which the organs of hearing make their appearance in the form of compact and solid bodies. He asserts that in the *Sepiolæ* the formation of these organs presents a complete parallelism with what we know of their development in the Vertebrata. As to the organ of smell, it does not appear until after exclusion; and this is the case also with the rudiments of the generative organs.

The two blastodermic lamellæ, which play so important a part in the development of the *Sepiolæ*, are called by M. Mecznikow the *epithelial* (exterior) and *parenchymatous* (interior) lamellæ. The author does not use these terms in an absolute sense, since the epithelial membranes of the vessels are formed at the expense of the interior lamella. We may say that the epithelial lamella gives origin to the general envelope of the body, the cartilages, the organs of sense and digestion (except the pharynx), and the ink-bag. The inner layer gives origin to the muscles, the nervous system, the mass of the pharynx, and the vascular system. According to M. Mecznikow, these two lamellæ correspond exactly to what he has described in the embryos of the scorpions.

From the preceding statements it appears that the formation of the nervous system of the *Sepiolæ* cannot be paralleled with that of the same system in the Vertebrata. On the other hand, the formation of the skin and of the organs of sense in the *Sepiolæ* is effected, as in the Vertebrata, at the expense of the interior lamella. Hensen's observations upon chickens seem also to authorize a parallelism between the formation of the internal skeleton of the *Sepiolæ* and that of the *chorda dorsalis* in the Vertebrata. The intestinal canal of the *Sepiolæ* is produced chiefly at the expense of the epithelial lamella, which is not usually the case in Vertebrata. However, in *Amphioxus*, according to M. Kowalewsky, the intestinal canal is formed by an invagination of the epithelial lamella. M. Mecznikow rejects all analogy between the foot of the Cephalophora and the siphon (*infundibulum*) of the Cephalopoda. He is equally adverse to the hypothesis of M. Häckel, according to which the Pteropoda are the immediate ancestors of the Cephalopoda.—*Bibl. Univ.* Oct. 25, 1867; *Bull. Sci.* pp. 186–192.

M. LeVaillant, the African Traveller.

Mr. Edgar Layard says:—"I have been at some little pains to trace LeVaillant's footsteps in Southern Africa, in order, if possible, to identify such of the birds as have been introduced into his great work as South African, but which are supposed by some to have been obtained from other countries. A statement which appeared some time ago in the serial 'Household Words,' to the effect that LeVaillant never was in South Africa, also stimulated my desire to obtain full information regarding him.

"I need not follow him through all his wanderings at this moment; this I may perhaps do at some future time. Suffice it for my present purpose to say that I do not believe that he ever crossed the Orange River.

"He describes in his travels how he was floated across the swollen river, and his chase after the giraffe. I question much if this account is true. There was living at Camiesburg, within the last few years, an aged woman named Van Zyl, who related to my informant that she well remembered the 'kleine Franschman' (little Frenchman), as she called him—that, during his stay in that part of the country, he lodged entirely at her house—and that he never crossed the Orange River, being too much of a coward so to do. When told that he had stated he had shot the giraffe, she scouted the idea, and declared that the skin which he took away was brought piecemeal, from the opposite side of the river, by his Hottentots. Mrs. Van Zyl was a huge, raw-boned woman, who stood upwards of six feet, and usually wound up her narrative concerning LeVaillant by laughingly relating how she had horse-whipped the 'little Frenchman' for attempting some liberties with her."—*The Birds of South Africa*, 8vo, Cape Town, 1867, p. 139.

Investigations on Rhabditis terricola. By M. J. Perez. (Notice by M. E. Claparède.)

The animal which constitutes the subject of this memoir has been determined by the author as *Rhabditis terricola* (Duj.). He found it first in the eggs of slugs, but soon found that this was a phenomenon of pseudoparasitism. The entire eggs contained no Nematodes, but those which were crushed had them in great numbers: the decomposing albumen had attracted them. The worm, in fact, lives freely in the earth, and multiplies with great rapidity wherever it finds albuminous matters in decomposition. It may be remarked, in connexion with this, that M. Schneider some years ago observed the same phenomenon as M. Perez, and made the same experiments. M. Schneider even ascertained that a great number of species exist under these conditions. Finding the genus *Rhabditis* of Dujardin imperfectly characterized, he described these worms at first under the name of *Pelodytes*, and afterwards under those of *Pelodera* and *Leptodera*. In our opinion, he would have done better had he retained the name of *Rhabditis* for one at least of these two genera. However this may be, the worms chiefly studied by M. Perez belong to the genus *Leptodera*; some figures only (especially pl. 7. fig. 2), which M. Perez himself admits represent exceptional forms, belong to *Pelodera* (Schn.). It is, therefore, not impossible that the author's observations relate to several species.

It is impossible for us to follow M. Perez in his very detailed anatomical investigation of his *Rhabditides*. Nor could this be done without establishing a detailed parallel with the fine monograph on the Nematoidea of M. Schneider, which appeared shortly after the memoir of M. Perez. Certain questions of cellular morphology, treated with great care by the author, also cannot be discussed here. We shall only express our regret that the author has not taken into consideration the ideas of the new cellular school (Lionel Beale, Brücke, Max Schultze, Häckel, &c.). To make up for this, we shall dwell upon some very interesting observations relative to the development of the *Rhabditides*.

The ova are developed and hatched in the interior of the terus. But the intra-uterine life does not terminate here. The oung worms remain in the uterus, moving about in all directions, passing from one matrix to another, and increasing gradually in size. They find nothing for their nourishment but the fragments of the ova which they have quitted, and the mucosity secreted by the wall. But this cannot suffice for them. They penetrate into the ovigerous tube itself, where the ovules burst and become their prey. Finally the young individuals break through the wall of the ovary, and penetrate into the splanchnic cavity. This finishes the mother, and she dies by being devoured alive by her progeny. The new generation then quits this dead body by the mouth and the vulva, only a portion of the embryos previously reaching the exterior by means of a normal parturition.

A little while before the publication of the memoir of M. Perez, MM. Leuckart and Mecznikow made known some perfectly similar phenomena in the *Rhabditides* belonging to the cycle of evolution of *Ascaris nigrovenosa*. These observations, made nearly simultaneously but quite independently in two different countries, mutually guarantee their correctness.

M. Perez has been greatly struck by the circumstance that, under certain conditions, these *Rhabditides* multiply for several generations without its being possible to find a single male. From this he concludes that the females of this species are fitted to reproduce parthenogenetically. We regret that M. Perez was not acquainted with the observations made by M. Schneider upon his *Pelodytes*. In these worms, which at any rate belong to the genus *Rhabditis* of Dujardin, M. Schneider saw the females reproduce during a series of generations without the presence of males. Nevertheless, a careful study of these supposed females having led him to recognize the normal existence of spermatozoids in the sexual nucleus, he concluded that these Nematodes are hermaphrodites. Are not the parthenogenetic females of M. Perez analogous to, or even specifically identical with, the hermaphrodite *Pelodytes* of M. Schneider? This question is particularly interesting in consideration of the dispute which has lately arisen between MM. Leuckart and Mecznikow on the one hand, and M. Schneider on the other, with regard to the development of *Ascaris nigrovenosa*. The two former regard the sexual *Rhabditides* as alternating with a generation of parthenogenetic *Ascarides* deprived of males. M. Schneider, on the contrary, assumes the alternation of a generation with separate sexes (*Rhabditides*) with an hermaphrodite generation (*Ascarides*). No doubt M. Perez's memoir may be interpreted rather in M. Leuckart's sense: the author has seen numerous successive generations of parthenogenetic females, amongst which generations provided with males were intercalated from time to time. However, as he does not seem to have even suspected the existence of hermaphrodite Nematodes, we may still question whether the denomination parthenogenetic females which he applies to these worms is altogether above discussion. (Thesis presented to the Faculty of Sciences of Paris, 1866, pp. 156 & 5 plates; *Bibl. Univ.* October 25, 1867.)

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END OF THE TWENTIETH VOLUME.

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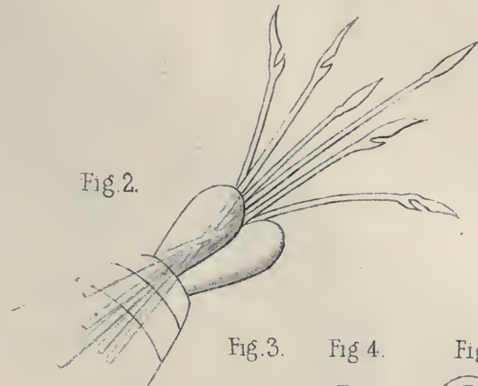
Fig. 2.



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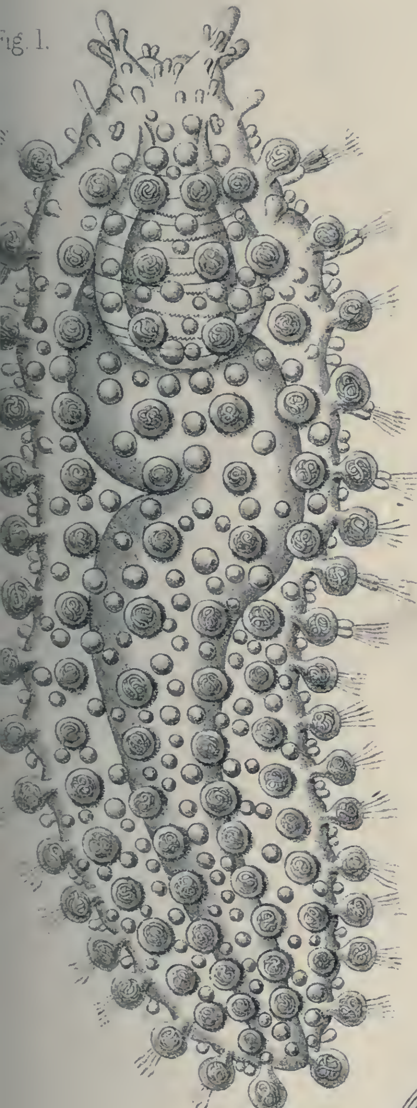
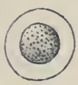


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.



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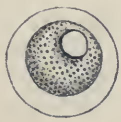

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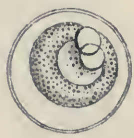

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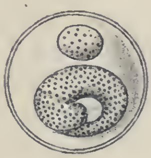

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

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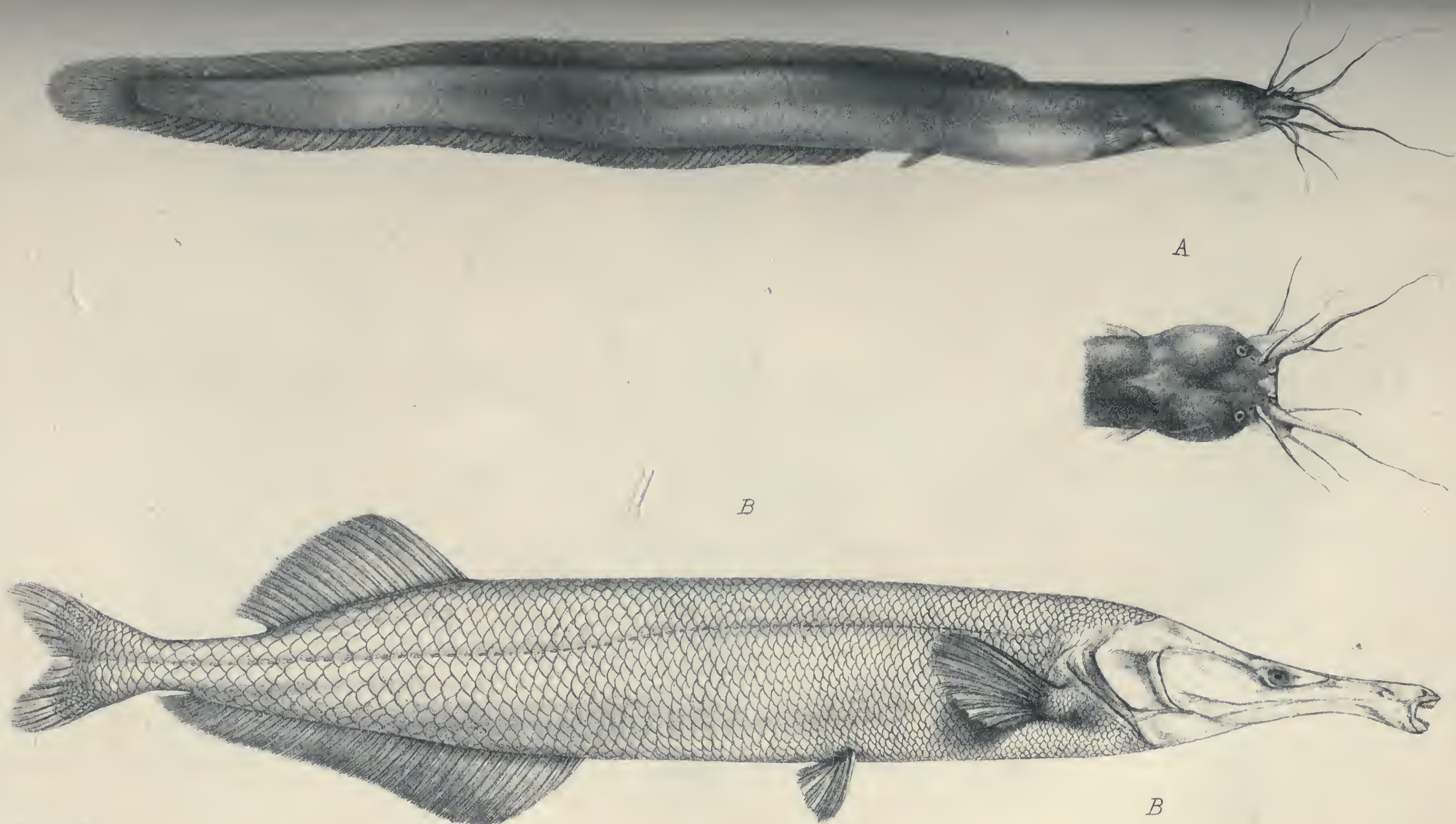
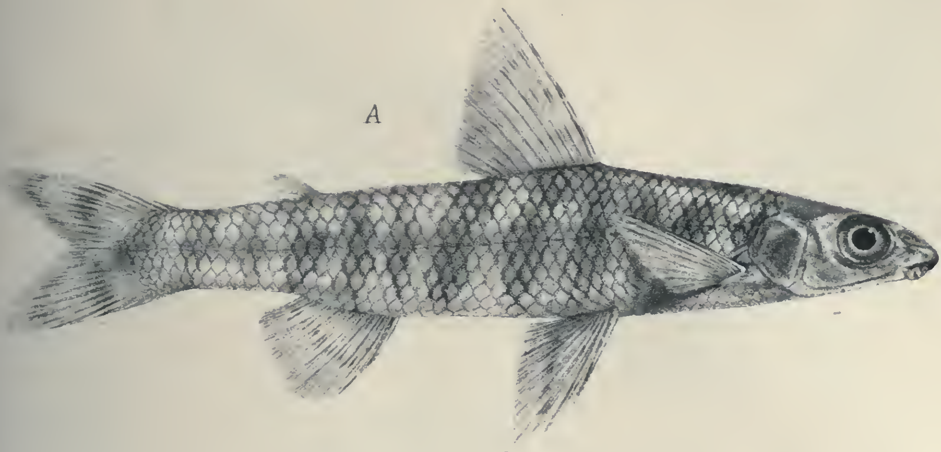


G. H. Ford.

W. West imp.

A. *Gymnallabes typus*. B. *Mormyrus zanclirostris*.

A



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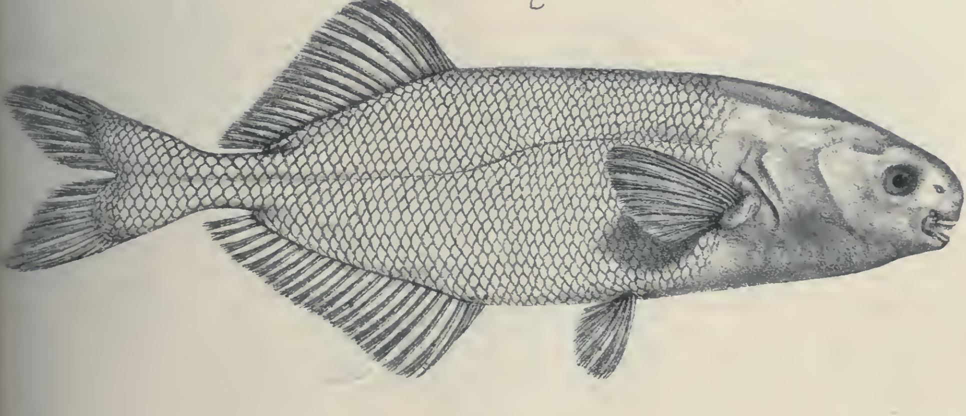
C



E. Ford W. West imp.

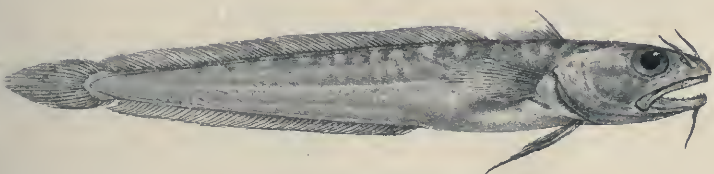
A. *Nannocharax fasciatus*. B. *Xenocharax spilurus*.
C. *Mormyrus walkeri*

A. G. Butler. del. et lith. Aug. 1867. W West imp.

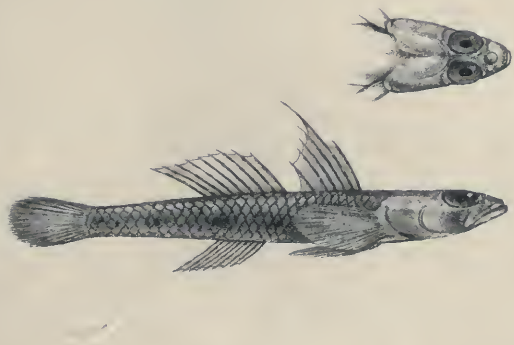
1. Mazæras Conferta, Walker. 6,7. Taygetis Albinotata, Butl.
2,3. " Woodii, Butler. 8,9. Callerebia Scanda, Kollar.
4,5. Euchloë Coliagenes Butl. Vars. (b) & (c).

A

B′



B



C

H. Ford. W. West imp.

A. Callionymus maculatus. B. Motella macrophthalma.
B′. Motella tricirrata. C. Gobius Jeffreysii.

J. Basire Lith.

Gymnobelideus Leadbeateri, M^c Coy.

Neochanna apoda.

G. H. Ford.

W. West imp.

...tler, del. et lith.

W. West imp.

1. Pieris Figulina. Butl. 2, 4, Terinos Robertsia. Butl. 5, 6, Charaxes Echo. Butl.
7. Clerome gracilis. Butl. 8. Cœlites humilis. Butl. 9. Mycalesis cinerea. Butl.

A. G. Butler del. et lith.

W. West imp.

1. *Neptis Charon*. Butl. 2. *Cœlites humilis*. Butl. 3. 4. *Mycalesis Cepheus*. Butl.
5. 6. *Mycalesis Polydecta*. Cram. 7. *M. Nautilus*. Butl. 8. *Lethe Whitleyi*. Butl.
9. *L. Manthara*. Feld. 10. *Elymnias lutescens*. Butl. 11. *Amphidecta pignerator*. Butl.

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