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.

[FOURTH 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. 91. JULY 1875.

I.—*Notes Introductory to the Study and Classification of the* Spongida. By H. J. Carter, F.R.S. &c.

Part I. Anatomy and Physiology.

[Plate III.]

Prefatory Remarks.

In prefacing these "Notes" with a few observations, the first thing that occurs to me, as a spongologist, is that I have lost my lexicographer by the death of the late Dr. J. E. Gray, of the British Museum. With him perished my lexicon, my aider and abettor in the study—in short, my kind and dear friend, whose heart overflowed with humanity, and whose imperishable works testify to one of the most active and sagacious intellects that ever existed. Alas! how little consolation is there in this statement!

These "Notes" will be divided into Three Parts, the contents of which will be respectively as follows:—

1. The Anatomy and Physiology of the Spongida.
2. A proposed Classification of the Spongida into Orders, Suborders, and Families.

3. A further Division into Subfamilies, Genera, and Species so far as our knowledge extends; to which will be added a short commentary.

As regards the First Part, this is almost entirely abridged from my own observations, which have been long since published in the pages of the 'Annals' *in extenso*; hence my former papers will be constantly referred to, for supplying more extended and more satisfactory information than can be embodied in an introduction.

The Second and Third Parts rest chiefly on my study and arrangement of the general and private collections at the British Museum, where *every* specimen has been microscopically examined and the microscopical elements delineated, and will include in addition rough sketches and preliminary descriptions of the most typical and striking specimens, together with the register-number of the specimen and my own private running number, which has also been attached. This of course has been a work of patience and time rather than one of difficulty; but it has led to a general acquaintance with the Spongida which could not otherwise have been obtained, at the same time that it has enabled me to make the classification given hereafter, which I found absolutely necessary before I could put the general collection at the British Museum into any kind of order that might be practically useful.

In my General Arrangement, so far as orders and suborders are concerned the way to me was clear; but I cannot say so much for the families, and still less for the subfamilies, genera, and species, which require a far wider range of specimens in much better condition than those which I have had at my command, although probably the largest and finest collection in the world. Still, from what is hereafter stated, it will be seen that we may have to wait so long for the latter that it is desirable to begin with what we possess, correcting the errors as more and better specimens are accumulated, since the characters which I have assigned as the limit to a group to-day appear to be often upset by a new specimen examined on the morrow; hence the late Dr. Gray was wont to observe respecting the Spongida, that "an accurately illustrated description of a species is the best contribution that can be made to the subject in its present state."

Our knowledge of the Spongida is altogether in its infancy; and hence I have called my observations "Notes," viewing them only as preparatory to what hereafter may become entitled to a more comprehensive term—at the same time seeing that it is necessary to make a *beginning*!

Again, as regards arrangement, I have availed myself, according to my need, of what others have done before me, just as the devotees of one religion that follows another not only make use of parts of the ritual of the foregoing religion, but also the material of its edifices to aid in promulgating their views, without acknowledging either one or the other. At least, such may be seen in the East; and the policy of this course is evident and permissible if the means are justified by the end. There is, however, this difference, viz. that I do not omit the acknowledgment from want of inclination, but from want of time and to avoid confusing the reader.

Further, it should be remembered that this *proposed* Classification is not to be viewed as a dictionary in which a small amount of preliminary knowledge is required to serve its purpose, nor as a classification that has been undergoing revision for centuries. Every one knows that a mariner almost always waits for a pilot to steer his vessel into port; and so it is with classifications. A general knowledge may enable the student to master the larger divisions, but when he arrives at the smaller ones a much more intimate acquaintance is required to guide him to the object he may wish to obtain. There is no "royal road," as it is termed, to this; and if, for instance, in an old and continually revised botanical classification this is necessary, how much more so is it in a classification of which there is only an attempt to lay the foundation.

Lastly, the subject is actually repulsive from its difficulties (as will be seen hereafter); but one who is determined never takes this into consideration: in short, as an old friend used to say to me, "When you are tired, then is the time to exert yourself if you wish to get beyond others; for this is the point where most people stop, and it is astonishing how little further will then place you at the head of the poll,"—which is but

"Tu ne cede malis, sed contra audentior ito."

SPONGIDA.

The term "sponge" is so generally accepted and of such great antiquity that it needs no excuse for preference; but as there are many kinds of sponges which more or less differ from that to which the term "sponge" is commonly applied, it is necessary to add some terminal affix by means of which all kinds may be added under the same name. Thus, if from the Greek word σπόγγος (sponge) we form a patronymic in the neuter plural, we get "Spongida," which, meaning "*Zoa Spongida*" (for the animality of sponges is now established), seems to me the best form that can be adopted for this purpose.

It may be said to be not so applicable as the term "Porifera," which has also been used for sponges; but in the promulgation of knowledge of whatever kind, as well as of opinion, it is an established principle not to scare away by new names and new things, but to retain as much as possible of the old, that the human mind may be tempted to receive that which under an unaccustomed appearance it might reject. Thus many a good system has never been generally adopted, because it has involved an entirely new nomenclature.

A sponge, in the common acceptation of the word, is the fibrous portion or skeleton of a pulp-like mass, and is analogous to the fibrous skeleton or support of a vegetable whose pulpy or soft parts have been washed or rotted away by putrefaction (*ex. gr.* hemp); only, in the first instance the fibre is horny (that is, of an animal), and in the latter woody (or of a vegetable nature). The skeleton of the sponge of commerce is resilient; but that of many Spongida is not so; and there are some in which it is glass-like and rigid; while in others it is altogether wanting, there being apparently no skeleton at all, and the whole mass, with the exception of the dendriform plexus of the excretory canal-system, is a simple pulp.

Sponges grow only under water and in the sea, all over the world (that is, as far as our geographical discoveries have extended), in the torrid as well as in the frigid zones; but as with plants and animals, so with sponges, particular ones are only to be found in particular localities. Thus the sponge of commerce is chiefly obtained from the Levant &c.

Again, they grow on hard bodies, such as rocks, or on soft ground, such as sand or mud: the rocks may be in deep or in shallow water; and so may be the soft ground. When growing on rocks, they for the most part fix themselves by flat expansion or root-like extension to the upper or under surface; and when on sandy or muddy ground, by root-like extensions alone projected into the sand or mud. When growing on the under surface of the rock towards shore or in submarine caverns, they may be pendent; and this is their wonted position and chief habitat; but when on the ground or on the surface of the rock, they are of course erect. Although for the most part preferring fixed objects, some kinds are found growing over shells which, from their kind, never could have been stationary; and some on the fronds of Fuci, which never could have been still, but ever waving in the Laminarian zone.

Again, some sponges grow both on the under and upper surfaces of rocks respectively of this zone, others in similar positions further out in the shallow seas, and others similarly situated in the deep seas. None of these in such positions, therefore, can be obtained by the dredge; and it is only when growing in such parts of the Laminarian zone that, as the tide leaves them uncovered, they can be obtained by the hand, unless gathered by divers from the rocks of the shallower seas, who then restrict themselves to such species as are likely to meet with a general and not a particular sale in commerce. Those alone which grow on the ground can be scraped off by the dredge or such like means; and the rest, if not obtained directly by the hand, come to us accidentally from the parts where they grew. The latter are for the most part broken off from their place of growth in deep water by having become "heady," or too heavy to be held on by the root, or by violent storms when growing on rocks in shallow water, after which, in either instance, they may be carried about in the sea by currents for a longer or shorter time, until they are finally thrown upon the shore by the waves, wherein they become more or less injured by trituration. After stranding on the beach they may be picked up at once and preserved—or they may be drawn into the sea again and again, and thus washed along the beach as the wind changes, up and down, backwards and forwards, buried and unburied in the sand and pebbles repeatedly, even for years, until they come into the possession of the collector. In the first instance more or less of the flesh or soft parts may remain upon them; but in the second, of course, nothing will be left but the skeleton; and in this state, for the most part, they at last find their way into our museums, picked up, perhaps, on some Survey by one.

> "Who loves to roam along the shore,
> Where none have ever walked before."

Hence it may be easily conceived that, such specimens being analogous to a deciduous tree in winter, no further description of them can be given than that which the bare skeleton permits. Again, as it is in the deeper water (from its stillness), and for the most part probably in submarine rock-caverns, pendent from the roof or projecting from the sides, that sponges attain their largest dimensions, so the larger specimens in our museums may be assumed to have come chiefly from these localities, and in the way and state above mentioned. At the same time, it should be remembered that there are several "land-locked" places where the sea is ever more or less calm; and therefore the same stillness which exists at great depths, and is so favourable to large growth, may be found in comparatively shallow water.

Notwithstanding all this, the Laminarian zone of our coasts, which is being beaten upon almost unremittingly by boisterous waves, frequently in the most tempestuous weather, is crowded with various species of Spongida, but all more or less dwarfed from such exposure.

Besides marine there are also freshwater sponges; and these grow in tanks, lakes, and rivers, on rocks, branches and roots of trees, and aquatic vegetation generally, where they may be subject to be left uncovered and dry for several months of the year.

Forms that may be assumed by Sponges.

The forms that may be assumed by sponges are very numerous and very different, not only in the mass, but in the individual; since, although a species may be recognized by the form which it generally assumes, yet it may assume other forms so different that it would be hazardous to decide on this alone. Still the old practice in the description of a sponge was to deal with the form only; nor can we do without it now; but the addition of the elementary composition, which came in with the improvements of the microscope, has furnished us with the means of correcting the mistakes to which this was liable. Yet the absence in the Spongida of any expression visible to the naked eye, as the flower on a plant or the calice on a coral, will ever be commensurately disadvantageous in the description of sponges. Indeed, as will be seen hereafter, little is to be achieved without the aid of the microscope, since, as before stated, the same species may assume different forms, and unfortunately the same elementary composition may also be accompanied by different forms, while, there being certain classes of forms which appear to be evolved out of each other, two species may assume the same form and therefore at last be only determinable by the microscope.

All this shows that the form of sponges is not less Protean than their soft parts will hereafter be found to be; and hence their study presents difficulties in the way of classification and species-determination to which no other branch of natural history is equally subject.

As, however, the means of designating sponges was originally and necessarily restricted to their forms and the likenesses they bore to some well-known objects, this means obtained considerable development; so that the following Table, although a little differently arranged, presents very little new in this way, and is intended to supply the student with the means not only of determining, but of describing a sponge so far as its general form may be concerned.

(For private use I also possess the accompanying Table of delineations corresponding to the names in the text: Plate III.)

Table of Forms that may be assumed by Sponges.

I. *Massive sessile, or spreading horizontally.*

a. Simple.
b. Lobed.

II. *Subpediculated or contracted at the base.*

a. Simple. *b.* Lobed.	Massive or compressed.

III. *Masses branched.*

a. Simple. *b.* Lobed. *c.* Dendritic. *d.* Anastomosing.	Solid or Tubular or Compressed. Sessile or Stipitate.	Vertical or Horizontal.

IV. *Flat or Fan-shaped vertically or horizontally.*

a. Palmate. *b.* Lobed.	Massive or Compressed.	Single or *e.* Grouped or *f.* Branched proliferously.
c. Simple. *d.* Patella-like.	Sessile or Stipitate.	

V. *Hollow.*

a. Crateriform. *b.* Vasiform. *c.* Funnel-shaped.	Circular or Oval or Compressed.	Single or Grouped or Proliferous.
d. Trumpet-shaped. *e.* Tubular. *f.* Obconic.	Sessile or Stipitate.	

VI. *Masses foliated.*

a. Simple. *b.* Lobed. *c.* Plicate.	Compressed or Eccentric or Concentric or Rose-like. Sessile or Stipitate.	*d.* Proliferous.

Observations.

Although the above Table includes most of the forms assumed by sponges, still it must not be inferred that it contains all; hence the student can add others to it at discretion.

Again, the same species, as above stated, may have several forms. Thus the massive form of a species may rise into a bunch of digital processes; these may again become branched into a tree-like or globular head, after which the branches may unite laterally or by their ends anastomosingly. Or the digital processes may be all on the same plane, simple or branched, &c.; they might then coalesce partially, so as to present a fenestrated or clathrous form, or, being single and straight, might unite laterally throughout so as to assume a fan-shape. After which the fan-shape has a tendency to assume a conchoidal form (like that of a clam-shell) and finally, becoming more and more concave, to meet on each side, join up, and thus form a vase, in which there is often a hole at the bottom from the union not being complete.

In this way a simple may pass into a complicated form, and thus many different forms be produced from evolution (see "Beitrag zur Morphologie und Verbreitung der Spongien," von N. Miklucho-Maclay, Mém. Acad. Imp. des Sci. St. Pétersb. 1870, t. xv. no. 3, Taf. 1).

Composition of Sponges.

Skeleton generally.

The general structure of the skeleton is reticular; and this may be compact or open, tough or tender; but under this state it may assume any of the forms above mentioned, each of which is not always an indication of a particular species; for in many instances the same species may assume several different forms, as has just been shown.

Minute Structure of the Skeleton.

The element of which the skeleton is composed may be termed "fibre;" and this is of two sizes, viz. large and small. The large fibre is the oldest, and generally grows vertically or in a direction more or less radiating from the base, in accordance with the general form of the sponge; while the smaller fibre, which is the younger of the two, unites the large fibres obliquely or transversely. In the skeleton of some species there is such a uniformity of growth that no lines of large fibre can be distinguished; and thus a simple reticulation goes on from the base to the circumference, presenting a simple gradation in size from the oldest to the latest-formed portions.

The fibre may be glass-like, horny, or spiculous—that is (in the latter case), composed almost entirely of spicules bound together by a minimum of sarcode.

(Spicules are siliceous or calcareous bodies, according to the nature of the sponge, which are developed by the sponge itself, and vary greatly in form, being for the most part linear and pointed at each end, as will be more particularly described hereafter.)

Again, the glass-like fibre contains a core of spicules; and the horny may be cored with a fine granular substance or with foreign bodies or spicules respectively.

Thus the fibre consists of two distinct parts, viz. the wall and the axis or core.

There is no difficulty in distinguishing between the glass-like and the horny fibre; but there is frequently a difficulty in determining between the horny cored with proper spicules and the spiculous fibre, since the horny substance is composed of the same material as the film which binds together the spicules of the spiculous fibre; and therefore the distinction is only one of degree, viz. that of whether the spicules or the horny substance forms the chief part of the fibre. Still, for the sake of classification, it will be found by-and-by necessary to make the distinction. When horny, the horny matter preponderates; when spiculous, the spicules.

The axis or core, however, is evident in all. Thus in the glass-like fibre it consists of proper spicules ("proper spicules" are spicules that are formed by, and peculiar to, the species); while in the horny fibre the core may consist of a fine, uniformly granular, tubular membrane or sheath everywhere anastomosing and the same, or of foreign objects which, in some parts, may be so scanty that the fibre for the most part is horny throughout; or the core of foreign objects may be so general as to form the axis in *every* part of the fibre, so that there are many degrees between these two extremes; or the core may consist of foreign objects and "proper spicules" mixed together, or of proper spicules alone. Lastly, as before stated, in the spiculous fibre not only the axis, but the whole fibre is composed of "proper spicules" held together by a minimum of hardened sarcode, which from its thinness is almost imperceptible, while the fibre thus composed is, when dry, opaque and white.

In addition to the core, the fibre is sometimes *echinated* with "proper spicules"; that is, the latter have only one end fixed in the surface of the fibre, or otherwise, being *in* the core, project through the fibre to a considerable extent. Thus the core of the fibre may consist of one form of "proper spicules" and the echination of another; or the form of the spicule a little modified may be the same in both; or the core may consist of foreign objects together with an echination of "proper spicules," as before stated.

Finally, the core may be generally or partially continuous (that is, interrupted).

Extremities of the Fibre.

The basal or radical ends of the fibre are of course fixed to the rock or other hard object on which the sponge may be growing, or projected into the sand or mud at the bottom of the sea, as the case may be; so that it is with the circumferential ones that we are now chiefly concerned.

The circumferential ends may terminate in simple anastomosis on a level with the surface; or the larger fibre may project in attenuated tag-like conical ends permeated respectively by a single horny hair-like filament, or filled with an axis of foreign bodies and surrounded by a dense anastomosis of simple small fibre, which, branching off into a more open reticulation at the circumference or base of the cone, joins that of the neighbouring tags. Or the tags may present themselves in the form of spines filled with an axis of "proper spicules" instead of foreign bodies — or in the form of monticules cored with one or more large spicules, which thus form the axis, and project a considerable distance beyond the summit like a hair or bunch of hairs. Or the large fibre may end in a dermal reticulation which may be surmounted by naked tufts of "proper spicules" that, when large, come into contact with each other and thus form a continuous incrustation more or less densely hirsute.

Such are the usual modes of termination; but of course they are subject to great modification.

Sponges with no Skeleton.

In some sponges, as before stated, there is no fibrous skeleton, and no apparent agent of support beyond the dendriform canal-system and the spicules; while in others there is not only no fibre, but also no spicules, nothing but the sarcode and the dendriform canal-plexus.

Nature of the Foreign Bodies.

The "foreign bodies" of the core chiefly consist of grains of sand mixed more or less with siliceous and calcareous spicules of other sponges (entire or fragmentary), of the spicules and calcareous structures of Echinodermata, of Diatomaceæ, and of minute Foraminifera—indeed, any thing of this kind, especially calcite in a minute columnar or prismatic form, banded with hair-brown, yellow, and amethystine colours, originally derived from the disintegration of thin bivalve shells allied to *Pinna*. At first I was at a loss to account for the origin of these little prisms; but finding them in certain kinds of sponges from all quarters of the world, especially from Port Jackson in Australia, and at last in direct connexion with some specimens of *Crenula phasianoptera* which had been overgrown and enclosed bodily by the sponge itself, their general occurrence, rhombohedral prismatic form, and banded colours were thus explained.

Spicules.

The spicules, as their name implies, are pointed, siliceous or calcareous bodies produced by the sponge itself, of an infinite number of forms, varying in accordance with the species, and extending from a simple linear one, pointed at each end, to the most complicated figure.

At first it would appear that the spicule is produced in the homogeneous or intercellular sarcode (that is, the basis or original living slime in which every part of the sponge is developed and imbedded), as it is present and of such a large size comparatively in the ovum even before the latter becomes elongated into the embryonal form, as well as in the intercellular sarcode of the adult sponge, that in either case there is no cell approximately large enough to contain it. But since, in some instances, it can be followed during part of its development (that is, from the time it is first recognizable to that in which it is considerably enlarged), while still within the parent or mother cell ('Annals,' 1874, vol. xiv. p. 97, pl. x), it may be assumed that all spicules are initiated in a mother cell, however soon after they may get into the intercellular sarcode. Thus the spicule appears to arise, within a mother cell, from a granule which, for convenience, will be termed the "spicule-cell," which cell becomes extended linearly in opposite directions, or immediately begins to put forth more or less points in a radiating direction, whereby what is called the central canal of the spicule is formed; and upon the tubular prolongations as they extend is deposited, in concentric layers, the siliceo- or calcareo-albuminous material of which the spicule may be composed, the extremity of the tubule or central canal only becoming covered when the fundamental form of the spicule is completed. Hence the spicule always has a central canal, which remains hollow in the siliceous ones, but in the calcareous spicules appears to me to be filled up by the same material of which the spicule itself is composed; while in some large, robust, acerate siliceous spicules, too, it is often diminished to an almost imperceptible line in the centre, although comparatively wide towards the extremities—thus showing, in some instances, a tendency to become filled up in the same way as the calcareous spicules.

That the spicule is developed from a central cell is often confirmed by the presence in some sponges of more or less abortive attempts at elongation, whereby globular or elliptical bodies of considerable size are formed through the deposit of concentric or successive layers of siliceo-albuminous material upon a central or elongated cell as the case may be, which for some reason has remained stationary, although it has continued to develop successively the layers of which the normal linear form is composed.

When once the spicule can be recognized, it is not difficult to follow its further development, which goes on *pari passu* with the extension of the central canal, linearly or in a radiating manner, as before noticed. If the spicule has a decided linear shaft, this makes its appearance first, and the radiating branches appear afterwards at one of its extremities; so that the *primary* form of a shafted spicule would always be a straight line. At least this is what may be seen among the spicules in the ovum of *Tethya cranium* ('Annals,' 1872, vol. ix. p. 429, pl. xxii. fig. 16). But while the central canal goes on extending itself as the spicule grows larger, it never goes beyond what may be termed the *fundamental form* of the spicule, which is thus determined by the central canal. All ornamental or subsidiary parts, such as the spines &c., are subsequently added, probably after the spicule has left the mother cell and has got into the intercellular sarcode, as shown by the central canal never extending into them. But still it may be a question whether they are not all *initiated* by the central canal, and thus appear to be evolved like any other development which cannot be traced backwards beyond a certain point.

We shall find by-and-by that, besides the spicules especially belonging to the skeleton, there are others as especially belonging to the sarcode or the soft parts, which will be described in connexion with this portion of the sponge-structure, to which they are so intimately attached that, when the sarcode drops off the skeleton from putrefaction, they for the most part go with it—thus still further reducing our means of describing the entire sponge from the skeleton alone.

As the *known* forms of the skeleton-spicules of sponges are exceedingly numerous, it may fairly be inferred that with the discovery of new species of sponges these forms will be found to be almost infinite. At the same time, as they are of much consequence in specific distinction, it becomes necessary to adopt some classification of them whereby the memory may not only be aided in this respect, but assistance may also be given in describing new ones.

Under these circumstances I have framed the following Table, in which the known forms of the skeleton-spicule are divided into three groups, viz. linear, radiating, and ramular, each of which is based upon a fundamental form out of which its divisions, subdivisions, genera, and species may be evolved. The fundamental forms will be found in the woodcuts; and their modifications, in accordance with the text, will be delineated hereafter in separate Plates, when the species are noticed to which they respectively belong.

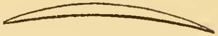
It has been already stated that the development of the spicule commences in a granule or minute cell, which on elongating would give the "linear group," or on immediately radiating would give the "radiating group," or, by elongating first and then branching off radiatingly at one or both ends, as the case might be, would give the "ramular group." Thus the Table of Forms would be based not on mere artificial arrangement, but absolutely on the development of the spicule. That it should be viewed as complete even up to the forms with which we are already acquainted is by no means wished; but that provisionally it offers a beginning to what must in this respect be ultimately accomplished is all that can be expected.

My kind friend the late Dr. J. E. Gray being well aware of the importance of this subject in studying the Spongida, communicated a valuable paper upon it ('Annals,' 1873, vol. xii. p. 203), to which the reader is referred for the views he has therein enunciated.

Table of known Forms which may be assumed by the Skeleton-Spicule of the Sponge.

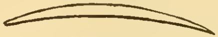
I. Linear Group.

Acerate.



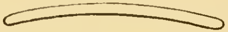
Simple Acerate, viz. linear curved, smooth, fusiform, pointed at each end.

Fusiform.



With or without central inflation.

Cylindrical.



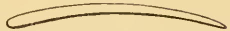
Uniform in calibre throughout.

Curved, straight, spirally sinuous or multiangulate.

Pointed at each end gradually, abruptly, or hastately. | Obtuse or rounded at each end.

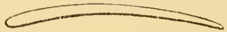
Inflated at each end.
Smooth or spined.
Spines conical or obtuse.
Vertical, inclined or recurved.
Spined throughout, mesially or terminally, more or less.
Spines scattered irregularly or verticillate.

Acuate.

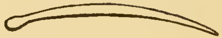


Simple Acuate, viz. linear, curved, smooth conical, round at one, pointed at the other end.

Conical.

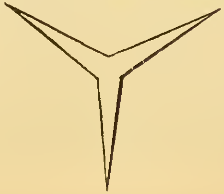


Fusiform.



Curved, straight, or sinuous.
Pointed gradually, abruptly or obtusely.
Obtuse end round or inflated.
Inflation larger or smaller in diameter than the shaft.
In a line with the shaft or bent to one side.
Inflated, globular, ellipsoid or bulb-like.
Terminal or subterminal.
Smooth or spined.
Inflation single or double.
Spines conical or obtuse.
Vertical inclined or recurved.
Spined throughout, mesially or terminally, more or less.
Spines scattered irregularly or verticillate.

II. Radiating Group.



Three-rayed, four-rayed, five- or six-rayed. Rays smooth, conical.
Straight or curved. Opposite or inopposite.
Equal or unequal in length.

Pointed, obtuse, inflated or bifid at the ends.
Spined generally or only at the ends.
Spines vertical, or inclined outwards or inwards.

III. Ramular Group.

Shaft.

Terminating in the head, or prolonged beyond it.
Very thin, medium size, or robust.
Very long, medium size, or short.
Attenuately or abruptly pointed.
Smooth, or spined partially or entirely.
Spines distinct or indistinct, vertically extended or recurved.
Dividing into branches simple or subdivided, at one or both ends: branches smooth or tubercled, filigreed curvilinearly, and interlocking with those of the subjacent layers. See "*Head.*"

Head.

Three-armed, four-armed, or multiarmed.
Arms expanded horizontally, obliquely, or anteriorly fork-like; or recurved anchor-like.
Conical.
Straight, round, or sinuous.
Opposite or inopposite.
Equal or unequal in length.
One, two, or three dichotomously divided.
Branches smooth or spined.
Spines distinct or indistinct, vertical, extended or recurved.
Branches or arms uniting into a simple circular disk, with even curvilinear margin more or less indented.
Arms and branches flattened and sinuous with even margin, or flattened with denticulated margin.
Arms and branches more or less round, infinitely and irregularly divided, spino-tubercled on one or both aspects (outer and inner), filigreed.

Anchoring-Spicules of the Hexactinellida.

Shaft.

Immensely long, fusiform.
Smooth or spined sinuously and subspirally.
Spines on the projections of the spire single or in groups confined to the lowermost third more or less.
Spines conical, smooth, directed towards the sponge.

Arms.

Arms short, recurved, anchor-like, conical, smooth, round, or compressed laterally.
Two, four, or more, opposite, inopposite, or lateral.
Rising from a tumid head, or with no perceptible inflation at this point.

Position of Surface-Spicules.

Where a spicule which has a point projects beyond the surface of the sponge to which it belongs, that point will be always outermost; but, of course, where both ends of the spicule are equally obtuse or bulb-like, an obtuse end *must* be outermost.

Still, as sponges are wont to seize with their sarcode any minute object that may impinge upon their surface, it is possible that, if this be a pointed spicule with one obtuse end, the latter may be outermost. But here the spicule does not belong to the sponge, it is a foreign object; and thus it becomes very desirable to distinguish between such foreign objects and the "proper spicules" of the sponge, so that the former in the description of the species may not be set down as part of the spicule-complement.

Monstrosities.

Again, spicules are much subject to monstrosity; and therefore it is very desirable to find out the *staple* form first, and describe or figure this, after which the others may be figured as *monstrosities.*

Development of the Fibre.

Although the fibre appears to originate in a cell which puts forth buds or processes ('Annals,' 1872, vol. x. p. 107, pl. vii. fig. 5, *c*, *d*, *e*) in plurality, and these in juxtaposition may, by elongation and anastomosis, produce a uniformly reticulate structure whose simple tubular core may be continuous and without foreign objects, like the "fine, uniformly granular" one above mentioned, still the final enlargement of the fibre by concentric layers throughout its whole course must be derived from the intercellular sarcode in which it is imbedded, just as in that of the spicule, whose substance being siliceo-albuminous renders the process identical with the formation of the glass-like fibre.

But although the extension of the fibre and the spicule respectively may be produced by a linear bud-like growth of the original cell in the first instance, these cells do not appear to me to be afterwards identified by their products, as Fritz Müller and others have fancied from the corneo-stellate form of the fibre in *Darwinella aurea* = *Aplysina corneostellata* (see 'Annals,' 1872, vol. x. *l. c. anteà*). Each structure has its peculiar origin and product distinct from the other.

So far we can understand the formation of the "simple fibre" *without* foreign bodies in the core; but when we find fibre cored with foreign objects or "proper spicules," we have to assume that the original germ, which for convenience we will term "horn-cell" (in accordance with what has already been stated of the horn-cell in the Hydractiniadæ, whose functions are analogous, 'Annals,' 1873, vol. xi. p. 6, pl. i. fig. 7), is at first living and plastic, when, *amœba*-like, it may take in foreign bodies, and, having arranged them in a linear or branched form, then proceed in the way mentioned to anastomose with the branches of other similar horn-cells, and thus finally produce a reticulated structure with a core of foreign objects as continuously throughout its whole course as the "fine granular tube" in the fibre without foreign objects, subsequently in like manner receiving, concentrically, additional layers from the intercellular sarcode of the sponge.

There is much more to commend this theory to our notice in the microscopical examination of the fully developed fibre itself, which need not be mentioned here; at the same time, it is impossible to conceive how foreign objects or "proper spicules" can become the core of horny fibre unless by some such hypothesis as that above stated.

Having thus described the spicules and the fibre of the Spongida, it is desirable to notice here that as there are sponges which only possess siliceous spicules, these will be termed "Siliceous Sponges," while others which only possess calcareous spicules will be termed "Calcareous Sponges."

Again, as the fibre may be either glass-like with proper spicules, or horny alone, or horny with foreign bodies, or horny with proper spicules, or composed of spicules only, the terms "vitreous," "horny," "arenaceo-horny," "spiculo-horny," and "spiculo-fibre" will be used for these kinds respectively; while there is yet another modification, as before stated, in which the core may consist of foreign bodies and proper spicules mixed.

Dissolution of Fibre and Spicules.

I have already noticed the disappearance by wasting or decay both in the siliceous and calcareous spicules, together with that of the glassy fibre ('Annals,' 1873, vol. xii. p. 456 *et seq.*); but I omitted to notice that the "proper spicules" of the spiculo-horny fibre also disappear after the same manner, leaving nothing in many instances but their central canals, with a fragment perhaps of the entire shaft in some part of their course, frequently in the middle (thus looking like a cotton-reel upon long spindles), which at first appeared to me like a new form of spicule; hence I mention the fact. The horny sheath or part of the fibre remains; but the spicules of the core almost entirely disappear.

Sarcode.

The sarcode of sponges may be generally defined to be the pulp-like part in which all the rest of the structures are not only imbedded, but from the original slime of which all have been developed, and is analogous to the soft parts of other beings, filling up the insterstices of and enclosing the skeleton or organ of support, thus giving more or less roundness to the surface of the whole mass. But as it is for the most part extremely delicate in structure, the cessation of life almost renders it semifluid, whereby it runs off the skeleton in some cases like oil. Being, too, of an albuminous nature, it collapses like glue when dried upon the skeleton in its fresh state, or coagulates upon it when placed in spirit. Both are preservative means in which the altered sarcode, so long as it is kept from putrefying (when it becomes exposed to the ravages of fungi), will last as long as the horny parts of the skeleton; but of course, on drying, its structure is greatly obliterated, although not so much so when coagulated and contracted by the astringency of spirit.

Tender and delicate, however, as the structure of the sarcode and its soft contents are, especially in the calcareous sponges (where there is no horny fibre, and therefore nothing to hold the spicules together but the living sarcode), we may observe the calcareous sponges growing upon the under surface of rocks on the sea-shore to increase in size and develop their forms there in the midst of daily washing by the falling and rising of the tides, to say nothing of the accompanying waves which are often rendered more or less boisterous by the wind; while if *life* were to be abstracted for an instant they would go to pieces immediately, just as "diffluence" takes place in animalcules under similar circumstances, or as a bunch of iron-filings kept together by a galvano-magnetic current falls to pieces when the circle is broken. Such is the power of *life* in keeping together the particles of which these living structures (which crumble to pieces under the finger and thumb when dry) are composed!

In using the term "sarcode" for the pulp-like part of sponges generally, it must be understood to imply that it is compounded of many parts, each of which requires a particular description.

Thus, when we come to examine the sarcodic mass microscopically, we shall find that its base is composed of a granuliferous, almost transparent, living substance like jelly. It is this living, locomotive, apparently structureless substance, to which I have before alluded, which holds all the rest together, and, originating in its simplest form in the ovum, as will be shown hereafter, finally evolves all that is subsequently developed in the sponge.

Of its *living* nature we, of course, can have no idea except from its manifestations; and of these I can offer no better description than I gave in the 'Annals' for 1849, vol. iv. (pp. 87 & 91, pl. iv. fig. 2), in the following passage, which will be found at p. 91:—

"If a seed-like body [of *Spongilla*] which has arrived at maturity be placed in water, a white substance will, after a few days, be observed to have issued from its interior through the infundibular depression on its surface, and to have glued it to the glass; and if this be examined with the microscope, its circumference will be found to consist of a semitransparent substance, the extreme border of which is extended into digital or tentacular prolongations, precisely similar to those of the Protean, which in progression or polymorphism throws out parts of its body in this way (pl. iv. fig. 2, *c*). In this semitransparent substance may be observed hyaline vesicles of different sizes, contracting and dilating themselves as in the Protean (fig. 2, *d*); and a little within it the green granules, [germs] so grouped together (fig. 2, *e*) as almost to enable the practised eye to distinguish *in situ* the passing forms of the cells ["spherical cells" of the seed-like body] to which they belong. We may also see in the latter [these "cells"] *their* hyaline vesicles with their contained molecules in great commotion, and between the cells themselves the intercellular mucilage (fig. 2, *f*)." The "intercellular mucilage" is the "semitransparent substance" above noticed, and for which I have above used the term "intercellular sarcode."

For another description of the "intercellular mucilage" see p. 87 of 'Annals' (*l. c.*). Thus in 1849 attention was directed to this primordial plasma.

The sarcode proper (for thus the "intercellular mucilage" might be designated) envelops the whole of the fibre, and, filling up the interstitial spaces of the skeleton, forms an areolar structure, which is densely charged with the "ampullaceous sacs," the "ova of the sponge," "muscular cells," together with various other kinds of cells not yet described if even recognized, and the "flesh-spicules;" while the mass generally is traversed by the inhalant and exhalant or excretory tubular branched systems—the former descending from the "pores" on the dermal surface *to* the ampullaceous sacs, and the latter leading *from* the ampullaceous sacs in little radicles, which uniting and interuniting at length form a large canal that opens on the dermal surface in the "vent."

Hence we shall have to examine each of these parts in particular, and thus pass from the general to the minute structure of the sarcode, in doing which it will be advantageous to divide the latter into that of the surface and that of the interior—the former under the term of "dermis," and the latter under that of the "body."

Dermis.

The dermal surface of sponges varies with the species: it may be uniformly smooth, or uniformly irregular, or uniformly hispid, aculeated, and even prickly, soft or hard; while in composition it may be sarcodic, horny, spiculous, or sabellous; but the chief points to remember are that the dermal sarcode or cuticle is supported for the most part by a subjacent reticular structure or framework, composed of one or more of these constituents, in the interstices of which the *pores* are situated, and here and there the *vents*, scattered singly or in groups.

This reticular framework when soft is formed of anastomosing fibre composed of elongated, spindle-shaped, granuliferous, nucleated, gelatinous cells, which lie parallel to each other (the "muscular cells" to which I have alluded, and which will be more particularly described hereafter)—or of simple horny fibre—or of horny fibre with a core of foreign bodies (the so-called arenaceous fibre)—or of horny fibre with a core of "proper spicules" (spiculo-horny fibre)—or of fibre composed almost of proper spicules alone (spiculo-fibre)—or of arenaceous fibre bearing foreign bodies on its outer surface as well as internally—or of spiculo-horny fibre or spiculo-fibre bearing respectively tufts of proper spicules on its external surface, so as to present a hirsute appearance, or with the same tufts so enlarged as to come into contact and thus to form a continuous incrustation; or, indeed, there may be no fibre at all but a smooth membraniform envelope composed of horny sarcode imbedding spicules of the species horizontally placed with respect to each other like a textile fabric, as on many of the deep-sea sponges dredged up on board H.M.S. 'Porcupine,' but always leaving apertures for the pores and vents respectively.

The "reticular framework," again, is supported on, if not given off from, the dermal extremities of the main or vertical lines of fibre of the skeleton, which may terminate at once on a level with the surface by simply anastomosing with each other through the intervention of the reticular framework of the dermis—or in an intricate reticulated structure with a core of foreign objects, which projects in a conical form beyond the surface—or in the same way, with a core of proper spicules assuming the form of an aculeation. These aculeations, again, may be separate or connected by prominent lines of fibre passing directly between them, which, bearing respectively a fold of the dermal sarcode, thus give a polygonally divided cellular aspect to the surface. Or the aculeation may be rounded by the projection of tufts of proper spicules based *upon* the reticulated fibre of the dermis. Indeed the aculeation always partakes of, and is modified in form by, the nature and composition of the dermal reticular framework.

Again, it should be remembered that, although these parts may be frequently bare (that is, uncovered by sarcode) in the fresh as well as in the dry specimen, they were originally invested by it, and only became denuded through wear and tear or natural withdrawal of the sarcode.

Body.

Having already described the skeleton and the sarcode *generally*, together with the " sarcode proper " or intercellular substance, as the basis in which all the other structures are imbedded and, as before stated, out of which they are all elaborated, also having described the " dermis," we shall now direct our attention to those parts of the sarcode of the body which have hitherto only been enumerated, beginning with the

Ampullaceous Sacs.

When the sponge is fed with carmine or indigo, which of course can only be effected during its *active living* state, the colouring-matter with the water is drawn into the substance of the sponge through the *pores* in the dermis, when also the former becomes arrested on the surface of the areolar cavities of the sponge, at points which present a globular or sac-like rounded form. To these points I have heretofore given the name of " ampullaceous sacs," because I found them in *Spongilla* (where I first saw them) of a globular form with a distinct sphinctral opening. They are exceedingly numerous, and may be said, comparing small things with great, to hang about the branches of the excretory canals like grapes in a bunch of this fruit.

The aperture in this assumed sac (for the sarcode, which is probably of the " intercellular " kind, is too subtle to present a distinct cell-wall) is circular and evidently sphinctral, inasmuch as it has the power of dilating and contracting itself, while, by adjusting the focus of the microscope to the interior, when the aperture is open, *in situ*, *under water*, and in an active living condition, cilia may be observed in a state of undular vibration.

Thus, watching the particles of carmine as they pass from the water through the *pores*, they appear to reach the interior of the ampullaceous sac through the opening just described. And still keeping our eye on the sac, we may observe that, after a time, certain of the coloured particles are transferred *en masse* into a circumjacent branch of the excretory canal-system, whence they immediately get into the main trunk, and are ejected at the *vent*; so that it must be assumed (for it has not been demonstrated) that there is a second or excremental aperture in the sac here, as in that of the calcareous sponges, unless the material is extruded into the excretory canal through an extemporized aperture, after the manner of an *Amœba*. The ampullaceous sac in the siliceous sponges is, for the most part, globular, but may be subglobular and sac-like of different shapes. In diameter it is about 1-600th of an inch in the siliceous sponges, and the body of the spongozoon (about to be described) from 1-6000th to 1-3000th of an inch in diameter, both ampullaceous sacs and spongozoa being by far the largest in the calcareous sponges.

Spongozoa.

So far our observation has been limited to what takes place in the ampullaceous sac generally. We have now to see what the organs in the sac are that receive the colouring-matter; and to ascertain this we have only to tear up a portion of the thus coloured sponge with needles, when we shall observe that the particles of carmine are in monociliated conical bodies, which in juxtaposition form a pavement-like structure round the inner surface of the sac, from which their cilia vibrate into its interior. For these bodies singly I have proposed the name of "spongozoon" ('Annals,' 1872, vol. x. p. 45).

Moreover we observe that in the *active* living state, or just after the spongozoon has been scratched out from the body of the sponge (for it soon passes into an amorphous amœboid condition), the spongozoon has a definite form, as the late Prof. James-Clark, of America, first pointed out in the calcareous sponge called *Leucosolenia botryoides*; and in another calcareous sponge, viz. *Grantia compressa*, I find it to consist of a round or conical body, from which projects a long bacilliform tube somewhat inflated at its extremity, where the neck of the inflation is surrounded by a sarcodic frill; and from its summit proceeds a long cilium (altogether not unlike the pistil and corolla of a flower), while in the body may be observed a granuliferous sarcode containing a nuclear organ and one or two "contracting vesicles," which, carrying out the simile, would be analogous to the seed-vessel of the flower.

Fig. 1.

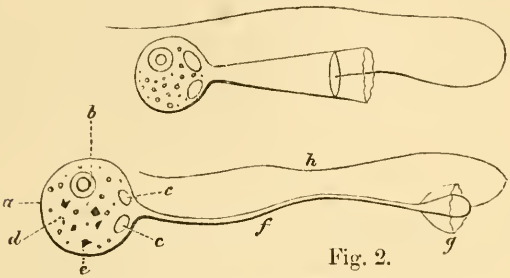


Fig. 2.

Fig. 1. Common form of spongozoon in *Grantia compressa*.
Fig. 2. Not unfrequent form: *a*, body; *b*, nucleus; *c c*, contracting vesicles; *d*, granules of sarcode; *e*, grains of food; *f*, rostrum; *g*, collar; *h*, cilium.

Scale 1-4th to 1-6000th of an inch.

The conical bulb-like portion has been called the "body;" the bacilliform tube, the "rostrum" or beak; the sarcodic frill, the "collar," in the midst of which is the inflated end of the rostrum and the cilium.

This, then, is the form of the spongozoon of *Grantia compressa* in its *active* living state; and that it is the animal of the sponge may be assumed from no other body or cell in the sponge taking in the colouring-matter *.

That the particles of colouring-matter pass into the ampullaceous sac directly through the pore has been demonstrated by the presence of a continuous line of colouring-matter having been seen to exist between the pore on the surface and the ampullaceous sac ('Annals,' 1874, vol. xiii. p. 437); and that subsequently it may pass into the body of the spongozoon through the rostrum or beak (by the side of the cilium, as in such flagellated Infusoria generally) seems most probable,

* It must not be thought that the colouring-matter requires to be so minutely divided as for its particles to be almost imperceptible, since the "rostrum" is so expansible that it will often admit the spores of Algæ into the "body" of the spongozoon, especially at the end of the breeding-season (say June), when the form of the spongozoon generally also appears to be best developed.

although from the polymorphic nature of the body it seems also not impossible that, on impinging upon its surface, it might be *incepted* after the manner of *Amœba*; but from what part of the spongozoon it is *ejected* remains to be discovered.

To describe the organ into which the colouring-matter first passes as a "sac" might appear objectionable, as, in its active living state, there is nothing but the globular form and sphinctral opening to support this view; but if we recur to the contents of the seed-like body (winter-egg or statoblast) of *Spongilla*, it will be found that they consist of a number of "spherical cells" respectively charged with germiniferous bodies, each cell of which with its contents, as the young *Spongilla* grows out of the hiliform opening of the seed-like body, becomes developed into an ampullaceous sac, when the spherical cell ceases to be demonstrable, from the commencement being so subtle in nature that, on placing a portion of the contents of the dried seed-like body in water, it is rapidly distended by imbibition, bursts, and disappears. Thus it may be assumed that there is a subtle film which holds the spongozoa together in the living *Spongilla*, just as the spherical cell contains the germs from which the spongozoa are developed in the seed-like body; and so far we are warranted in using the word "sac." That this cell in the dried seed-like body might pass into a living plastic state is confirmed by the germinating of the rest of the substance itself of the seed-like body, which was equally dry, returning to this state—to say nothing of the entire sponges which, on the walls of the tanks of Bombay, return to life at the commencement of the "rains," after having been exposed above water for several months to the scorching heat of a tropical sun. The body-substance of a dried *Geodia*, which I picked up on the southern shores of Arabia, manifested polymorphism on being moistened with water several months afterwards. But all who are acquainted with the habits of the Infusoria &c. are familiar with this phenomenon.

It should also be remembered that the sarcode and all its *soft* contents when living are more or less polymorphic, and that therefore at one time they may present one form, and at another another.

Thus the spongozoon among the rest, when observed immediately after the *Grantia compressa* has been torn to pieces for microscopical examination, resembles that above delineated; but after a short interval it may be seen to be moving about the field in the form of an *Amœba*, as before noticed, and with or without the cilium, thus totally unlike the original form.

Indeed this power of polymorphism may enable the spongozoon to assume so many phases that it would be absurd to attempt to describe them all; but when the observer knows that they are the result of a polymorphic property, he will not be surprised at seeing them differ entirely from the shape which the spongozoon presents in the active living sponge *in situ* or, at all events, immediately after it has been eliminated for observation under the microscope by tearing a portion of the *Grantia compressa* to pieces for this purpose.

The spongozoon has its analogue, if not its identity, in the solitary Infusoria, both marine and freshwater, first pointed out and described by the late Professor James-Clark in America (Mem. Bost. Soc. Nat. Hist. 1866, vol. i. pt. 3, pls. 9 & 10; reprinted in the 'Annals,' 1868, vol. i. p. 133); in one specimen of which, viz. *Codosiga pulcherrima* (figs. 23 & 24 *h*), the "reproductive organ" is indicated—equal to our "nucleus."

Development of the Ampullaceous Sac and Spongozoa.

See 'Annals,' 1857, vol. xx. p. 26 &c., pl. i., and 1874, vol. xiv. p. 400, pls. xx., xxi., & xxii. figs. 2, 23, for descriptions and illustrations respectively.

Ovum.

For a description and development of the Ovum, see 'Annals,' 1874, vol. xiv. pp. 321–389, pls. xx., xxi., & xxii.

Spermatozoa.

See 'Annals,' 1874, vol. viv. p. 105, pl. x.

Not being satisfied with my search after the spermatozoa of sponges, I began earlier this year (1875) to examine *Grantia compressa*, with the following results:—

On the 29th of April, 1875. Gathered some branches of *Ptilota* bearing *Grantia compressa*, placed them in sea-water on the spot, brought them home, and in three hours after gathering examined fragments of six, good, large living specimens successively, torn to pieces in sea-water, and placed under $\frac{1}{4}$-inch focus with high ocular. Ova generally about 3-6000ths of an inch in diameter (that is, a little less than double the size of the spongozoon), actively polymorphic, and all the parts visible and well-marked but the germinal vesicle. No appearance of spermatozoa either in cells, free, or about the ova.

On the 5th of May, 1875. The same. Ova generally now about 7-6000ths of an inch in diameter, and all parts, including the germinal vesicle, well defined. No appearance of spermatozoa.

On the 12th of May last year (1874). The same. Ova about 7-6000ths of an inch in diameter, passing and having passed in many instances into the embryonic state (*Gastrula*, Häckel). No appearance of spermatozoa. Living and active specimens of this gathering were also examined on the 13th, 14th, and 15th respectively, with the same results.

On the 16th of May, 1874. The same, but with more embryos. No appearance of spermatozoa. Living and active specimens of this gathering were also examined on the 17th, with the same results.

On the 18th of May 1874. The same in every respect. Living and active specimens of the same gathering were examined on the 20th, when the spermatic-looking bodies, loose and apparently dead (figured in plate x. fig. 21 *l. c.*), were observed.

On the 25th of May 1874. The same in every respect, with the exception of more embryos and fewer ova, but no spermatozoa.

So far, therefore, as my own observations are concerned, I cannot say with certainty that I have yet seen the spermatozoa of any sponge.

The little calcareous sponge *Grantia compressa* has been chosen for examination, from the following circumstances, viz.:—that it is very hardy, grows on branches of *Ptilota* midway between high and low-water marks, may therefore be obtained twice a day and thus gathered without injury; while its breeding-season is now determined; hence, perhaps, where it abounds, it furnishes the best sponge for discovering the spermatozoa.

Epitomism of the Ampullaceous Sac.

Thus, then, the "ampullaceous sac" is an epitome of the whole sponge, in so far as it has an inhalant and an exhalant aperture, and contains the spongozoon or animal of the sponge in plurality, which again has *its* oral and anal apertures respectively, together probably with all the other organs in its body, capable of nourishment and reproduction.

Pore-System and Dermal Cavities.

The pore-system may be divided into the "pores" on the surface, and the "subdermal cavities" with which they are immediately connected; while each division, being equally important, will be separately described.

Pores.

The pores are situated, as before stated, in the sarcode covering the interstices of the dermis, which sarcode is not a homogeneous substance, but composed of a number of polymorphic nucleated cells or bodies of a particular kind ('Annals,' 1857, vol. xx. p. 24, pl. i. figs. 6 & 7; *ib.* 1874, vol. xiv. p. 336). These cells, together with the intercellular sarcode which unites them into a common membranous expansion, have the power of separating from each other, so as to extemporize circular holes or pores, and close them wherever and whenever it may be requisite. The average size of a pore is about 1-100th inch in diameter.

It may open inwardly into a minute canal or into a "subdermal cavity." When the former is the case, the canal in some instances, as before noticed ('Annals,' *l. c.*), goes direct to the subjacent ampullaceous sac; but as the latter are much more numerous than the pores and for the most part deeply situated throughout the structure of the sponge, it may be assumed that the original pore-canal sends off branches to supply them respectively. On the other hand, when the pore opens into the subdermal cavity, it may do so singly or in variable plurality.

In some instances the pores are not generally distributed over the surface, but chiefly limited to certain cribriform areæ, each of which forms the summit of a prominent pustular eminence. These eminences, although separated from each other, are plentifully scattered over the surface of the sponge; and while the pores are open and in active operation the pore-area thus formed presents an expanded convexity, but when they are closed it is conical, puckered, and contracted.

In some instances, again, the dermal layer, together with the subjacent sponge-structure, is prolonged into mastoid (teat-like) or tubular appendages, which thus not only increase the extent of the pore-areæ, but specialize it, so as to indicate that these parts in particular are appropriated to the inhalant function.

Subdermal Cavities.

In 1857 ('Annals,' vol. xx. p. 25), in my account of the development of *Spongilla* from the seed-like body, the "subdermal cavities," as they are more or less united together, have been termed the "cavity of the investing membrane" (*l. c.* pl. i. fig. 1, *b b b*). In 1864 Dr. Bowerbank directed attention to this structure under the term of "intermarginal cavities" (B. S. vol. i. p. 100).

The subdermal cavities are situated immediately under the pores, which thus open into them; and presenting a much more open or cavernous structure generally than that which lies inside them, they are easily recognized in a section of the sponge perpendicular to the surface, where they at once point out the side on which the pores are chiefly situated, in contradistinction to the opposite or vent-bearing surface, whose margin is comparatively without them.

The subdermal cavity has an hourglass-shape, in some sponges at least; and the constricted portion is furnished with a sphinctral diaphragm of sarcode which still further divides them into two chambers, viz. an outer one, which is immediately under the pores, and an inner one, which is extended canal-like into the sponge. (For illustrations of this in *Pachymatisma Johnstonia*, Bk., see 'Annals,' 1869, vol. iv. p. 12 &c., pl. ii. figs. 9–12.)

Being an essential part of the pore or inhalant system, they of course exist in all sponges, although perhaps most strongly marked in the siliceous ones; while the dermal sarcode which covers them, having, as before stated, the property of opening or closing its pores, can by this sphinctral power convert the subdermal cavities into closed or open chambers as required, to say nothing of the more powerful sphincter of the hourglass constriction of the cavity itself, which may act in unison with the pores, or as a check upon them when they admit material that ought to have been rejected.

How these cavities terminate inwardly—that is, whether, after branching out, their radicles are directly, or indirectly through the medium of the ampullaceous sacs, connected with those of the excretory canal-system (to be presently described), or whether some terminate one way and some the other—remains to be shown. (See a description and figure of the subdermal cavity, 'Annals,' 1869, vol. iv. pl. vii. figs. 15, 6 & 9.) As the sponge increases by additional layers to its surface, new subdermal cavities must be continually formed, as the old ones become obliterated by passing into the more compact areolar structure of the interior.

Excretory Canal-System and Vents.

The excretory canal-system commences in radicles among the ampullaceous sacs, which radicles pervade the body of the sponge and, uniting with each other plexus-like, form branches that finally terminate in a large trunk, which opens on its surface in what has been called the "vent" or "osculum," which varies in size, but for the most part is large and conspicuous. In what way the ends of the radicles communicate with ampullaceous sacs in the siliceous sponges has not been satisfactorily explained; but from their opening out of these sacs so directly and conspicuously in the calcareous sponges, it may be inferred that this is the case also in the siliceous ones. Be this as it may, the function of the system is to carry off the excrementitious matter of the sponge, as may be observed in the young *Spongilla* (which at first has only one canal-system, and therefore only one vent) after it has been fed with carmine or indigo.

The opening in which the main trunk of the canal-system terminates may be on a level with the surface, or more or less raised above it by a mammiform (nipple-like) or tubular prolongation of the dermal structure entire, or of sarcode alone; but whether of dermal structure generally or the sarcode alone, the opening is always provided with a sphincter, which may be closed or opened as required. This is similarly situated in some sponges to the sphincter of the subdermal cavity of the pore-system (that is, a little below the surface), but differs from the latter, of course, in not being covered by the poriferous sarcode of the dermis. Where the prolonged vent consists of sarcode alone, the opening of course is at its extremity.

Occasionally the vents appear in little groups, distinctly although irregularly disposed; sometimes they are arranged in a petaloid form, and sometimes stelliformly—that is, with little gutters running to them radiatingly, in the dried state, which are converted into canals by the dermal sarcode during life.

They are situated on the inner aspect of the excavated or tubular sponges, and always on the depending or inner side of flabellated expanded forms, which, on becoming frondose and sinuously plicated, cause the depending sides to vary with the sinuosities—so that the vents are found in patches, sometimes on one, sometimes on the other side, as determined by the undulation of the frondose expansion.

Sometimes the opening of the vent is accompanied by a row of spicules, arranged round the orifice so as to lean towards each other in a conical form when the opening is closed, and *vice versâ* when it is dilated.

Although the excretory canal-system is single in the embryonal sponge, it becomes multiplied as the latter increases in size; so that the surface of a large sponge may present several vents, each of which is generally the outlet of a distinct system or plexus; while the vents may exist here and there singly and separate or in groups, where their size and number indicate those of the system with which they are respectively connected. Moreover the sponge has the power of opening them at one place and closing them at another; while in abnormal states their currents may even be reversed. The notion that each vent represents one "person" or individual sponge is not always correct, as I have shown in the young *Spongilla*, wherein a second vent is occasionally produced, thus forming two for its excretory canal-system ('Annals,' 1857, vol. xx. p. 31). Among the calcareous sponges, too, *Grantia compressa* may have one, two, three, or more vents to its cloacal cavity &c. One vent therefore does not always represent one "person."

Function of the Pore- and Vent-Systems respectively.

As the function of the pore-system is to admit nourishment to the interior of the sponge, so that of the vent- or excretory canal-system is to carry off the refuse. Hence in sponges growing horizontally, like the fungus *Polyporus*, the pores are generally on the upper and the vents on the lower surface; but when sponges grow (as they usually do) on the under surface of rocks, the mammiform or tubular prolongations are directed downwards and terminated by the vents. Where the sponges are tubular, as before stated, the vents open on the inner side of the tube, which has thence been called by Dr. Bowerbank the "cloaca." But whether the sponge be tubular, and thus provided with one great cloacal opening, or whether flat and provided with several, each kind of vent is but the termination of a cavity into which many minor vents have previously opened; so that the great cloacal or general vent is but a modification of the smaller and much more common kind.

For a detailed description of the function of the pores and vents, under the appellations of "afferent" and "efferent canals," see my account and illustrations of the development of *Spongilla* from the seed-like body, 'Annals,' 1857 (vol. xx. p. 27 *et seq.*). But a special study of every thing connected with the pore- and vent-systems respectively throughout the Spongida is much to be desired; for there is yet much to be revealed concerning their functions.

Flesh-Spicules.

As there is a class of spicules entirely connected with the skeleton, so there is one as exclusively connected with the sarcode of the sponge; hence the latter has been called "flesh-" in contradistinction to the "skeleton-spicule." They are objects for the most part of singular beauty, from their often complicated and symmetrical forms, of infinite variety, of microscopic minuteness, and dispersed, without any appreciable regularity or constant quantity, more or less abundantly throughout the sarcode. One or more forms may exist in the same sponge, and thus they become of much importance in specific distinction; but as they do not exist in all sponges, this advantage is not general; while their extreme minuteness, causing them to fall through the skeleton when the sarcode in which they are imbedded putrefies and becomes washed out, as small pebbles pass through the meshes of a large net, still further deprives us, as before stated, of their specific aid in most of the sponges, which never come to hand in any other form than the skeleton.

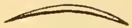
Where they are present, they may be of use in giving greater firmness to the sarcode—that is, by acting as a kind of sub-skeleton; hence Dr. Bowerbank has called them "retentive spicules:" but as they are frequently absent, and, indeed, the skeleton-spicules, too, in some sponges, the latter can evidently do without them, so we must look for some other bond of union for the sarcode; and this, which may be found in the contractile power that it possesses during life, but which immediately disappears on death, is well exemplified in the calcareous sponges, as before stated, where these, the tenderest of all sponges when dry, grow upon rocks in the midst of the boiling surf during their lifetime.

To describe the forms of these beautiful little flesh-spicules in detail, in a general introduction to the classification of the Spongida, would be out of place; and therefore the student must seek for this in the description of the sponges respectively to which they belong, while now they can be only noticed in a general way; and as with the "skeleton-spicules," so here, it seems best to give a Table of the commonest known forms which the flesh-spicule may assume, that the student may to a certain extent become acquainted with them, and thus prepared to describe others which he may afterwards discover. Descriptions, however, at best are very inadequate to the purpose; and therefore I hope to add hereafter tabular delineations of both the skeleton- and the flesh-spicules, as before stated.

Table of known Forms which may be assumed by the Flesh-Spicule of the Sponge.

I. Linear Group.

Acerate.



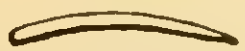
Simple.

Fusiform | Cylindrical curved or straight.

Extremities pointed finely or abruptly; obtuse or round.

Inflated in the centre or towards the ends.

Acuate.



Simple or Fusiform.

Capitate or pin-like.

Smooth or spined.

Bihamate C- or S-shaped, subspiral.

Simple.

Fusiform | Cylindrical more or less spiral or tortuous.

Inflated or not in the centre.

Extremities pointed or obtuse.

Smooth or spined.

Spines partial, general, terminal, or verticillate.

Tricurvate or Bow-shaped.

Simple.

Fusiform | Cylindrical

Curves deep or shallow, varying from nearly straight to pincers-shape.

Equal or inequal.

Extremities pointed, obtuse, or inflated.

Smooth or spined.

Spines general, partial, terminal, or verticillate.

Sinuous subspiral.

Simple.

Fusiform | Cylindrical

Curve single or in plurality, often varying in number with the length.

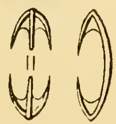
Equal or unequal.

Extremities finely pointed or obtuse.

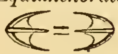
Smooth or spined.

Spines general, partial, terminal, or spiral.

II. Hamular Group*.



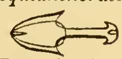
Equianchorate.



Equiended.

Ends conical, expanded alæform, or navicular shuttle-like.

Inequianchorate.



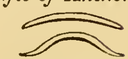
Inequiended.

Ends conical, expanded alate, or navicular.

Ends three- or more armed, *i. e.* fluked.

Arms linear and round; compressed laterally or knife-shaped, with the edge towards the shaft; or expanded alæform, with the central one petaloid.

Shafts of Anchorates.



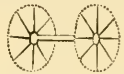
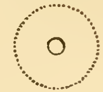
Simple fusiform.

Slightly curved or straight, or tricurvate, *i. e.* bow-shaped (*angulate*, Bk.).

Fusiform, round, or flattened; expanded centrally or throughout.

More or less falciferous—that is, united to the shaft by an arched web-like expansion. Separate or webbed together umbrella-like. Opposite or lateral—that is, on one side only. Disunited, or united end to end with those of the opposite extremity.	Pointed or flattened, expanded or round at the extremities. Alate towards both or one end only.

III. Stellar Group.

Stellate.	*Bistellate, Birotulate or Amphidisk*†.	*Globostellate.*	*Globular.*
			
Radii few or numerous. Opposite or inopposite. Equal or unequal in size and length. Pointed, inflated, or bifid at the extremities. Spined partially, generally, or terminally. Spines vertical or inclined one way or the other.	Ends stelliform (bistellate) or discoid (birotular). Rays stelliform, or rotular and discoid, or recurved and anchorate. Rotula horizontal and irregularly dentate, or discoid with even margin, or discoid with recurved and uniformly denticulated margin. *Umbonate.* Ends equal or unequal. *Shaft.* Straight cylindrical. Smooth or spined. Spines scattered, vertical, irregular in length and position.	Globe or body variable in size. Rays few or numerous; general, or sexradiate and opposite. Pointed, inflated or bifid at the extremities. Smooth or spined. Spines partial, general, or terminal.	Spheroid, ellipsoid; or compressed vertically to extreme thinness (*i. e.* discoid). Structure radiate, compact. Radii simple or branched. Terminating on the surface in stellate, flattened, or inflated or round extremity.

* For a detailed description of the *equianchorate*, see 'Annals,' 1874, vol. xiv. p. 208, pl. xiii. fig. 1, and for the *inequianchorate*, ib. 1871, vol. vii. p. 277, pl. xvii. figs. 7 & 8, both of which must be studied before this Table can be understood.

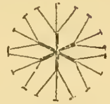
† For figures of the birotulate in the freshwater sponges, see Dr. Bowerbank's 'British Sponges,' vol. i. pls. 210–227.

IV. Hexactinellid Group.

Simple or unrayed.

Two- or six-armed.
Arms equal, opposite.
Pointed, inflated, or hooked capitately at the extremities.

Compound or rayed.



Rays double, few or numerous, equal, opposite, and symmetrical.
Straight, sigmoid, or floriform, *fleur-de-lis*-like.
Single or branched.
Smooth or spined.
Pointed or capitate.

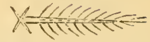
Birotular anchorate.*

Ends eight-armed, symmetrical, recurved elliptically.
Round or flat at the apex.
Blades or arms knife-shaped, falcate, with the thin end towards the shaft.

Shaft.

Straight, cylindrical, spinotubercled, especially about the centre.

Plumose.



Ends crucial, four-armed.
Arms opposite, straight, or sigmoid, horizontal or advanced, smooth or spined, pointed or obtuse.

Shaft.

Straight, conico-linear, more or less spined all round plumosely.
Spines long, curved, more or less deflected from the shaft, inclined towards the free end.

Scopiform Flesh-Spicule†.

Head.

Two, four, five, or more prongs. Prongs round, attenuated, smooth or microspined.
Capitate or pointed.
Extended separately *en fleur-de-lis*; or more or less parallelly fork-like.
Or more or less united horizontally, discoid or umbrella-like; recurved. Umbonate.
Rays microspined.

Shaft.

Smooth or microspined.
Pointed at the free end; inflated, just before its union with the head, elliptically and smooth, or presenting four tubercles opposite.

* For figures of these three forms, see 'Annals,' 1873, vol. xii. pl. 13; and for figures of the "Spinicruces" of Brandt, which are peculiar to the lower end of the sponge and corium of the glass rope in *Hyalonema*, see Dr. Bowerbank's 'Brit. Spong.' vol. i. pl. vi. figs. 153–157.

† For figures of these, see 'Annals,' 1873, vol. xii. pl. xv. figs. 1–4.

Observations.

It is not intended that this Table should be considered complete even for all the known forms of the flesh-spicule; but it may aid the memory in retaining an acquaintance with most of them; and as with the Table before given of the "known forms" that may be assumed by the skeleton-spicule, so here, also, this may aid the student in describing new ones of the flesh-spicule.

Specific Value of the Flesh-Spicule.

A few remarks here are necessary as regards the specific value of the flesh-spicule, since, as the same form of skeleton-spicule is often found among the normal spicule-complement of different species of the Spongida, or with such slight and almost inappreciable differences that they are of no use specifically, so it is with the flesh-spicule.

Although the navicular or shuttle form of the equianchorate and the simple minute bihamate are common to several very different kinds of sponges, there is no form so common or so diversified, perhaps, as the tricurvate or bow-shaped spicule, which in many instances is a simple minute acerate so like the skeleton-spicule that it might be easily mistaken for a young form of the latter.

It is under this form that the tricurvate often appears in sheaf-shaped bundles, each bundle of which is developed in a separate cell (see "Mother Cell of the Spicule," 'Annals,' 1874, vol. xiv. p. 100, pl. x. figs. 3–9), and so numerous in some instances that it would appear to afford a characteristic feature, if it did not so happen that the sheaf-shaped bundle is common to so many totally different kinds of sponges. It is therefore desirable to remember that this is the tricurvate spicule which, after the bundles have been eliminated from the mother cell into the structure of the sponge generally, may attain a somewhat more recognizably tricurvate form.

It is also desirable to notice that sponges are often densely charged with minute transparent globules, which have such a siliceous aspect that, if it were not known that the Hyphomycetous Fungi (*Mucor* and *Botrytis*) sooner or later destroy the whole of the sarcode, or soft parts of the sponge, under the least humidity, and thus fill it with their sporules, these little transparent bodies might be taken for a part of the spicule-complement of the sponge. If, however, there should be any doubt on the subject, and the parent filaments or mycelium of the *fungus* be not observed, the doubt may be got rid of by boiling a bit of the sponge in nitric acid, or exposing it to a red heat, which will destroy every thing but the siliceous elements of the sponge.

Muscular Cells.

In many sponges, especially in the harder and tougher species, chiefly about the dermal layer, there are long fusiform cells, whose central contents are a nucleus and several granules. These cells are often united together longitudinally, in the form of a cord, to form the dermal reticulation, or are massed together so as to form a densely tough, contractile cortical layer. Their shape contrasts strongly with the globular cells in the dermis, as may be seen by my figures ('Annals,' 1872, vol. x. p. 107, pl. vii. figs. 10 & 11); while they so closely agree in shape &c. with the fusiform cells of "unstriated muscle," that I have provisionally called them "muscular." I have not been able to make an extended examination of them; but having often met with them in various sponges and in different parts of the sponge, especially in the Pachytragia, it is to be hoped that some one will give his attention to the subject specially, for their general elucidation, as well as that of many other cells of the sarcode whose specific forms and functions have yet to be particularly described and determined.

Colour of Sponges.

The most prevalent colours of sponges are different shades of tawny yellow and brown; but they may be snow-white or jet-black, golden or bright yellow, scarlet or crimson, green, blue, violet, carmine, and purple, passing into the dark neutral tint of writing-ink—indeed, all the colours of the rainbow.

Still the prevailing colour of the horny skeleton-fibre is tawny yellow, brown, or grey; but this is no indication of the original colour of the sponge when invested with its natural sarcode, since in fresh specimens of the officinal sponge the surface most exposed to the light may be black, that less exposed (viz. the sides) purple, and the lower part, which is excluded from the light, almost colourless, or partaking only of the light tawny yellow tint of the interior of the body—a tint derived from the horny skeleton, which, being the only part retained in the officinal sponge, presents the well-known "sponge-colour."

Thus, in this instance, the colour is confined to the dermal sarcode, and is most intense where most exposed to the light, becoming less so in the lower parts; this is the case in all sponges, whether the colour be continued into the sarcode of the body or confined to the surface.

The colouring-matter may be diffused through the sarcode like a dye, or in small pigmental granules; the granules may be diffused generally, or confined in pigment-cells, or both, as if the former had been derived from the latter. Or the colouring-matter may be confined to the spongozoa, which, again, may only partake of it where most exposed to the light, or possess it generally throughout the body. Lastly, the ova on approaching the embryonal state may become coloured; and, in most instances, where the spongozoa and the ova are coloured they present an intensified tint of the sponge to which they belong; so that in a red- or yellow-coloured sponge the ova, when advanced in development, may be recognized generally by being intensely red or yellow, as the case may be. Yet in some cases they appear in the midst of a tawny-yellow-coloured sponge as opaque *white* bodies when they attain their embryonal state (see 'Annals,' 1874, vol. xiv. p. 331).

The same species of sponge may assume different colours; thus *Grantia clathrus*, Sdt. (= *Clathrina*, Gray), may in some instances be vermilion-red, in others sulphur-yellow, and in others grey-white, which is the most usual: here the colour is general, and seated in the "granules." *Esperia macilenta*, Bk., of our coasts, although generally tawny yellow, is sometimes vermilion-red.

The colour, again, may be "fast" or permanent, or fade after death, and on drying or preservation in spirit disappear altogether, or leave a grey or brown tint only. Again, some calcareous sponges (*Clathrina*) which are opaque white while living, become brick-brown when killed by being thrown into fresh water; while others (*Grantia nivea*) retain their opaque snow-white colour under all circumstances. The cause of this has not been explained.

Then, again, the tawny-yellow colour of the officinal sponge of the shops, which, as before stated, is due to that of the horny skeleton-fibre of which it is alone composed (which fibre is analogous to the fibre of wool or that of the cocoon of a silk-worm), is no indication of the colour of the skeleton-fibre throughout the Spongida; for it may be of all shades, from colourless, grey, to brown, yellow, and deep dark amber; while in one instance at least (*Spongia flabelliformis*, Pallas; *Ianthella*, Gray), where the soft parts are madder-brown and the fibre deep amber, there are layers of carmine-coloured cells intercalated with those of the fibre, thus presenting a beautiful appearance under the microscope.

Lastly, the colour may be due to the presence of a parasite, as in the cerulean sponge of the rocks here (Budleigh-Salterton), which only appears in patches about half as large as the nail of the finger, but always of a sky-blue colour, possessing a pin-like spicule, and accompanied by a minute *Oscillatoria* in the form of short bacillar filaments like those colouring the Red Sea, in whose granules the pigment is seated which gives the blue colour to the sponge while fresh, though the blue fades greatly on drying. The green colour in *Spongilla* also sometimes depends upon the presence of an *Anabina*, but as often comes from its own granules; while *Halichondria incrustans* is often pervaded and rendered pink by a minute alga whose cells, both fresh and dry, present a beautiful red Floridean colour; indeed the mere contact of a red seaweed with a sponge may be followed by the latter assuming a similar tint.

The most striking colour which I have seen among the sponges is the carmine of the Suberites *Alcyonium purpureum*, Lam., from Australia, and *Vioa Johnstonii*, Sdt., from the Adriatic, whose spicules are very much alike, and in both of which the colour is exquisite and permanent.

Starch.

Starch, impalpable, diffuse, or amorphous, and in the common potato form of grains, although much more compressed, is common in *Spongilla* and probably in sponges generally; the latter form is even found in the ovum or seed-like body ('Annals,' 1859, vol. iii. p. 334, pl. i. fig. 7). Still it is very necessary, in examining marine sponges for starch, to be sure that the latter does not come from a neighbouring Fucus, whose cells are always pregnant with starch-grains, and very apt to be cut open when minute and intimately connected with the sponge under microscopical examination.

Size of Sponges.

Some sponges are always diminutive, others only so when they are young. In some places the same species may be only found in small amorphous fragments, while in others it may attain a large size with definite form. The largest size that a sponge may attain under favourable circumstances (that is, unmolested &c.) is almost indefinite; so that the size of a specimen, unless very large or very small and of definite form, goes for nothing specifically.

All the calcareous sponges are small, and many diminutive, even when full-grown; while many species of siliceous ones have been found of very large dimensions. Thus, while the cavity of *Grantia ciliata* may when full-grown only admit a pin's head, a small child might sit down in the great suberitic siliceous sponge called "Neptune's cup." Dr. Bowerbank, in a note written to my friend the late Dr. J. E. Gray, mentions a massive sponge (Suberite, *mihi*) nearly as large as a "military drum;" and the crown of another from Belize, in the Bay of Honduras, "3 feet across." The well-known "Neptune's cup," just mentioned, also belongs to the Suberitida. Mr. Clifton, again, in a note to Dr. Gray (which I possess), states that he has seen specimens of a branched sponge (*Axos Cliftoni*, Gray) on the beach in South Australia, after a storm, "6 feet long." In the British Museum there are many species, too, of totally different sponges, massive, excavated and frondose, or flabelliform, of comparatively gigantic growth; but, as I have before stated, they are only indications of the size that some sponges may attain, and therefore of little or no value specifically. Still the smallest and most amorphous fragment of a sponge which presents a new set of spicules should not be overlooked. That called "*Acarnus innominatus*, Gray," I first found on a large specimen of *Ectyon sparsus*, Gray, from the West Indies, in a fragmentary state not larger than the human nail ('Annals,' 1871, vol. vii. p. 273, pl. xvii. figs. 4–6), a specimen of which as large as the human head was afterwards presented to the British Museum, from Ceylon, by Mr. Holdsworth.

Parasitism.

As no living being is exempt from parasites, so the sponges have theirs. Algæ, polypes, cirripedes, and crustaceans live in and on them respectively, as I hope to show hereafter in a separate and illustrated communication. One parasite in particular, for which I have proposed the name of *Spongiophaga communis* ('Annals,' 1871, vol. viii. p. 330), so entirely replaces and simulates the sarcode of the original sponge, in *Hircinia* especially, that, but for its occurrence in many other sponges of a totally different kind and in different parts of the world, it might (as it has been) be considered part of the sponge itself.

Fossil Sponges.

In a palæontological and geological point of view, it might be assumed that all the orders of sponges to be hereafter mentioned existed as far back, at least, as the Upper Greensand of the Cretaceous system, not only from the resemblance of entire forms, but from actual identification of the spicules and other elementary parts themselves. These, besides being found in the powder of many hollow flints, exist at Haldon Hill, near Exeter, promiscuously and abundantly in a distinct stratum of fine sand—the former in direct connexion with the fossilized sponge, and the latter in a drift-accumulation. This has long been known; and what I have stated respecting the representatives of the orders will be found in the figures &c. of my paper on the subject, published in the 'Annals' of 1871 (vol. vii. p. 112, pls. vii. to x. inclusive). It is true that all the orders are not represented by the bare spicules and fragments of glassy fibre therein illustrated; but sufficient, I think, to justify our assuming that the others, which can only be recognized by a fragment of the entire fibre respectively, may hereafter be found in this very interesting, but very little worked, field of discovery.

What took place in the Cretaceous Period is taking place at the present day, especially in the deep sea, as evidenced by the "dredgings" of H.M.S. 'Porcupine,' which indicate, through the specimens now with me, that about 100 miles north of the Butt of Lewis, in 632 fathoms (station no. 57), there must be a bed of sponge-spicules of many kinds, portions of which are rounded by the currents into pebble-like forms, which one day may become the nuclei of flints or rounded portions of sandstone respectively, like those now scattered over the Cretaceous area; while the bed itself may become, like that in the Upper Greensand of Haldon Hill, a heterogeneous mass of sand and fossil sponge-spicules. So also a recent specimen of the same "dredgings," figured in the 'Annals' (1873, vol. xii. pl. i. figs. 1 & 2), consisting, at least, of *seven* different sponges congregated together in a very small space on a bunch of dead *Lophohelia*, points out how "the powder of hollow flints" is often found to contain a heterogeneous mixture of spicules in addition to those which belonged to the original sponge, and thus defies all attempts, in many instances, to specialize the latter.

[To be continued.]

II.—*On the Development of the* Calcispongiæ. By Elias Metschnikoff*.

[Plate II.]

During my residence at Messina in the spring of 1868 I made some observations on the development of *Sycon ciliatum* (*Sycandra raphanus*, Häck.), which I have not hitherto published, because I did not consider them sufficiently complete†. But now, since the appearance of Häckel's 'Monograph of the Calcispongiæ'‡, I feel compelled to publish my investigations. The reasons which have moved me to hesitate no longer in doing this will be clear enough from what follows.

I hope that my memoir, small as it is, will not be passed unnoticed by the readers of Häckel's three-volume monograph, inasmuch as it is devoted exclusively to developmental history, *i. e.* to that department of zoology the great importance of which in morphological questions seems to be now generally recognized. With regard to the special case before us, that of the Calcispongiæ, the important part of developmental history is strongly insisted upon by Häckel; but unfortunately the investigations of that naturalist relating to this subject are so defective that a fresh treatment of the matter has become a pressing necessity.

I pass now to the description of my investigations. When we examine transverse sections of sexually mature *Syca*, we observe beneath the entodermal lining a great number of ova and embryos in very different stages of development. The total and regular segmentation takes place in the same way as is described by Häckel in *Sycyssa Huxleyi* and *Leuculmis echinus*. We have only to remark that a small so-called segmentation-cavity (Pl. II. fig. 2, *c*) is formed, which, however, soon disappears (fig. 3). As the result of the process of segmentation a roundish embryo (fig. 4) is produced, on which a great number of small cells are to be detected. I could not succeed in discovering any process of differentiation in the embryo, for which reason the question of the origin of the germ-lamellæ must remain undecided. Evidently the stages are too quickly passed through for them to be accurately observed. I must therefore pass on at once to the description

* Translated by W. S. Dallas, F.L.S., from the 'Zeitschrift für wissenschaftliche Zoologie,' Band xxiv. (1874), pp. 1–14, pl. i.

† I have already given a short account of them in my annual report upon the progress of developmental history, printed in Russian.

‡ 'Die Kalkschwämme: eine Monographie.' 3 vols. Berlin, 1872. In this paper I shall only quote the first volume of this work.

of the formed larva, which has already been observed in the same species by Lieberkühn, and in the nearly allied *Dunstervillia corcyrensis* (*Sycandra Humboldtii*, Häck.) by Oscar Schmidt. In agreement with these naturalists, especially the latter, I have found all normally developed swarming *Sycon*-larvæ divided into parts of nearly equal size, only one of which appeared to be composed of vibratile cylindrical cells, and the other of unciliated spherical cells (fig. 5). The former portion constituted a sort of hemisphere containing in its interior a central cavity of no great size, in the vicinity of which a great number of very fine brown pigment-granules were accumulated (fig. 5, *g*).

If two or three specimens of sexually mature *Syca* are kept only for a few days in small glass capsules, the larvæ swarm out in great quantities in order to become further developed, *i. e.* to attach themselves. To observe the subsequent processes, all that is necessary is to put a few object-bearers at the bottom of the glass capsules, so that they may serve as points of adhesion for the larvæ; but even without this precaution the adherent young sponges may be detected, as they adhere to all objects existing in the vessels, even the smallest.

The first process of postembryonic development consists in the complete disappearance of the central cavity, by which the upper (*i. e.* the vibratile) half of the larval body is perceptibly reduced in size (fig. 6)*. Then commences the fusion of the spherical cells of the hinder part into a compact mass—only one row, of the spherical cells in immediate contact with the vibratile epithelium, being an exception, as these still retain their integrity for a considerable time (figs. 6, 8, 9, *d*). The larvæ often attach themselves even during this stage; but not unfrequently they continue for some time longer in their swarming activity, but without being thereby hindered in their development. As one of the most important processes occurring in this, the formation of the calcareous spicula must be specially noticed. The rather brownish, unciliated, compact mass of the hinder portion is the place in which the skeletal structures originate; to be convinced of this, one need only glance at figs. 7 and 8. It must also be mentioned as worthy of notice that at first only long rod-like spicula are formed; so that at this early stage our *Sycon* passes through a state which is persistent in the genus *Sycyssa*, a fact which may be of significance in phylogenetic considerations.

The principal thing in the metamorphosis is that the un-

* The above-mentioned brown mass of granules collected into a central aggregation, as shown in figs. 6–8.

ciliated (posterior) half becomes converted into the skeleton-forming layer; whilst the anterior* ciliated section draws back into the interior of the larval body, to form the entoderm. That the half of the body consisting of what Häckel calls flagellated cells actually draws back into the interior is convincingly shown by comparing with each other the four larval stages represented in figs. 5 to 8. It will be seen that in each stage it projects less and less, while the skeleton-forming layer, on the contrary, becomes proportionately larger. In order to obtain a notion of the mode in which the ciliated half retracts itself, we must examine larvæ which have adhered rather early, *i. e.* before the formation of the skeleton. In these we can see that, while the hinder half has altered very little, the anterior ciliated section becomes invaginated in the interior of the body (fig. 9), by which means, of course, an aperture (aperture of invagination, fig. 9, *o*) is produced at the upper pole. The ciliated hemisphere consequently forms a sac-like body, which appears to be surrounded by the skeleton-forming layer. It appears from the next following stages that the aperture of invagination just mentioned does not pass directly into the definitive osculum, but becomes entirely effaced. Hence, in its further development, the young adherent sponge appears as a perfectly closed body, in which two principal constituents may be clearly distinguished (fig. 10). Externally there is the skeleton-forming layer, in which several rod-like spicules are enclosed; in the interior, on the contrary, there is a closed body, which represents the entoderm. The walls of the latter appear so thick that for a time one is unable to detect any cavity; this comes later into view, when the double-layered wall becomes formed into a vesicle. In the sponge three days old, represented in fig. 11, I could already observe an internal cavity (fig. 12, *c*), but it was still very narrow and small. It was only in a larger *Sycon*, six days old, that a considerable cavity was to be seen; it shimmered through the body-walls even in the living animal (fig. 13). When this same animal was treated with acetic acid, the two vesicularly inflated layers† (fig. 14, *a*, *b*), as well as the internal gastro-vascular cavity (fig. 14, *c*), could be most clearly distinguished. In this stage, the latest that I have seen, no buccal aperture was yet formed; on the other hand, three-pointed spicules were already present.

* As regards the designations "before" and "behind" I agree, upon developmental historical grounds, with Lieberkühn and Schmidt, but not with Häckel.

† It is to be remarked that I could detect no cilia on the entodermal cells of this stage.

From the preceding it follows that the two principal layers of the sponge-body are founded already in the body of the larva, and, further, that the upper ciliated half of the body is converted into the entoderm, and the lower unciliated half into the layer surrounding the entoderm.

Having now communicated the facts of my investigations, the question may be put, How far can the results obtained by me be brought into accordance with Häckel's statements? At pp. 34 and 216 of his work this naturalist gives the following short summary of the developmental phenomena in the Calcispongiæ:—"From the egg is produced, in consequence of total regular segmentation, a simple spherical or elongated round body, which is at first composed of homogeneous spherical cells. Then there is produced in the interior of the cell-aggregate a small central cavity (the stomach), which, breaking through outwards, forms an orifice (the *osculum* or buccal orifice). The surface becomes covered with cilia; and then the embryo swims about as a free larva (*planula*) for a long time. . . . . . The body-wall (of the larvæ) consists of two layers of cells, entoderm and exoderm. The inner layer, or entoderm, consists of a layer of unciliated cells; the outer layer or exoderm consists of a layer of ciliated cells (flagellate cells)." Then "the larva falls to the bottom, and attaches itself. The attachment takes place at the pole of the longitudinal axis, opposite to the buccal orifice (aboral pole), by a flat or peduncular surface of adhesion, which from this time forth forms the base of the sponge-body. The flagellate cells of the exoderm now retract their flagellar filaments, coalesce to form the syncytium, and begin to secrete their interior protoplasmic products, the calcareous spicules. The cells of the entoderm, on the contrary, which were previously not ciliated, stretch forth each a long vibratile process, and thenceforward line the surface of the stomach as a flagellate epithelium."

This description therefore runs quite differently from that given by me above; for according to Häckel the skeleton-forming layer (exoderm, Häck.) originates not from the unciliated cells, but from so-called flagellate cells provided with long cilia; and the converse is the case with the entoderm, which Häckel derives from spherical cells, whilst, according to my observations, it takes its origin from the ciliated (or flagellate) cells. This is the chief difference in our statements, the elucidation of which will here be attempted. Häckel describes the larvæ of four species of Calcispongiæ, of which those of *Sycyssa Huxleyi* exhibit the greatest analogy with the larvæ of *Sycon*, inasmuch as they appear to be composed of two dissimilar halves (only one of which is clothed with cilia). But as, according to Häckel, the course of development agrees in essentials in different Calcispongiæ, we must deal with his representation as general.

With regard to the first stages (embryonic development), my observations are in accordance with those of Häckel; but this only renders the difference as to the later states more remarkable. Besides that according to Häckel the internal cavity in the larvæ is always lined with a particular layer of spherical cells, whilst Oscar Schmidt and myself detected nothing of the kind, Häckel's description deviates most widely from mine with respect to the postembryonic development. He makes no mention either of the invagination of the ciliated layer or of the hypertrophy of the unciliated layer; the whole metamorphosis is supposed to be reduced to this—that the ciliated exoderm retracts its flagellar filaments and becomes converted into the so-called "syncytium," while the entoderm of the larva acquires cilia in order to furnish the so-called flagellate epithelium. The reason why these views are so directly opposed to mine is easy to find, if we carefully peruse the chapter on the developmental history of the Calcispongiæ (pp. 328–338). From this it appears that Häckel never observed the postembryonic development in the sponges, but has invented it *à priori*. The following passage is very instructive:—"The conversion of the swimming *Gastrula* into the youngest and simplest attached state, which we will call *Ascula*, appears to take place very rapidly and *has not yet been observed. The changes occurring therein may, however, be directly inferred from the comparison of the* Ascula *and* Gastrula (!). The attachment of the latter takes place at the aboral pole of the longitudinal axis, at the end opposite to the buccal orifice. The flagellate cells of the dermal lamella suspend their vibratile movements, retract the flagellar process, and lose their slender cylindrical form, flattening and spreading out into the extending intestinal surface. The unciliated entodermal cells, on the other hand, divide repeatedly and then become converted into flagellate cells, each of them extending a filiform flagellum from its proximal end, or that turned towards the stomachal cavity" (p. 337). But even this is not all! Häckel says that he has "inferred" (*erschlossen*) the metamorphosis of the Calcispongiæ from the comparison of the *Gastrula* with the *Ascula* (*i.e.* "the youngest and simplest attached stage"); but nowhere does he give either a description or a figure of even a single actually observed *Ascula*! From this we may infer that he has really never seen an *Ascula*; for otherwise he would have said something about it, especially seeing that in general he describes his subjects diffusely and circumstantially (as, indeed, may be seen from the quotations just given). It is evident that he has compared the free-swimming larva with a young but on the whole fully-formed sponge, without considering that in this way he might very easily be led astray, as in fact has happened. The most remarkable circumstance is that, in several parts of his monograph, Häckel puts forward his "directly inferred transformation" as an actually existing fact, and not as a more or less probable hypothesis. Thus, for example, he says at p. 160, "I give the name of syncytium in the Calcispongiæ to the whole mass of tissue which *is produced by the fusion of the cells of the exoderm of the ciliated larva*;" and at p. 216, "Each cell of the entoderm *stretches forth* a long vibratile process &c." In these cases he forgets entirely that he has never seen either the fusion or the extension of the cilia*. Is this the philosophical "method of scientific investigation" so celebrated by Häckel, and for the non-employment of which the embryologists (ontogenists) are so severely blamed by him?† (p. 472).

I now pass to the question how far the developmental history of the Calcispongiæ can be made available for the comparison of the principal layers of these organisms with those of other animals. In this respect Häckel has arrived at a settled conclusion. He regards as one of the most important results of his work the statement that the two layers of the sponge-body are homologous with the ectoderm and entoderm of the Cœlenterata. By the ectoderm (or exoderm) he understands the so-called syncytium—that is, the skeleton-forming outer layer of the sponge, whilst he characterizes the flagellate epithelium as the entoderm. He gives this conclusion as the result of his investigations in developmental history. Thus he says, for example :—"The relationship of

* I must indicate the following passage as exceedingly *naïf* :—"The structure of the flagellate cells of the exoderm in the *Gastrula* is exactly similar to that of the flagellate cells of the entoderm in the fully developed Calcispongia" (p. 335). And yet this striking agreement did not suffice to raise any doubt in Häckel as to whether his *à priori* conception of the germ-lamella represents the truth.

† It is truly surprising to read how this method has been employed in the representation of the *Ascula, Protascus, Protospongia,* and other form-stages invented by Häckel. Thus, for instance, it is said at p. 339 :—"Formerly I *supposed* that all Calcispongiæ in their earliest youth pass through the characteristic form of the *Protolynthus.* But I must now add as a limitation that *in many cases* the transition from the *Ascula* to the *Olynthus takes place* not through the *Protolynthus* but through the *Protospongia.*" All these conclusions are assumed without any single fact ascertained by observation being cited in their support.

the Sponges to the Cœlenterata, and the comparison of the 'water-vascular system' of the former with the 'gastro-vascular apparatus' of the latter, which Leuckart first indicated, has then been demonstrated (?) more circumstantially and firmly established by developmental history in my memoir 'Ueber den Organismus der Schwämme' &c. I therein proved that a true homology really exists between these two systems of canals, and that the wall of these canals in the Sponges, as well as in the Hydromedusæ, Ctenophora, and Corals, is formed from two originally different cell-layers or lamellæ—namely from the exoderm, which represents the outer, and the entoderm, which represents the inner germ-lamella of the higher animals. I further demonstrated that these two primitive formative membranes show the same characters in the ciliated larva developed from the egg in both the groups of the Cœlenterata and Sponges" (p. 214; see also p. 33). As we have seen that one of the principal momenta in the developmental history of the Calcispongiæ, the metamorphosis, was not observed but constructed *à priori* by Häckel, and further that this construction is contradicted by facts, of course the just cited opinion as to the germ-lamellæ of the sponges must also be subjected to a thorough revision.

I will first consider Häckel's statements, and then pass to the expression of my own views. Häckel has expounded his theory most completely in the last section of his first volume ("Philosophie der Kalkschwämme"). We find there the following passages:—" If we compare the coarser and finer structural characters of *Hydra* and *Cordylophora* . . . . with the corresponding structural characters of *Olynthus**, we cannot but be astonished at the striking agreement which occurs even in minute details" (p. 460). Now in what does this astonishing agreement consist? "1, the simple stomachal cavity with buccal orifice; 2, the composition of their stomachal wall of two lamellæ, the ciliated entoderm and the unciliated exoderm; 3, the composition of the entoderm of flagellate cells" (p. 460). The differences cited by Häckel are as follows:—" 1, the constitution of the exoderm, the cells of which in *Hydra* and *Cordylophora* develop urticating capsules and neuro-muscular processes, but in *Olynthus* fuse into the syncytium; 2, the circlet of tentacles of the former, which is wanting in the latter; 3, the different origin of the sexual organs." It will be seen at once that in the first three points an homology of the entoderm alone can be spoken of, since for

* By *Olynthus* Häckel understands a simple, solitary calcareous sponge with double walls (ectoderm and endoderm), and with a spacious sacciform "stomachal cavity."

the agreement of the outer layer only the absence of cilia, a negative and unimportant character, has been cited. But as regards the differences, the different structure of the outer layer must be placed in the first rank. Häckel endeavours to get over this difficulty, saying :—" but this [difference in the structure of the exoderm] is to be regarded as a secondary histological differentiation of the two divergent groups" (p. 460). Although he cites no evidence of this, he has no hesitation in explaining the "differences in anatomical structure between the simplest hydroids and the simplest sponges" as "*of quite subordinate significance*" (p. 460). But is it really so insignificant that the outer layer of the sponge exclusively produces all skeletal formations, whilst in the true Cœlenterata these are never developed from the ectoderm, but always from the cutis (therefore from the mesoderm)? Where do we know of any examples of an epithelial tissue (to which the ectoderm of the Cœlenterata belongs) serving as the seat of the formation of a calcareous skeleton? These are questions for an answer to which we may seek in vain from Häckel.

Let us return to Häckel's argumentation :—At p. 461 we read as follows :—"Of the greatest significance is the ontogeny of *Cordylophora*, which *perfectly agrees with that of Olynthus*." Unfortunately Häckel knows so little of the ontogeny of *Olynthus*, that he has no right to say any thing about this "perfect agreement." As we have seen, Häckel has invented the metamorphosis of the Calcispongiæ (without hitting upon the right thing), in doing which he evidently took the agreement with the Hydroida as his starting-point, instead of arriving at it as a result. In my opinion the metamorphosis "directly inferred" by Häckel is nothing more than a cast (*Abklatsch*) from the well-known metamorphic history of the Hydroida. Häckel says with particular emphasis that "the *Planula* and the *Planogastrula* are perfectly alike in both animals;" but that proves nothing so long as neither the origin nor the metamorphosis of the ciliated larva has been observed*.

Häckel may repeat, as often as he pleases, that he was the first to *demonstrate* the homology of the two lamellæ of the Sponges and Cœlenterata†; but every critically thinking naturalist will at once see that this is not the case, and that in

* The transformation of his "*morula*" into the swimming larva has not been observed by Häckel any more than by myself; he has neither described nor figured any transition-stage; nevertheless he feels justified in filling up the existing gap *à priori*, without, however, expressly saying so.

† See the above-cited quotations from p. 214, and, further, pp. 33, 456, and 470.

reality Häckel has furnished no proof at all of the homology of the ectoderm and the skeleton-forming layer. But it would also not be difficult, by the aid of facts already sufficiently well known, to convince ourselves that no such homology exists in nature. We need only take into consideration the known points in the developmental history of the marine siliceous sponges*. It is known that in the embryo of these animals the whole cell-mass divides into two portions, of which the outer becomes the ciliated epithelium, whilst the *inner* takes on the character of a *skeleton-forming* cell-aggregate. The topographical position of this inner cell-mass (beneath the ciliated layer), the circumstance that it appears as an aggregate of compact spiculigenous elements, and, further, the fact that these cells never appear as ciliated epithelial cells, furnish us with sufficient data for rejecting their supposed homology with the ectoderm of the Cœlenterata. To this of course must also be added the argument above cited, that the ectoderm of the Cœlenterata never produces skeletal structures, which always appear as derivatives of the cutical layer. I have designedly left out of consideration the facts observed by me in the developmental history of the *Sycon*, in order to show that by careful consideration of the known material it is impossible to arrive at the erroneous notion of the agreement of the skeleton-forming layer with the entoderm. But if we will also consider the facts above described, we shall see at once that the development of the Calcispongiæ is likewise opposed to Häckel's interpretation. It was established that it is the hinder unciliated half that furnishes the calcareous skeleton, and consequently that the skeleton-forming elements never appear in the form of flagellate or ciliated epithelial cells, which are characteristic of the ectoderm of the Cœlenterata.

From the reasons adduced, I venture to draw the conclusion that the skeleton-forming layer of the sponges, or the so-called "syncytium," of Häckel, does not represent the ectoderm, but the skeleton-forming layer of many other animals, especially

* See, *e. g.*, the investigations of Lieberkühn. I have myself made some observations upon the development of the siliceous sponges, which I shall publish elsewhere. Here I limit myself to the remark that the larvæ of four genera (*Reniera, Esperia, Raspailia*, and an undetermined genus) are essentially of similar structure. As an example I have figured the larva of *Reniera* (Plate II. fig. 15), which is chiefly distinguished from the others by the presence of a posterior circlet of cilia. I have observed the metamorphosis in an *Esperia*. The external epithelial layer is gradually lost, so that for a time the young sponge appears to be composed of an irregular aggregation of parenchyma-cells. It is only subsequently that the so-called ciliary baskets (*Wimperkörbe*) appear, in the form of closed spheres, which as yet are in no way connected with each other.

Cœlenterata and Echinodermata, and consequently belongs to the domain of the middle lamella (*mesoderm*, Häckel). Besides the points cited, the fact that the cells of the middle lamella in both the Cœlenterata and the Echinodermata (at least in the young state) are exceedingly changeable, may also be adduced in favour of this view. Thus, for example, we see that the naked amœboid cells of the skeleton-forming layer in the larvæ of Echinoderms move about in the body-cavity, and, in consequence of active movements, collect in particular spots, *e. g.* in the stone-canal.

In order to explain my view still more clearly, I will here compare with each other three objects which are at the first glance very similar. If we examine the three figures here given (A, B, C), we observe that all three consist of a one-layered

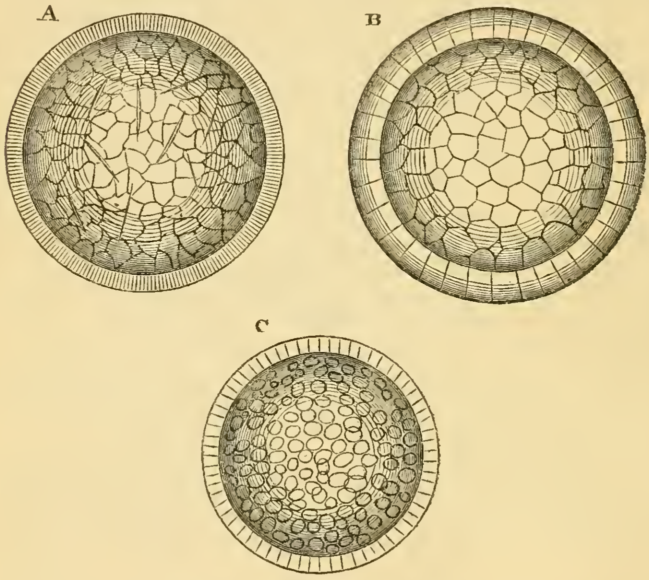


Fig. A represents an embryo of *Reniera*, B an embryo of *Sertularia*, and C an embryo of *Echinus*.

sphere, densely packed with a compact cell-mass. If it were possible in the comparison to take only such data into consideration, we should say (as Häckel actually has done with regard to the planulæ of the Sponges and Hydroida) that all the three embryos are perfectly homologous, and especially that all three have originated in a similar manner. It is only the close examination of subsequent stages that shows us that the homology can be accepted only for two embryos. The one-layered external envelope is in all three cases the dermal layer, which afterwards becomes covered with cilia and represents an epithelial tissue, which may be characterized throughout as the ectoderm. In the siliceous sponges this layer is only of short persistence; it disappears during the transformation into the attached form. In the *Echini* also the ectoderm is only provisional, at least upon many parts of the body. In the Hydroida, on the contrary, it persists throughout life, as is sufficiently well known. The inner cell-mass, in our three cases, experiences the following alterations: in the siliceous sponges it furnishes (at least for the most part) the skeleton-forming layer, becoming converted into the so-called syncytium of Häckel; in the *Echini* it plays a perfectly similar part, although the cellular elements here retain their individuality; but it is quite otherwise in *Sertularia* (and the Hydroida in general), in which the cell-mass, although similar in appearance, becomes the entoderm.

The conclusion at which I have arrived is, that the syncytium corresponds to the skeleton-forming layer of the Echinodermata (and Cœlenterata), whilst the ectoderm (in the siliceous sponges) appears as a provisional structure confined to the larval stage. (With regard to the inner layer (*b*) of our three embryos, a still more profound analysis may be instituted; we may elucidate the question as to the homology of this layer by the consideration of the mode of origin of the mesoderm. But this we shall pass over, so as not to depart from the principal theme, especially as at the moment several important facts are still insufficiently known.)

What, then, is the position of the Calcispongiæ in relation to the question of the germ-lamellæ? With regard to this order in general nothing definite can be said at present, as the larvæ of different representatives of the order appear to be constructed in various ways, while the history of the metamorphosis is known only in the case of a single species. But if we take this species alone into consideration, we may, by comparison with the better-known siliceous sponges, obtain an understanding of many circumstances. Above all it must be borne in mind that the larvæ of four genera of marine siliceous sponges observed by me always have a gap in the ectoderm at the posterior end of the body through which the skeleton-forming layer projects outwards. Now this baring, which, indeed, is very peculiar, occurs in a still greater degree in the *Sycon*-larvæ, which is in connexion with the weak development of the ciliated layer. The latter, instead of forming a sphere as in so many other animals, remains only in the form of the segment of a sphere, which is afterwards invaginated to constitute the entoderm. Of the four larvæ described and figured by Häckel, that of *Sycyssa Huxleyi* is most nearly allied to the *Sycon*-larvæ, although the former is strikingly distinguished by the presence of a layer of spherical cells lining the internal cavity. How the metamorphosis takes place in this and in the other three cases (*Ascetta mirabilis*, *Asculmis armata*, and *Leuculmis echinus*) I cannot say in the present state of our knowledge.

After what has been said, I need hardly say particularly that all the inferences founded by Häckel upon the "homology" of the sponge-larvæ (*Gastrula*) with the larvæ of other animals, collapse of themselves, because they are destitute of all solid grounds.

In conclusion, I will make one or two remarks upon the question of Cœlenterism, but without entering into any detailed discussion, as I have elsewhere (in the concluding chapter of my "Studien über die Entwicklung der Medusen und Siphonophoren," appearing simultaneously with this paper*) treated this question in detail. Here I will only endeavour to show that the opinions expressed by Häckel are by no means capable of shaking my theory† as to homologies of the cœlenteric apparatus, inasmuch as they for the most part rest upon misconceptions. Häckel's course of thought is as follows:—1, "the true body-cavity," which occurs only in the Vermes‡, Echinodermata, Arthropoda, Mollusca, and Vertebrata, "always originates by a cleaving of the mesoderm;" 2, "as the mesoderm is entirely wanting in the sponges, there can be no body-cavity in them—nor does it occur in the Cœlenterata;" 3, "the true body-cavity can never, like the intestinal or stomachal cavity, be surrounded by the entoderm;" 4, "consequently also the cavities of the gastro-canal-system in the Sponges and Acalephs are not body-cavities, but an intestinal cavity" (p. 469). To this I must object:—1, the body-cavity in many animals

* Zeitsch. für wiss. Zool. Band xxiv. (1874) pp. 15-83.

† This theory is that the gastrovascular apparatus of the Cœlenterata corresponds to the complex of organs which in the Echinodermata is formed from the lateral diverticula of the primitive intestine. Consequently the peritoneal cavity with the water-vascular system is to be regarded as the homologue of the gastrovascular system. This theory is supported by a whole series of facts, as is more particularly explained in my memoir just cited.

‡ It may here be mentioned in passing that the notions accepted by Häckel of the *Vermes acœlomi* and *V. cœlomati* by no means possess the importance which that naturalist ascribes to them. The Nemertina and Microstomea have a "true body-cavity" as well as several Trematoda, at least in the states of rediæ and sporocysts.

does not originate by cleaving of the mesoderm, and may even exist without it; thus, a body-cavity exists in several larvæ of Cœlenterata in the space between the ectoderm and entoderm; 2, the Sponges possess the mesoderm in the form of the skeleton-forming layer (see above); 3, the inner cavity of the Echinodermata (which Häckel regards as a true "body-cavity") is enclosed by the entoderm, as it is produced as a derivative of the primitive intestine. Thus we see that Häckel's three fundamental opinions will not hold good; and for this reason the fourth point remains without a foundation.

The whole question of Cœlenterism turns upon the idea of the body-cavity. As soon as we without further consideration conceive the inner cavity of the Vermes, Echinodermata, &c. as a "true body-cavity," we place ourselves upon false ground; for that which in different animals acts as a body-cavity, represents structures which are morphologically quite different. Thus we see that in the Echinoderm-larvæ a spacious body-cavity is formed which stands in no genetic connexion with the definitive cavity of the body; the latter originates in the interior of the so-called lateral disks, which, in the last resort, take their origin from the primitive intestine. The Cœlenteric apparatus is to be paralleled with the peritoneal cavity of the definitive Echinoderm-body, not with the body-cavity of the Echinoderm-larva.

EXPLANATION OF PLATE II.

Fig. 1. Portion of a transverse section through the *Sycon*-tube with two segmented germs.
Fig. 2. A segmented germ with segmentation-cavity (*c*).
Fig. 3. A somewhat later stage.
Fig. 4. Portion of a transverse section with an embryo.
Fig. 5. The free-swimming larva: *g*, aggregation of granules.
Fig. 6. A later larval stage: *d*, individual cells; *g*, aggregation of granules.
Fig. 7. A free-swimming larva with skeleton-formation already commenced.
Fig. 8. A somewhat further developed larva: *d*, individual cells.
Fig. 9. An attached larva without calcareous skeleton. *o*, orifice of invagination (half diagrammatic); *d*, individual cells.
Fig. 10. An attached larva with calcareous spicules: *a*, outer; *b*, inner layer.
Fig. 11. A young *Sycon*, three days old.
Fig. 12. A similar stage, treated with acetic acid: *a*, *b*, as in fig. 10; *c*, gastrovascular cavity.
Fig. 13. A young sponge, six days old.
Fig. 14. The same treated with acetic acid: *a*, *b*, *c*, as in figs. 10 & 12.
Fig. 15. A free-swimming larva of *Reniera* from the Crimea: *e*, outer ciliary layer; *m*, inner skeleton-forming cell-mass.

III.—*Note on an apparently new Parrot from Cardwell, N.E. Australia.* By Frederick M'Coy, Professor of Natural Science in the University of Melbourne.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,

My attention was called several months ago by Mr. Leadbeater, the skilful taxidermist to the National Museum at Melbourne, to the apparently new characters of a small parrot of the genus *Cyclopsitta* very nearly related to the *C. Coxeni*, one of the newly described species from the same part of Australia, the distinguishing characters separating it from which he so correctly appreciated that I wish, if the species is as yet undescribed, to name it after him, as a recognition of his acute observation. I have since searched all the records available to me; and failing to find any indication of any such species, I beg to send you a descriptive note of it.

Cyclopsitta Leadbeateri (M'Coy).

Spec. char. Rich dark green above, lighter below; wing-feathers blackish, with the outer webs of the primaries and secondaries bright blue above, two pale yellow transverse bands below; under wing-coverts bright green; a golden-yellow small patch on each side concealed by the closed wing, and a small dull orange-red patch at inner edge of tertiaries, the outer webs of which and wing-coverts are of the same green as the back; a dark vermilion-red transverse oblong patch on forehead, from which a greenish blue broad band extends, including the eye, over the ear-feathers towards the outer edge of the auriculars, changing slightly to opal-purplish hue. The male only differs in having a transverse patch of red, as in *C. Coxeni*, through the ear-feathers, dividing the blue above from that below. Bill and feet blackish horn-colour.

Length 5 inches 3 lines, wing from shoulder 3 inches 3 lines; length of bill along gape 7 lines; depth of both mandibles 8 lines; tarsus $6\frac{1}{2}$ lines.

The general size, shape, and colouring is nearly like that of *C. Coxeni*; but it is somewhat smaller, and has in both sexes an oblong patch of red on the forehead just over the cere. It differs also in habitat, frequenting the scrubs more than the *C. Coxeni* does. It seems to be rather rare at Cardwell, where the specimens described were collected for the Melbourne Museum by Mr. Broadbent.

April 19, 1875.

IV.—*Additions to the Australian* Curculionidæ. Part VIII.

By Francis P. Pascoe, F.L.S. &c.

[Plate I.]

Alexirhea singularis.

A. sat breviter ovata, fusca, griseo-varia; rostro crasso, rugoso-punctato, in medio profunde canaliculato; prothorace setoso-tuberculato, longitudine fere duplo latiore, in medio sulcato, margine postico supra scutellum producto; elytris breviusculis, subcordatis, costis alternis setoso-tuberculatis, singulis postice tuberculo majore instructis, regione suturali griseis; corpore infra nigro. Long. $4\frac{1}{2}$ lin.

Hab. Perth, Swan River.

The prothorax of this curious species is longitudinally grooved in the middle, the groove behind opening out into a flat space, which is produced to form a short triangular spine covering the scutellum.

Lycosura.

Rostrum cylindricum, validiusculum, apicem versus sensim incrassatum; *scrobes* subterminales, arcuatæ, ad marginem inferiorem oculorum currentes. *Oculi* rotundati, subtenuiter granulati. *Scapus* ad partem posteriorem oculi attingens; *funiculus* articulis duobus basalibus longioribus, æqualibus, cæteris gradatim brevioribus, ultimo obconico: *clava* ovalis, distincta. *Prothorax* oblongus, lobis ocularibus nullis. *Scutellum* distinctum. *Elytra* convexa, elongato-cordata, prothorace multo latiora, basi truncata, humeris paulo obliquis. *Pectus* antice late emarginatum. *Coxæ* anticæ contiguæ; *femora* in medio incrassata, mutica; *tibiæ* flexuosæ, anticæ longiores; *tarsi* articulo tertio late bilobo. *Metasternum* elongatum. *Abdomen* segmentis duobus basalibus ampliatis.

The long scape and form of the rostrum are characters indicating an affinity with the Cylindrorhininæ; but the normal length of the metasternum would, in strict accordance with Lacordaire's system, rather point to a connexion near the Hylobiinæ. It will, however, I think, be more natural to place it with the former.

Lycosura bispinosa. Pl. I. fig. 9.

L. ferruginea, squamis griseis, plurimis piliformibus, irregulariter vestita; rostro capite parum longiore, modice arcuato; prothorace latitudine manifeste longiore, basi apiceque fere æquali, lateribus rotundato, dorso lineis duabus albescentibus ornato; elytris basi prothoracis multo latioribus, sulcato-punctatis, interstitiis convexis, tertio postice in spinam acutam horizontalem producto, apicibus perparum divergentibus, subacuminatis, fascia arcuata pone medium maculaque prope apicem, e squamis minus condensatis formatis, notatis. Long. 5 lin.

Hab. Albany.

SYAGRIUS.

Rostrum modice elongatum, arcuatum; *scrobes* præmedianæ, obliquæ, infra rostrum currentes. *Oculi* ovales, grosse granulati. *Scapus* oculum haud attingens; *funiculus* 7-articulatus, articulis extus gradatim crassioribus. *Prothorax* lateribus rotundatus, basi rectus; lobis ocularibus nullis. *Scutellum* invisum. *Elytra* cylindrica, prothorace haud latiora. *Coxæ* posticæ rotundatæ; *femora* mutica, antica majora; *tibiæ* flexuosæ, muticæ; *tarsi* breves, latiusculi; *unguiculi* liberi. *Abdomen* segmentis duobus basalibus ampliatis, sutura prima distincta.

This curious Curculionid is very similar to certain species of *Anchonus*; but, viewed geographically, it is doubtless allied to the rare genus *Steremnius*, from which it is at once differentiated by its rounded, not transverse, posterior coxæ, and elytra not broader than the prothorax. I have seen but a single example, sent to me by Mr. French, of the Melbourne Botanic Garden.

Syagrius fulvitarsis.

S. oblongo-parallelus, niger, sparse setulosus; capitis fronte bituberculata, inter tubercula breviter lineatim sulcata; rostro prothorace paulo breviore, dimidio basali grosse lineatim punctato; antennis fulvo-ferrugineis, funiculi articulo basali breviusculo, secundo duplo longiore, cæteris transversis et ad apicem gradatim crassioribus; prothorace latitudine longitudini æquali, supra rugoso, in medio tuberculis duobus parvis instructo; elytris prothorace vix duplo longioribus, pone basin supra subito elevatis, irregulariter tuberculatis, et grosse impresso-punctatis; corpore infra nigro, segmentis duobus basalibus abdominis grosse punctatis; tarsis fulvo-ferrugineis. Long. 2 lin.

Hab. Wien-wien (Richmond River).

Euthyphasis.

Caput subcylindricum; *rostrum* capite paulo brevius, parallelum; *scrobes* flexuosæ, infra oculos desinentes, apicem versus laterales. *Scapus* arcuatus, oculum attingens; *funiculus* articulis quatuor basalibus obconicis, a primo gradatim brevioribus, tribus ultimis transversis; *clava* ovata, acuminata. *Prothorax* oblongo-subcylindricus, basin versus sensim latior. *Elytra* elongata, prothorace basi haud latiora, humeris obliquis, singula in spinam acutam protensa. *Femora* vix pedunculata; *coxæ* anticæ in medio pectoris locatæ. *Cætera* ut in *Rhadinosomo.*

Most of these characters are diagnostic, and differentiate the genus from *Rhadinosomus,* to which it has, however, a most unmistakable resemblance. The eyes are round as in *Rhodinosomus* (not oval); and, owing to the rostrum not being dilated at the tip, the scrobes are not apparent above.

Euthyphasis acuta. Pl. I. fig. 3.

E. fusiformis, ferruginea, squamis fulvescentibus sejunctim tecta; collo haud constricto; rostro latitudine sesquilongiore; antennis ad apicem nigricantibus; prothorace in medio lineatim dense squamoso; scutello minuto; elytris striato-punctatis, punctis approximatis, lateribus ad medium parallelis, deinde sensim attenuatis, singulis macula mediana oblique subcurvata notatis; corpore infra griseo-squamoso. Long. 4 lin. (rostr. incl.).

Hab Swan River.

Acalonoma.

Caput subcylindricum, modice elongatum; *rostrum* capite vix longius, crassiusculum; *scrobes* submedianæ, obliquæ, infra rostrum desinentes. *Oculi* subrotundati. *Scapus* brevis, oculum attingens; *funiculus* articulo primo ampliato, secundo obconico, cæteris brevioribus; *clava* distincta, elliptica. *Prothorax* oblongus, basin versus sensim latior, basi rotundatus. *Scutellum* angustum. *Elytra* elongata, basi prothorace haud latiora, humeris obliqua, apicibus angulato-divaricata. *Pedes* ut in præcedente. *Abdomen* segmentis duobus basalibus quam tribus sequentibus vix longioribus.

Although there is a considerable gap between this genus and the preceding, I have little hesitation in regarding it as an ally. Lacordaire has referred *Rhadinosomus* to his tribe "Brachydérides"—an unsatisfactory position in my opinion, as it is not adelognathous, and there is nothing resembling it in any of the adelognathous groups to which the "Brachydérides" belong. I am inclined to consider that *Rhadinosomus* and the two genera here described constitute a distinct and isolated subfamily, which will be found, like *Methypora* (another anomalous genus), to have a place near Aterpinæ.

Acalonoma reducta. Pl. I. fig. 2.

A. fuscescens, vel ferruginea, squamositate grisea plus minusve tecta; capite, rostro prothoraceque aliquando nigris, crebre punctatis; antennis subferrugineis; elytris prothorace quadruplo longioribus, pone medium utrinque leviter rotundatis, striato-punctatis, interstitiis modice convexis, sutura aliquando nigra; corpore infra nigro, crebre punctato, punctis squamigeris. Long. $2\frac{1}{4}$ lin.

Hab. Swan River.

CLISIS.

Rostrum tenue, arcuatum; *scrobes* medianæ, rectæ. *Scapus* antennarum oculum vix attingens; *funiculus* 7-articulatus, articulo primo elongato, ad apicem clavato, quatuor ultimis transversis; *clava* majuscula, distincta. *Oculi* rotundati, grosse granulati. *Prothorax* basi rotundatus. *Elytra* subovata, prothorace paulo latiora, humeris haud productis. *Pectus* excavatum. *Coxæ* anticæ basi contiguæ. *Mesosternum* integrum. *Femora* clavata, postica dentata. *Tarsi* articulo tertio late bilobo. *Ungues* simplices.

The genus *Bagous* has also a pectoral cavity not extending behind the anterior coxæ; but then its tarsi are filiform. The species described below is covered with minute scales, so that its sculpture is completely masked; in rubbed specimens, however, the prothorax is seen to be closely punctured, and the elytra have lines of punctures but are not striate. I place the genus in a line with *Erirhinus*; but its immediate affinities are not obvious.

Clisis modesta.

C. elliptica, fulva, squamulis argenteis omnino tecta; rostro prothorace paulo longiore; funiculi articulo primo quam duobus sequentibus conjunctim longiore; prothorace subtransverso, utrinque paulo rotundato, basin versus sensim latiore; scutello triangulari; elytris regulariter convexis, lineatim punctatis, interstitiis latis planatis. Long. $1\frac{3}{4}$ lin.

Hab. King George's Sound.

Agestra rubiginea.

A. rufo-fulva, setulis subaureis leviter induta; rostro basi paulo compresso; scrobibus præmedianis; funiculo articulo primo quam secundo fere duplo longiore; prothorace transverso, sat dense punctato, in medio linea lævi subnotato; elytris striato-punctatis, interstitiis modice latis, subconvexis; corpore infra tenuiter piloso; abdomine segmentis duobus basalibus modice ampliatis, sutura prima bene determinata; coxis intermediis magis approximatis; femoribus dente minuto acuto armatis. Long. $1\frac{2}{3}$ lin.

Hab. King George's Sound.

In *A. suturalis*, the type of the genus, the scrobes begin nearly in the middle of the rostrum, the intermediate coxæ are comparatively rather widely separated, and the two basal segments of the abdomen are unusually short, and their suture nearly obsolete; to which it may be added that the femora are more decidedly toothed. In both species the rostrum is thicker or compressed at the base, but is of the same width throughout anteriorly.

Cydmæa selligera.

C. breviter elliptica, atra, sat dense albo-, medio elytrorum prothoraceque fusco-squamosa; rostro nigro, minus tenuato; antennis ferrugineis; prothorace transverso, basi latiore; elytris subcordatis, leviter striato-punctatis, humeris callosis; pedibus ferrugineis, sparse albo-squamulosis. Long. 1 lin.

Hab. Champion Bay.

Allied to *C. pusilla*; but in that species the prothorax is less transverse and tolerably straight at the sides, and the coloration is different.

Cydmæa notaticollis.

C. breviter ovata, fusca, sat dense squamosa, prothorace utrinque albo, elytrisque, præsertim basi, sublineatim albo-ornatis; rostro fulvo, basi apiceque nigris; antennis tenuioribus, funiculi articulo primo quam duobus sequentibus longiore; prothorace transverso, basi latiore; elytris subcordatis, striatis; pedibus fulvis; corpore infra dense niveo-squamoso. Long. 1 lin.

Hab. Western Australia (Perth).

This is a very distinct species, being in the character of its coloration quite dissimilar to its congeners.

Dicomada murina.

D. ovata, fusca, squamis argenteis griseo-nebulosis sat disjunctim tecta; rostro capite fere triplo longiore; antennis ferrugineis; prothorace in medio magis convexo; scutello nigro; elytris subcordatis, fortiter striatis, interstitiis squamis in series tries instructis; corpore infra dense albo-squamoso. Long. $1\frac{1}{4}$ lin.

Hab. Champion Bay.

Readily distinguished by its deep striæ and the disposition of the scales on their interstices.

Methone.

Rostrum cylindricum, apice latius; *scrobes* medianæ, obliquæ, infra oculos currentes. *Antennæ* funiculi articulo basali crassiore, secundo longiusculo, cæteris brevibus, gradatim crassioribus; *clava* ovata. *Oculi* ovales, tenuiter granulati. *Prothorax* transversus, basi rotundatus; lobis ocularibus nullis. *Elytra* obovata, prothorace manifeste latiora. *Femora* incrassata; *coxæ* intermediæ fere contiguæ; *tibiæ* intermediæ flexuosæ. *Abdomen* segmentis duobus basalibus ampliatis, suturis tertio quartoque rectis.

This genus is like *Dicomada* in habit; but the abdominal segments are not curved at the sides, the intermediate coxæ are approximate, and the scrobes are oblique; notwithstanding, I think it should rank close to that genus.

Methone ornata.

M. rufo-ferruginea, squamis concoloribus aliisque albidis plagiatim notata; rostro prothorace duplo longiore, basi subseriatim punctulato; funiculo breviusculo; prothorace fortiter transverso, in medio minus squamoso, utrinque albo-plagiato; elytris striato-punctatis, interstitiis vix convexis, uniseriatim setosis, singulis plagis magnis duabus, una basali, altera pone medium oblique sita; corpore infra sat dense opalescenti-squamoso. Long. $1\frac{1}{3}$ lin.

Hab. King George's Sound.

Antyllis togata.

A. rufo-castanea, ad latera albo-squamosa; rostro prothorace vix longiore, modice robusto; antennis ferrugineis; funiculi articulo secundo quam primo multo breviore; prothorace fusco, sat confertim punctato; elytris striato-punctatis, interstitiis latiusculis, vix convexis; corpore infra leviter albo-squamoso. Long. $1\frac{1}{3}$ lin.

Hab. Adelaide.

The coloration of the elytra is variable, the white sometimes forming bands, more or less interrupted, on the disk. The genus is known by its six-jointed funicle.

Myossita sublineata.

M. oblonga, depressiuscula, fulvescens, leviter albo-pilosa; capite inter oculos postice impresso; rostro prothorace breviore, apicem versus parum latiore; prothorace longitudine latitudini æquali, utrinque modice rotundato, tenuiter punctulato; elytris subparallelis, striato-punctatis, punctis distinctis, approximatis, interstitiis alternis perparum elevatis; geniculis infuscatis. Long. 2½ lin.

Hab. Albany.

Like *M. tabida*, but narrower, the rostrum less dilated towards the apex, the elytra more parallel at the sides, and the alternate interstices very slightly elevated, the other interstices more hairy, so as to give the elytra a somewhat striped appearance.

Euops pulchella.

E. gracilis; capite prothoraceque æneo-fulvis, irregulariter punctatis; oculis nigris, approximatis; antennis fulvis, clava articulis præcedentibus conjunctim longitudine æquali; scutello æneo; elytris nitide fulvis, regione suturali æneis, basi apiceque infuscatis, fortiter striato-punctatis; corpore infra fulvo, metasterno fusco; pedibus fulvis. Long. 1⅔ lin.

Hab. Port Bowen.

A very distinct species. The head and prothorax together are nearly as long as the elytra; the eyes are large and frontal, but not contiguous.

Orchestes perpusillus.

O. obovatus, niger, opacus; rostro prothorace breviore; antennis articulis duobus basalibus ampliatis, flavis, cæteris clavaque nigris; prothorace transverso, utrinque rotundato, tenuiter sat confertim punctato; elytris amplis, postice latioribus, striato-punctatis, punctis approximatis, interstitiis convexis; pedibus breviusculis, femoribus tibiisque anticis incrassatis. Long. 1 lin.

Hab. Champion Bay.

Like *O. saliceti*, but rather larger and less convex, with a broader prothorax, and shorter and stouter legs, especially of the anterior pair. The species of *Orchestes* have hitherto been supposed to be confined to the northern hemisphere.

Nanophyes maurus.

N. obovatus, niger, nitidus, tenuiter albo-pubescens; rostro prothorace paulo longiore, basi sulcato; scapo articuloque primo funiculi flavidis, cæteris clavaque nigris; prothorace transversim conico, subtiliter punctato; elytris subcordatis, striato-punctatis, interstitiis latis, convexis; femoribus basi testaceis, infra dente minuto acuto instructis. Long. 1 lin.

Hab. South Australia.

Smaller and shorter than *N. lythri*, and very differently coloured. It is the only species of this genus yet recorded from Australia. [*N. ferrugatus*, Blanch., from Tasmania, is referred to *Cionus* in the Munich Catalogue.]

Melanterius carinicollis.

M. breviter ovalis, fuscus, subopacus, squamis piliformibus flavicantibus adspersus; rostro prothorace sesquilongiore, omnino tenuato, basi seriatim punctato, scrobibus infra rostrum cito currentibus; antennis ferrugineis; funiculi articulis duobus basalibus elongatis; prothorace transverso, antice constricto, fortiter longitudinaliter corrugato, in medio carinato; elytris cordatis, sulcato-foveatis, interstitiis carinatis, tertio quintoque magis elevatis; femoribus minus crassis. Long. 3 lin.

Hab. Cape York.

In this very distinct species the ocular lobes are less prominent than in the more typical forms.

Melanterius fugitivus.

M. obovatus, ferrugineus, squamis ochraceis dense plagiatim tectus; rostro prothorace parum breviore, basi crassiore, squamoso; funiculi articulis duobus basalibus elongatis; prothorace modice transverso, apice sat subito constricto, in medio minus squamoso; elytris subtrigonatis, striato-punctatis, punctis rotundatis subapproximatis, interstitiis vix convexis; corpore infra fusco, sparse albido-squamoso; femoribus dente magno subcylindrico armatis; tibiis apice haud ampliatis. Long. $2\frac{1}{2}$ lin.

Hab. Swan River.

Allied to *M. cinnamomeus*, but, *inter alia*, a shorter and stouter rostrum, thicker at the base; the tibiæ longer and straighter, &c.

Melanterius floridus.

M. obovatus, rufo-ferrugineo squamosus, elytris læte ochraceo-maculatis; rostro prothorace breviore, basi vix incrassato; funiculi articulo basali quam secundo fere duplo longiore; prothorace transverso, antice vix constricto, basi latiore, confertim punctato; elytris subcordatis, tenuiter striatis, striis punctis subremotis notatis, interstitiis præcipue posticis elevatis; femoribus anticis dente minusculo, posticis dente magno armatis; tibiis brevibus, compressis, valde flexuosis, apice ampliatis. Long. 2 lin.

Hab. Adelaide.

Also allied to *M. cinnamomeus*; but differently coloured, larger and closer scales on the elytra, which in part cover the striæ; the tibiæ shorter and more compressed.

Teutheria.

Caput globosum; *rostrum* mediocre, cylindricum, arcuatum, apice haud latius; *scrobes* præmedianæ, infra rostrum currentes. *Oculi* subrotundati, grosse granulati. *Scapus* gradatim incrassatus; *funiculus* articulo primo ampliato, secundo obconico, cæteris transversis, gradatim brevioribus et crassioribus; *clava* distincta, ovata. *Prothorax* subconicus, lobis ocularibus nullis. *Elytra* subcordata, basi reflexo-marginata. *Pectus* canaliculatum. *Coxæ* anticæ basi contiguæ. *Mesosternum* horizontale, haud canaliculatum. *Metasternum* brevissimum. *Femora* sublinearia, mutica; *tibiæ* rectæ, breviusculæ; *unguiculi* connati. *Abdomen* segmentis duobus basalibus ampliatis. *Corpus* ellipticum.

This genus, like *Melanterius,* belongs to Lacordaire's "Cléogonides;" but it can scarcely be said to be allied to any of their genera.

Teutheria insculpta.

T. valde convexa, nigra, nitida; rostro piceo, striato-punctato, prothorace paulo breviore; antennis pallide ferrugineis; prothorace grosse punctato-impresso; elytris fortiter striatis, striis punctis elongatis notatis, interstitiis elevatis; tibiis tarsisque piceis; abdomine segmentis duobus basalibus grosse punctatis, punctis squama alba minuta instructis. Long. $1\frac{1}{4}$ lin.

Hab. Albany.

The following Table will show the diagnostic characters of the genera allied to *Melanterius*; they are all Australian.

Claws free.
  Rostrum perfectly straight .... *Euthebus.*
  Rostrum more or less curved.
    Eyes coarsely faceted .... *Melanterius.*
    Eyes more or less finely faceted.
      Anterior tibiæ with two mucros .... *Diethusa.*
      Anterior tibiæ with one mucro.
        Anterior coxæ contiguous.
          Rostrum as broad at the tip as at the base .... *Lybæba.*
          Rostrum gradually narrowing to the apex .... *Enide.*
        Anterior coxæ not contiguous .... *Psydestis.*
Claws united at the base .... *Teutheria.*

Mecistocerus denticulatus.

M. niger, dense griseo-squamosus; capite parvo, inter oculos fovea ovali profunde impresso; rostro tenuato, nitide fusco-castaneo; antennis ferrugineis; funiculi articulo secundo quam primo sesquilongiore; prothorace (♂) antice ampliato-rotundato, apice constricto, basin versus paulo angustiore, (♀) dimidio basali lateribus parallelo, antice haud ampliato; scutello parvulo, rotundato; elytris oblongo-cordatis, punctato-striatis, punctis striarum squama majuscula repletis; corpore infra sparse squamoso; pedibus anticis in mare sat valde elongatis; femoribus intermediis et posticis infra dente acuto armatis, femoribus anticis infra denticulis plurimis irregulariter aspersis; tibiis anticis denticulis in series duas ordinatis; tarsis anticis fimbriatis, articulo basali elongato. Long. ♂ 6, ♀ 5 lin.

Hab. Port Bowen (Queensland).

The male of this species differs in several particulars from the female: in the former the club of the antennæ is cylindrical, in the latter it is shorter and thicker towards the tip, or oblong-obovate; the male has the fore legs unusually long, with a number of small spine-like teeth beneath the femur and tibia, the tarsus is also finely fringed with rather long hairs at the side; in the female these parts are of the normal character. In some specimens there are one or two pale indefinite semilunar marks on the elytra. The genus in general appearance is like *Macromerus* and its allies, but is distinguished by the pectoral canal being bounded behind by the metasternum, not by the mesosternum as in the great majority of the Cryptorhynchinæ.

Salcus elevatus.

S. breviter ellipticus, valde convexus, niger, squamulis piliformibus griseis adspersus; rostro prothorace longitudine vix æquali; antennis ferrugineis; funiculi articulis duobus basalibus longiusculis, longitudine æqualibus; prothorace longitudine fere duplo latiore, sparse punctulato; elytris lineatim impresso-punctatis; femoribus infra canaliculatis, anticis dente parvo instructis. Long. $3\frac{1}{2}$–$4\frac{1}{2}$ lin.

Hab. Port Bowen.

This species has the femora grooved beneath, a character also present in *S. globosus* (the type), but it is wanting in *S. dorsalis* and the following species. *S. globosus* is much less convex, the prothorax is closely punctured, and the scales are much smaller and less hair-like. In all the species of the genus the scales on the tibiæ are arranged in widely separated lines.

Salcus latissimus.

S. modice convexus, latissime ovatus, niger, squamulis minutis valde adspersus; rostro validiore, prothorace longitudini vix æquali, apice magis dilatato; antennis ferrugineis; funiculi articulis duobus basalibus elongatis; prothorace longitudine fere duplo latiore, subtilissime punctulato; elytris lineatim impresso-punctatis; femoribus muticis, haud canaliculatis. Long. $3\frac{1}{2}$–$4\frac{3}{4}$ lin.

Hab. Port Bowen.

A remarkably broad species, the breadth of the elytra exceeding their length. The first abdominal suture is not traceable, or rather is replaced by a large, deep, irregular impression.

ÆTHREUS.

Caput rotundatum; *rostrum* rectum, subulatum, basi excepta nudum; *scrobes* subbasales ad partem inferiorem oculi desinentes. *Oculi* antice approximati, tenuiter granulati. *Scapus* brevis; *funiculus* articulis duobus basalibus elongatis, tertius usque ad septimum gradatim brevioribus et crassioribus; *clava* distincta, breviter ovata. *Prothorax* transversus, dorso planatus, lateribus verticalis, apice haud productus, basi bisinuatus, lobis ocularibus fere obsoletis. *Scutellum* distinctum. *Elytra* oblongo-subcordata, supra depressa, prothorace latiora, apicibus rotundata. *Rima* pectoralis in mesosterno mitræformi terminata, apice cavernosa. *Pedes* mediocres; *femora* modice elongata, mutica; *tibiæ* subcylindricæ, rectæ, vel intus paulo bisinuatæ, apice extus spina recta instructæ; *tarsi* articulo tertio ampliato, profunde bilobo; *unguiculi* subdivergentes. *Abdomen* segmentis duobus basalibus majoribus, sutura prima arcuata.

An isolated form, which I can only suggest may be found to have *Menios* and *Mitrastethus* as remote allies. To these genera it is approximated by its straight rostrum, short scape, general character of the underparts, except that the metathoracic episterna are rather narrow; and to *Mitrastethus* somewhat in outline, but not otherwise. The peculiar armature of the tibiæ may belong possibly to only one sex. The elytra of the only exponent of this genus are marked with brown lines, caused by the dark approximate punctures in the sulci, and each elytron has a brown oblong spot, to the naked eye apparently depressed or contracted like a scar. I am indebted for my specimen to Mr. Masters.

Æthreus cicatricosus. Pl. I. fig. 8.

Æ. ellipticus, fuscus, supra sat dense, infra pedibusque densissime griseo-squamosus; rostro nitide piceo, prothorace multo breviore; antennis ferrugineis; prothorace apice valde angusto, squamis rotundatis paulo sejunctim tecto; elytris sulcato-punctatis, punctis approximatis, interstitiis paulo convexis, quinto sextoque in medio macula oblonga fusca notatis, apicem versus paulo prominulis. Long. 6 lin.

Hab. Lord Howe Island.

Platyphæus.

Caput parvum; *rostrum* subulatum, arcuatum, apice latius; *scrobes* postmedianæ, parum obliquæ, ad oculum currentes. *Scapus* clavatus, oculum haud attingens; *funiculus* 7-articulatus, articulo basali longiusculo, cæteris sensim brevioribus, ultimo solo transverso, in clavam continuatis. *Oculi* modice angusti, fortiter granulati, infra contigui. *Prothorax* latus, depressus, apice tubulatus, basi bisinuatus, lobis ocularibus haud prominulis. *Elytra* depressa, prothorace haud latiora. *Pygidium* tectum. *Pectus* ampliatum, integrum. *Coxæ* antice approximantes. *Pedes* breviusculi; *femora* clavata, obsolete dentata; *tibiæ* rectæ; *tarsi* breviusculi. *Abdomen* segmentis duobus basalibus conjunctis, sutura in medio arcuata.

A genus allied to the Brazilian *Parallelosomus*, but differing in its broader outline, very coarsely faceted eyes contiguous beneath, more subulate rostrum, and scrobes commencing behind the middle. In habit it is like *Lyterius complanatus*, but longer. This is one of the most interesting discoveries of Mr. Masters.

Platyphæus lyterioides.

P. rufo-castaneus, subnitidus, setulis albis valde adspersus; rostro prothorace longiore, basi subseriatim punctato; prothorace ampliato, subtransverso, ante medium utrinque fortiter rotundato, apice valde constricto, supra sat crebre leviter punctulato; elytris sulcato-punctatis, interstitiis subplanatis, rude punctatis; corpore infra punctis adsperso, singulis setam albam gerentibus. Long. 4 lin.

Hab. Gayndah.

EXPLANATION OF PLATE I.

[Most of the figures on the Plate refer to species published in previous parts of these "Contributions."]

Fig. 1. *Æsiotes leucurus*, XII. p. 278.
Fig. 2. *Acalonoma reducta*, XVI. p. 58.
Fig. 3. *Euthyphasis acuta*, XVI. p. 57.
Fig. 4. *Isacantha congesta*, VIII. p. 98.
Fig. 5. *Ocynoma antennata*, XII. p. 234.
Fig. 6. *Embaphiodes pyxidatus*, XIII. p. 419.
Fig. 7. *Scolyphrus obesus*, XIII. p. 413.
Fig. 8. *Æthreus cicatricosus*, XVI. p. 65.
Fig. 9. *Lycosura bispinosa*, XVI. p. 56.
Fig. 10. Head of *Dicomada murina*, XVI. p. 60.
Fig. 11. Head of *Olanæa nigricollis*, XI. p. 193.
Fig. 12. Head of *Xeda amplipennis*, XI. p. 192.
Fig. 13. Head of *Agestra rubiginea*, XVI. p. 59.
Fig. 14. Head of *Faryzeta musiva*, XI. p. 192.

Fig. 15. Head of *Cydmæa viridula*, IX. p. 138.
Fig. 16. Head of *Erytenna consputa* (Trans. Ent. Soc. 1870, p. 196)*.
Fig. 17. Head of *Phæodica fulvicornis*, XIII. p. 386.
Fig. 18. Front and side views of the head of *Glaucopela unicolor*, XIII. p. 385.
Fig. 19. Fore leg of *Melanterius floridus*, XVI. p. 62.
Fig. 20. Fore leg of *M. fugitivus*, XVI. p. 62.
Fig. 21. Fore leg of *Diethusa fervida*, XI. p. 185.

V.—*Descriptions of some new Shells from Kerguelen's Island.* By EDGAR A. SMITH, F.Z.S., Zoological Department, British Museum.

THE following species form part of the collections made at Kerguelen's Island by the Rev. A. E. Eaton, the naturalist sent by the Royal Society with the British expedition for observing the recent transit of Venus. Only those species are here mentioned which are apparently undescribed, as it is purposed to publish elsewhere complete and detailed accounts of all the specimens obtained at the island. Of Mollusca the number is small, comprising only about twenty species; but of these the proportion of new forms is large, and several of them very remarkable discoveries.

1. *Struthiolaria mirabilis*, sp. nov.

Testa ovata, tenuis, imperforata, leviter turrita, alba, epidermide tenuissima fugaci olivaceo-alba amicta; anfractus $6\frac{1}{2}$, convexiusculi, superne anguste planulati, lente accrescentes, longitudinaliter oblique arcuatimque crebre plicati (plicis inferne ad suturam vix attingentibus); liris spiralibus prominentibus supra plicas undulatis (in anfr. superioribus 7–8, in ultimo circiter 22, illis infra medium simplicibus) succincti; apertura longitudinis totius circiter $\frac{4}{7}$ æquans; columella arcuata.

Operculum corneum unguiculatum, inferne costis duabus a nucleo unguiformi divergentibus munitum, superne medio longitudinaliter unisulcatum, concentrice striatum.

Long. 42 mill., diam. 22.

Hab. Swain's Bay, Kerguelen's Island.

But a single specimen of this very remarkable shell was obtained by Mr. Eaton. This unfortunately has the labrum so much broken away, that it is impossible to describe the form of the aperture and the nature of the basal channel. However, the animal and operculum agree in all respects ex-

* Figured in forgetfulness of its not having appeared in the 'Annals.'

ternally with *Struthiolaria*; and although the shell has more the general aspect of *Buccinum*, there can be no doubt of its true location. The species which compose this genus are strong thick shells; this, on the contrary, is particularly fragile, and clothed with a very thin deciduous epidermis.

2. *Buccinopsis Eatoni*, sp. nov.

Testa elongato-ovata, turrita, tenuis, lævis, pallide livido-fuscescens, haud nitens; anfractus 6? (apice fracto), reliqui 4 perconvexi, lente accrescentes, læves, incrementi lineis flexuosis insculpti, sutura profunda fere canaliculata sejuncti; apertura ovata, longitudinis totius circiter $\frac{4}{9}$ æquans; columella lævis, polita, medio leviter arcuata, versus basim obliqua; canalis latissimus, perbrevis, vix recurvus; labrum simplex, tenue.

Operculum ovatum, concentrice plicato-striatum, nucleo laterali, vix terminali.

Long. 56 mill., diam. 27; apertura long. 27 mill., diam. 14.

Hab. Royal Sound and Swain's Bay, Kerguelen's Island.

This is a very remarkable species, and chiefly characterized by the smooth convex whorls, which are destitute of all sculpture and ornamentation with the exception of the lines of growth. The suture is particularly deep, and almost amounts to a canaliculation. Around the short cauda of the body-whorl, from a little below the middle of the columella, runs a carination (which frequently occurs in species of *Bullia*), and joins the basal channel near the lip.

The operculum is peculiar in that the nucleus is not terminal as in *Buccinopsis Dalei*, but situated on the inner side about one tenth of the entire length from the extremity, and just at this point the outline is interrupted by a slight sinus. It consists of one whorl, which gradually increases by concentric layers well defined by the lines of growth; the inferior surface is somewhat thickened along the outer edge—that is, that opposite the nucleus. Such slight differences are scarcely sufficient to warrant a generic separation.

3. *Trophon albolabratus*, sp. nov.

Testa ovato-fusiformis, turrita, alba; anfractus 6, primi duo (nucleus) læves, cæteri convexi, liris spiralibus (in anfr. superioribus 4–5, in ultimo circiter 13) æqualibus subæquidistantibus cincti, et lamellis foliaceis numerosis subconfertis et prominentibus instructi; apertura superne ovalis, infra in canalem prolongata, intus saturate fusca, longitudinis testæ circiter $\frac{3}{5}$ æquans; labrum intus sublate albo marginatum, leviter expansum; columella medio parum arcuata, basi obliqua, callo inferne crassiusculo, superne tenui labroque juncto induta, cæruleo-alba, margine interno fusca;

regio umbilici leviter rimata; canalis angustus, obliquus, paululum recurvus, modice elongatus.
Operculum flavo-corneum.
Long. 40 mill., diam. 18; apertura long. 24 mill., diam. 11.

Hab. Swain's Bay and Royal Sound, Kerguelen's Island.

The nearest ally of this species appears to be *T. philippianus* of Dunker, which is found in the Straits of Magellan, at Cape Horn, and the Falkland Islands. From this species it differs in having the whorls rounded above, and not flattened or excavated, the penultimate is larger and more elevated, the body-whorl is more inflated below the middle and not produced into such an elongated cauda, and the canal is shorter and the aperture rather larger, the longitudinal lamellæ are more prominent and not nearly so numerous.

4. *Littorina setosa*, sp. nov.

Testa imperforata, ovato-turrita, tenuis, pallide rosea, circa medium anfractuum linea spirali rufa cincta, epidermide fugaci villosa vel setosa olivacea induta; anfractus 6, convexi, superne aliquanto tabulati, sutura profundiuscula discreti, ubique spiraliter et oblique minute punctato-striati; apertura subquadrato-circularis, longitudinis totius $\frac{1}{2}$ æquans; columella perparum arcuata, ad basim leviter patula; labrum simplex.
Operculum paucispirale, ovatum, superne acuminatum, tenuissimum, flavo-corneum.
Long. 14 mill., diam. $8\frac{1}{2}$; apertura long. 7 mill., diam. 5.

Hab. Swain's Bay, Kerguelen's Island.

The epidermis which clothes this species is of a very deciduous nature; it is minutely hairy, the hairs being disposed in obliquely longitudinal series showing the layers of increase.

5. *Rissoa Kergueleni*, sp. nov.

Testa ovata, semipellucida, vitrea vel lactea, ad apicem pallide rubescens, tenuis, imperforata; anfractus 5, convexi, politi, sutura angustissime marginata divisi; apex obtusus; apertura ovata, superne acuminata, longitudinis totius $\frac{5}{12}$ adæquans; peristoma continuum, leviter incrassatum et expansum.
Operculum paucispirale, corneum, simplex.
Long. 3 mill., diam. $1\frac{1}{2}$.

Hab. On a sponge, Kerguelen's Island.

This pretty species is of a glassy texture, sometimes streaked longitudinally with opaque white. The whorls are divided by a narrowly margined suture, and below it there is a faint depression; the first two whorls form an obtuse apex; and the penultimate is large.

Eatonia, gen. nov.

Testa formæ rissoideæ; apertura subcircularis; peristoma simplex, continuum, margine labrali haud incrassatum.

Operculum ovatum, pauci- vel unispirale, nucleo subterminali a latere columellari paululum remoto, infra ossiculo prominenti a nucleo exsurgente et versus marginem columellarem extenso munita.

There are two genera which have affinity to the present one—*Jeffreysia* and *Rissoina*. With *Jeffreysia* it agrees in the form and character of the aperture, but differs in having the nucleus of the operculum not lateral, but situated within the margin and towards the lower end—in fact, agreeing in this respect with *Rissoina* (see Adams, 'Genera of Recent Mollusca,' vol. iii. pl. 35. f. 1, *a* & *b*), but distinguished from it by the absence of the basal faint channel of the aperture and the lack of any incrassation to the labrum.

The operculum of *Jeffreysia* is composed of concentric layers (as in *Purpura*), commencing from a nucleus situated on the margin of the inner or columellar side; and the ossicle or rib proceeds "from the nucleus in the direction of the *outer* margin" (Jeffreys, 'Brit. Conch.' iv. p. 58; in the figure, *l.c.* pl. 1. f. 3, it is apparently the reverse).

In *Eatonia* the operculum is spiral, consisting of one or more whorls, the nucleus is situated within the margin and about one fourth the entire length from the lower end, and the ossicle is directed towards the *inner* margin.

I feel much pleasure in associating with this group the name of the Rev. A. E. Eaton, who worked so indefatigably in collecting specimens during the expedition.

6. *Eatonia kerguelenensis*, sp. nov.

Testa ovato-conica, tenuis, olivaceo-nigrescens, versus labrum pallidior semipellucida, vix rimata; anfractus 6, convexi, læves parum nitidi, incrementi lineis striati, sutura simplici sejuncti; apertura fere circularis, longitudinis totius $\frac{5}{12}$ æquans; peristoma simplex, continuum, in regione umbilicali leviter incrassatum et vix reflexum.

Operculum ovatum, intus concavum, nucleo posteriore sed haud terminali, crassiusculum, margine externo lira incrassatum, unispirale, supra incrementi lineis valde striatum, infra ossiculo elongato a nucleo exsurgente munitum.

Long. 3 mill., diam. $1\frac{2}{3}$.

Hab. On a sponge, Kerguelen's Island.

This species was found in company with *Rissoa Kergueleni*. It is of a very different form, the spire being conical, the last whorl shorter and a trifle broader; and it also differs in colour. In general aspect it resembles very much several species of *Hydrobia*; but the operculum will at once separate it.

7. *Eatonia caliginosa*, sp. nov.

Testa ovata, modice tenuis, nigra, vix rimata; anfractus $4\frac{1}{2}$, convexi, læves, vix nitidi, sutura simplici discreti, incrementi lineis obsolete striati; apertura fere circularis, superne paululum acuminata, longitudinis totius $\frac{1}{2}$ fere æquans; peristoma continuum, levissime incrassatum, in regiono umbilicali albidum, aliquanto reflexum, et versus basim parum effusum.

Operculum ei *E. kerguelenensis* fere simile.

Long. 2 mill., diam. 1.

Hab. Swain's Bay, Kerguelen's Island.

This minute shell has a simple style of sculpture. It is of a very black olive-colour, with a nearly circular aperture, the peritreme of which is black outwardly and whitish in the columellar region.

8. *Eatonia subrufescens*, sp. nov.

Testa ovata, leviter conica, tenuis, semidiaphana, vix rimata, subrufescens, versus labrum albida; anfractus $4\frac{1}{2}$, lente accrescentes, convexi, sutura subprofunda divisi, læves nisi incrementi striis tenuiter sculpti; apertura subcircularis, longitudinis testæ $\frac{1}{3}$ paulo superans; peristoma continuum, ad marginem columellarem leviter incrassatum et reflexum, rimam umbilicalem indistinctam effingens.

Operculum ei *E. kerguelenensis* fere simile, sed ossiculo fortissimo munitum.

Long. $1\frac{1}{2}$ mill., diam. $\frac{2}{3}$.

Hab. On a sponge, Kerguelen's Island.

The reddish colour of the upper whorls is attributable to the dried remains of the inhabitant.

9. *Skenea subcanaliculata*, sp. nov.

Testa minuta, orbiculata, depressa, tenuis, subdiaphana, albida, late profundeque umbilicata; spira minime elevata; anfractus $3\frac{1}{2}$, sublente accrescentes, perconvexi, ad suturam valde incurvati, fere canaliculati, læves nisi incrementi striis levissime sculpti; apertura subcircularis, leviter obliqua; peristoma continuum, simplex.

Operculum subcirculare, paucispirale, nucleo fere centrali.

Diam. max. $1\frac{1}{3}$ mill., diam. min. 1, alt. $\frac{1}{2}$.

Hab. On a sponge, Kerguelen's Island.

Some specimens are of a faint reddish colour in the upper whorls; but this may be from the dried animal within. The whorls are very much incurved at the suture, so much so that almost a channel is produced.

10. *Scissurella supraplicata*, sp. nov.

Testa heliciformis, spira brevi, anguste perforata, tenuis, semipellucida, alba, epidermide caduca crassiuscula pallide olivacea amicta; anfractus 3, primus —— ? (abruptus), secundus convexiusculus, superne aliquanto planulatus et radiatim arcuate plicatus, ultimus magnus, paululum supra medium carina duplici tenui (cum scissura continua) succinctus, supra carinam radiatim arcuate plicatus, infra eam incrementi lineis striatus; apertura maxima, irregulariter circularis, ad marginem basalem levissime expansa; peristoma continuum, scissura profunda angusta.

Operculum corneum, —— ?

Diam. max. $1\frac{1}{3}$ mill., diam. min. 1, alt. 1.

Hab. Swain's Bay, Kerguelen's Island.

The deep narrow slit is situated between the two thread-like keels, as is the case in several other species. The operculum is too far within the aperture to allow of examination.

11. *Solenella gigantea*, sp. nov.

Testa elongato-ovalis, postice subrhomboidalis, parum inæquilateralis, postice longior, aliquanto ventricosa, versus marginem posticum compressiuscula, epidermide nitidissima (vel fusco- vel flavo-olivacea) induta, incrementi lineis concentricis (interdum prominentibus) ornata, et striis paucis tenuissimis et confertis ab umbonibus usque ad medium lateris antici radiata, intus alba, iridescens; margo dorsalis utrinque leviter declivis, ventralis vix arcuatus; extremitas lateris antica brevioris paululum supra medium leviter acuminato-rotundata; postica superne subrostrata, medio leviter sinuata; dentes cardinales postice circiter 32, antice 11; pallii impressio perprofunde sinuata.

Lat. 62 mill., long. 32, crass. 19.

Hab. Royal Sound, Kerguelen's Island.

This magnificent species is by far the largest yet described of this genus, and is at once known from the other three species by its difference of form. The posterior end pouts in the same manner as in the North-American *Yoldia thraciæformis*. The epidermis in young and half-grown specimens is of a bright yellowish olive colour; but in the adult shell it becomes of a dark olive-brown, and is much eroded in the umbonal region; it is slightly reflexed within the margin of the valves. The few radiating contiguous striations towards the anterior end furnish another very distinctive character.

12. *Yoldia subæquilateralis*, sp. nov.

Testa ovalis, postice acuminata, subæquilateralis, postice paululum brevior, convexiuscula, epidermide olivacea vel flavo-olivacea induta, concentrice rugose striata, utrinque umbonibus ad marginem subventralem striis paucis subgranosis radiantibus insculpta, utrinque leviter hians, intus cæruleo-alba; margo dorsalis utrinque multum declivis, antice levissime convexo-arcuatus, postice fere rectus; margo ventralis ubique arcuatus; latus anticum late rotundatum, posticum subacuminate productum; fovea ligamentalis parva triangularis; dentes cardinales utrinque 11; sinus pallii latissimus parum profundus.

Lat. 34 mill., long. 23, crass. 9.

Hab. Swain's Bay, Kerguelen's Island.

I know but one species which approaches the present one somewhat closely, namely *Y. Eightsii* of Couthouy. From this, however, it is well distinguished by its difference in form. By reference to Jay's figure upon which *Y. Eightsii* is founded (for no description is given; Cat. Shells, 1839, ed. 3, pl. i. f. 12 & 13), it will be perceived that a very inequilateral shell is there represented, with a much *excavated* posterior dorsal slope; on the contrary, *Y. subæquilateralis* is almost equilateral, with a *straight* posterior dorsal acclivity.

VI.—*Descriptions of new Species of Crustacea collected at Kerguelen's Island by the Rev. A. E. Eaton.* By Edward J. Miers, Zoological Department, British Museum.

The Crustacea collected at Kerguelen's Island (exclusive of the Entomostraca, which have not yet been examined) amount to ten species, seven of which are here described for the first time. One of these, *Serolis latifrons*, is mentioned (but not characterized) by A. White, in the 'List of Specimens of Crustacea in the British Museum;' and examples from the Auckland Islands have long existed in the Collection.

Dynamene Eatoni, n. sp.

Convex, smooth, naked, with the sides of the pereion nearly parallel. Cephalon transverse, deeply encased within the first segment of the pereion; its front with a thin raised marginal line. Eyes very small. Segments of the pereion narrow, of equal width above; the seventh segment produced backward on the sides over the front of the first (real) segment of the pleon. Segments of the pleon (the last excepted) coalescent, with the lines of union indicated on the sides by incised lines; last segment of the pleon convex, with the sides nearly straight, and with a rounded emargination at its extremity, which is about as wide as deep. Rami of the lateral appendages of the pleon subequal, oval, entire, reaching nearly to the notch at the extremity of the terminal segment. Colour reddish or greyish brown, with darker spots.

Length of the largest specimen nearly $\frac{3}{4}$ inch.

Hab. Kerguelen's Island, Swain's Bay and Royal Sound.

Serolis latifrons.

Serolis latifrons, White, List Crust. Brit. Mus. p. 106 (1847).

Convex, with a series of impressed lines and punctulations near the posterior margin of each segment. Segments of the pereion with the posterior margin sinuated, acute at the infero-posterior angle, but not greatly produced backward (as in some species of the genus). Terminal segment of the pleon large, subtriangular, with a semicircular notch at its extremity, with a high longitudinal central carina extending from the base of the segment to the terminal notch, and with a less-elevated carina on either side, rising near and continued for some distance parallel to the base of the segment, then curving backward and terminating before reaching the lateral margin. Rami of the lateral appendages of the pleon narrow-acuminate, the outer one very small, not half the length of the inner ramus. Colour brown, with irregular paler patches.

Length about 1 inch.

Hab. Kerguelen's Island, Royal Sound; Auckland Islands, Rendezvous Cove (*Lieutenant A. Smith, R.N.*, Brit. Mus.).

Lysianassa Kergueleni, n. sp.

Smooth. Eyes not visible. Superior antennæ subpyriform, with the first joint large, robust, the second and third joints short; the secondary appendage short. Inferior antennæ slender, longer than the superior, with the last two joints of the peduncle longer than the preceding. Gnathopoda weak; the first pair short, subchelate; the second pair longer, with the dactylos rudimentary. Second pair of pereiopoda with the coxæ emarginate behind, and produced backward at the infero-posterior angle. Third segment of the pleon produced backward at its infero-posterior angle into a narrow subacute lobe.

Length $\frac{1}{2}$ inch.

Hab. Kerguelen's Island, Royal Sound.

PARAMŒRA, n. g.

Melita, Dana (nec Leach), U.S. Explor. Exped., Crust. p. 911 (1852).
Mœra (part.), Spence Bate, Cat. Amphipod. Crust. Brit. Mus. p. 181 (1862).

Superior antennæ exappendiculate, but little longer than the inferior. Gnathopoda subequal, well developed; dactylos closing along the inferior margin of the palm. Posterior pair of pleopoda with the rami very unequal, the inner ramus short or rudimentary. Telson cleft nearly to the base.

This genus will apparently include *Melita Fresnelii*, Audouin, and *Melita tenuicornis*, Dana, which latter species is placed by Mr. Spence Bate provisionally in the genus *Mœra*.

Paramœra australis, n. sp.

Smooth, without dorsal carinæ. Eyes subreniform, black. Antennæ about half as long as the animal, slender; first and second joints of the peduncle of the superior antennæ about as long as the cephalon, third joint short; inferior antennæ with the first to third joints short, the fourth and fifth longer. Gnathopoda with the carpus narrow at the base, enlarging anteriorly; propodos with the sides nearly parallel, obliquely truncate at the extremity; dactylos short, slightly arcuate. Third, fourth, and fifth pairs of pereiopoda with the coxæ transverse, small; the basa longer, with the inferior margins rounded. First three segments of the pleon with the inferior margins rounded, minutely serrulate. Antennæ, gnathopoda, pereiopoda, and rami of the pleopoda with short hairs.

Length $\frac{1}{2}$ inch.

Hab. Kerguelen's Island, Royal Sound.

Podocerus ornatus, n. sp.

Antennæ subequal, very robust, clothed with long hairs; peduncles with the last two joints much longer than the preceding, subequal. Superior antennæ with a small secondary appendage. Second pair of gnathopoda the largest, with the carpus short; the propodos large, ovate; the dactylos strong and arcuate. Pereiopoda subprehensile, with the tarsus flexible. Rami of the pleopoda with a series of short spines. Segments of the pleon somewhat produced backward, with the posterior margin rounded. Telson small, simple, conical. Colour pale, with very numerous small black spots.

Length $\frac{1}{6}$ inch.

Hab. Kerguelen's Island, Swain's Bay.

Nymphon gracilipes, n. sp.

Very slender, clothed with very short hairs. Legs very long. Head and neck of equal length, together about as long as the body. First (mandibular) pair of palpiform appendages three-jointed, terminating in slender chelæ; second pair five-jointed, the first joint very small, the second the longest, the remaining joints very hairy; third (ovigerous) pair eleven-jointed, the first joint very short, second, third, and fourth longer, fifth very long, sixth to tenth gradually decreasing in size, the eleventh minute. Legs with the first and third joints very short, the second rather longer, the fourth to sixth very long, the seventh and eighth (first and second tarsal) subequal, straight. Claws two, one very small.

Length $\frac{1}{3}$ inch.

Hab. Kerguelen's Island, Royal Sound.

Nymphon styligerum, n. sp.

Rather robust, hairy; legs short. Head sessile, very thick. First (mandibular) pair of palpiform appendages rudimentary or abortive, a single joint only being developed; second pair five-jointed; third (ovigerous) pair ten-jointed, with the first three joints short, the fourth and fifth longer, the sixth to the ninth short, the tenth quite minute. Legs with the first three joints very short, the next three joints longer, the seventh (first tarsal joint) minute, the eighth (second tarsal) longer, curved. Claws two, unequal. Abdomen terminating posteriorly in a long styliform process.

Length $\frac{1}{12}$ inch.

Hab. Kerguelen's Island, Royal Sound.

Should the form of the first pair of palpiform appendages prove constant, this species would probably constitute the type of a new genus allied to *Achelia*, Hodge.

VII.—*On* Hyalonema cebuense. By Dr. A. B. Meyer.

To the Editors of the Annals and Magazine of Natural History.

Dear Sirs,

Messrs. Higgin and Carter describe and figure, in the last number of your Journal (June, p. 377, plate xxi.), *Hyalonema cebuense*, a new hexactinellid sponge from Cebu, Philippine Islands. It is just a year now that I sent the enclosed photograph to the late Dr. J. E. Gray. I received this photograph from a friend in Cebu, Mr. Hepp, who had taken it himself from the specimen, which was in the possession of Mr. Legaspi there, a native known to possess a large collection of shells &c., which I examined myself when on Cebu in 1872. I expressed the wish to Dr. Gray that he might describe or notice the sponge, as apparently distinct from all the other new forms which I had brought home from there (viz. *Meyerina claveæformis*, *Crateromorpha Meyeri*, *Rossella philippinensis*, and *Labaria hemisphærica*), all described by Dr. Gray; but Dr. Gray "did not venture to notice the sponge from the photograph," and I, of course, still less. My exertions to get the specimen itself from Cebu were in vain till now; but if you will compare the photograph, which it would be perhaps interesting to reproduce in your Journal as a woodcut*, with the figure of *Hyalonema cebuense* on plate xxi. (*l. c.*) the identity of both is not to be overlooked a moment. The habitat of this species, "Cebu," as stated by Mr. Higgin, seems to be confirmed hereby. But I do not believe that these sponges are obtained there by diving, but only by dredging in a similar manner as I described it shortly in your Journal for January 1874, which note affords occasionally a more detailed account.

R. Natural History Museum,
Dresden, June 6, 1875.

Very respectfully,
A. B. Meyer.

Note by Mr. Higgin.

Dear Sir,

I have the pleasure to return to you Dr. Meyer's letter of the 6th inst., with the photograph attached to it, and thank you much for sending it for my perusal.

I think there can be no doubt that the sponge photographed is an example of *Hyalonema cebuense*; it is, however, apparently in a very decayed condition, and seems to have entirely lost the beautiful latticework surface shown in the Liverpool-Museum specimen.

It is satisfactory to have the locality of the Liverpool sponge thus confirmed; and we may hope that other examples will have been obtained by H.M.S. 'Challenger' during her recent dredging-cruise amongst the Philippine Islands.

Huyton,
June 17, 1875.

To Dr. Francis.

I am, dear Sir,
Yours very faithfully,
Thomas Higgin.

* [As, from the note which Mr. Higgin has had the kindness to append to this paper, there cannot be the slightest doubt as to the identity of this specimen with his *H. cebuense*, we do not consider it necessary to reproduce the photograph.—Eds.]

MISCELLANEOUS.

On the Fauna and Flora of Kerguelen's Island. (A letter addressed to the French Minister of Foreign Affairs.) By M. Lanen.

Capetown, Feb. 22, 1875.

I have the honour to transmit to you an article from a Capetown newspaper containing some interesting information on the fauna and flora of Kerguelen's Island, communicated by Dr. Kidder, a naturalist attached to the American Expedition for observing the transit of Venus on that island.

From Dr. Kidder's investigations it appears that there exists on Kerguelen's Island only one species of bird which is not web-footed; this is the sheathbill (*Chionis alba*); it feeds on the shell-fish and sea-weeds left on the shore by the tide. On the other hand, aquatic birds are very numerous. The green-winged teal is found in great abundance; its flavour is exquisite. Among the sea-birds observed are:—17 species of petrel; 2 of albatross: 3 penguins; and a very large variety of *Lestris catarrhactes*, which, although web-footed, feeds only on birds and eggs.

The insects are very few. Some wingless Diptera and red Acrididæ are found on the leaves of the cabbage. The only Invertebrata provided with wings which have been discovered by Dr. Kidder are various species of Coleoptera; he has seen neither Hymenoptera, Hemiptera, nor Diptera.

There are neither Reptilia nor Batrachia, but a great many Crustacea and a few Gasteropoda.

Only one species of fish has been found in the lakes. It seems to belong to the family Gadidæ, but is of small dimensions.

The class Mammalia is scarcely represented at Kerguelen. The sole mammal (not amphibious) met with is the common mouse, which was doubtless introduced from some vessel. As regards amphibia—seals, sea-elephants, sea-leopards, sea-lions, &c., which formerly abounded there, have been so hunted by the American whalers that they have become very scarce.

The flora of the island is poor but singular; some of the plants which grow there are met with in no other part—among others *Lyallia kerguelensis* (the only species of a genus *incertæ sedis*), *Colobanthus kerguelensis*, and *Triodia kerguelensis*. The Kerguelen cabbage and tea-plant (*Pringlea antiscorbutica* and *Acæna affinis*) offer to seamen a valuable remedy against scurvy. Dr. Kidder has discovered some plants not described in Dr. Hooker's work published after his exploration in the years 1839 to 1841. He brings from Kerguelen 28 boxes of botanical specimens.

The Rev. Mr. Eaton (naturalist to the English Expedition) and Dr. Naumann (naturalist to the German Expedition) will, no doubt, make a more complete collection; for they will prolong their stay several months.

The area of the island is about 100 miles in length by 40 in breadth.—*Comptes Rendus de l'Acad. des Sciences,* tome lxxx. pp. 1224, 1225.

On Androgynous Diptera. By Dr. Loew.

The occurrence of characters of the two sexes in different parts of the body of insects has been noticed chiefly in those orders which are generally collected, and more especially in the Lepidoptera. Nearly 30 years ago (in 1846) Dr. Loew described (Stett. ent. Zeit. vii. p. 302) an androgynous specimen of *Beris nitens*, Latr., in which the head, thorax, wings, fore legs, and left middle and hind legs presented male characters, while the abdomen with the genitalia and the right middle and hind legs were female. This case, which is not mentioned in Hagen's list of known hermaphrodite insects (Stett. ent. Zeit. xxii. 1861), has hitherto stood alone in the order Diptera.

Dr. Loew now describes another androgynous Dipteron, namely an example of his *Synarthrus cinereiventris*, a species of the family Dolichopodidæ from Texas. He describes in considerable detail the distinctive characters of the two sexes of this species, which are combined in the hermaphrodite in a way hitherto unrecorded for any insect, the head, body, and wings being entirely of normal female structure, whilst the whole of the legs display the peculiar characters of the male sex fully developed.—*Zeitschrift für die gesammten Naturwissenschaften*, Neue Folge, Band x. 1874, pp. 75–79.

The Blind Fish and some of the associated Species of the Mammoth Cave, Kentucky, probably of Marine Origin.

Mr. F. W. Putnam, in an article published in the Bulletin of the Essex Institute, vol. vi. no. 12, 1874, remarks as follows on the origin of some of the present inhabitants.

That many or, with two or three exceptions, nearly all of the thirty or forty species of vertebrates, articulates, mollusks, and still lower forms, including a few plants, now discovered in the caves of Kentucky, are of comparatively late introduction, is probable from the fact that they are so closely allied to forms living in the vicinity of the caves. But that the blind fishes, the *Chologaster*, and a few of the lower forms of articulates, such as the Lernæan parasitic on the blind fish, may have been inhabitants of the subterranean streams for a much longer period, is worthy of consideration on the following grounds:—

First, the blind-fish family has no immediate allies existing in the interior waters *, the only species of the family, in addition to

* In common with others I have considered the Heteropygii as belonging to the same order with the Cyprinodontes; but I now have, from further information of their structure, doubts as to their close association with that group. This subject will be presented on another occasion.

the three found in the Mammoth Cave, being known at present only from the rice-ditches of the low coast of South Carolina.

Second, the Lernæan parasite is much more common on marine fishes than on strictly fluviatile species, and is more decidedly a marine than a freshwater form. These facts may therefore be taken as at least indicating the probability of the early origin of some part of the great cave-system of the region of the Ohio valley; and while there may be nothing in the present structure of the caves to indicate their having been formed in part while in contact with salt water, the supposed erosion of the limestone and the modification of the early formed chambers by later action should be carefully considered before it can be denied that the caves were, in some slight part, for a time supplied with marine life. Until a specimen of *Chologaster*, or some other member of the family, has been obtained in the external waters of the Ohio valley, it is hardly logical to regard the family to which the blind fishes belong as one originally distributed in the rivers of the Ohio valley, and afterward becoming exterminated in the rivers and only existing in two such widely different localities as the coast of South Carolina and the subterranean streams of the south-western States. That marine forms of life are found in our freshwater lakes and rivers is known to be the case. The specimen of a shrimp exhibited was secured in the Green River, near one of the outlets of the Mammoth Cave. The fact that in some of the waters of Florida fishes once marine are now confined to freshwater lakes of comparatively recent formation, and that in the St. John's river, and others of that State, many marine and freshwater species are found associated, are evidence of the change that may take place in the habits of some marine animals, while a recent announcement of the *Gobiosoma* found in the Ohio river* is another instance of a marine fish living in fresh waters.—*Silliman's American Journal*, May 1875.

Note on Neobalæna marginata †.

In the 'Annals' for October last (p. 316) an awkward mistake has crept into the abstract from one of my letters to Dr. Gray, published by him as a paragraph. It is the *skull* of the calf of *Neobalæna marginata* that is 2 feet 3 inches in total length, not the calf itself.

Wellington, New Zealand, January 19, 1875. JAMES HECTOR.

* Putnam, "Notice of *Gobiosoma molestum* from the Ohio," Amer. Nat. viii. Feb. 1874.

† [We are requested by Dr. Hector to state that the above correction would have been made at an earlier date, but for the unfortunate circumstance that it was enclosed in a letter addressed to Dr. Gray which arrived in England after his death.—ED.]

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

No. 92. AUGUST 1875.

VIII.—*On the Position of* Sagitta, *and on the Convergence of Types by Pelagic Life.* By M. A. GIARD*.

No animal has been more frequently shifted from one systematic division to another than *Sagitta*. Some have regarded it as a degraded vertebrate, and have placed it beside *Amphioxus*; others have considered it a heteropod mollusk; Oscar Schmidt declares that it "is neither a true annelid nor a legitimate mollusk"†; Leuckart, Schneider, and Claus approximate it to the Nematoidea.

Häckel, in his 'Generelle Morphologie,' also places the Chætognatha among the Nemathelmintha, and, further, he takes up the idea of Meissner with regard to the relationship of *Sagitta* and the Vertebrata. If we make a perpendicular section of the tail of a fish, we see clearly, he says, that the trunk of a vertebrate is formed originally of four antimera, and not of two. The primitive form of the lower Vertebrata, like that of the Nematoidea, is the *eutetrapleural interradial* form. Thus we may put forth, with some appearance of reason, the hypothesis that the Vertebrata have issued from the Chætognatha by a progressive metamorphosis, whilst the Nematoidea have been produced from them by a retrograde metamorphosis.

Since the admirable researches of Kowalevsky upon the

* Translated by W. S. Dallas, F.L.S., from an article in the 'Revue des Sciences Naturelles,' tome iii. March 1875, communicated by the Author.

† The Doctrine of Descent and Darwinism, p. 37.

embryogeny of the Ascidia, Häckel has modified his opinions upon this point: but we may say that the *Sagittæ* were a badly chosen group among the Nematoidea for the support of this theory; for we do not find in them the four muscular bundles mentioned by Häckel, and their body is formed rather of two antimera.

On the other hand, the four primitive antimera occur with wonderful distinctness in the tail of the larvæ of certain Ascidia (*Perophora Listeri*); and even in some adult Ascidia they are clearly indicated by the quaternary symmetry of the buccal aperture.

Kowalevsky has himself expressed his opinion as to the position of *Sagitta* in the animal tree: he does not hesitate to place the Chætognatha *among the true Annelides**.

Before examining these various opinions more closely, it seems necessary to enter upon some general considerations which will enable us the better to appreciate the causes of their divergence.

One of the most difficult problems of modern zoology, and indeed that which must now-a-days preoccupy every thinking naturalist, is to determine in every peculiar arrangement of an organism what belongs to heredity, and what must be attributed to adaptation. Such inquiries present immense difficulties, and can only be fruitfully attempted with groups of which the embryogeny is sufficiently known. I speak, of course, of stratological embryogeny, which only dates from ten years back, and the general importance of which is unfortunately not understood by all who are engaged in zoological investigation. Every anatomical investigation that is not made with the object of elucidating this new embryogeny, is a work which may certainly possess some interest, but one which is no longer of our epoch, and even loses an enormous portion of its value. However, all naturalists of any merit have always been sustained in their efforts by a philosophical idea; and, although I may thereby subject myself to bitter criticism, I regard the memoirs of a Geoffroy Saint-Hilaire, a Wolf, or a Kowalevsky as having contributed much more to the progress of science than the anatomy of the cat by Straus-Durckheim, or that of the tortoise by Bojanus.

We shall endeavour to show what enormous influence the external conditions of existence may have upon the form of an animal, what astonishing resemblances may result from the action of identical causes upon originally different organisms. It will be the eternal glory of Lamarck that he was the first to

* Nablioudenia nade rajvetierne Brachiopoda. Moscow, 1874, p. 34, note.

bring into the light this power of ethology. It will be the glory of Darwin that he has shown how much this action of the surrounding media is increased by natural selection, the idea of which is essentially inseparable from that of adaptation, selection at a given moment being determined by the limits of this adaptation.

We shall see hereafter how, in the particular instance of the Chætognatha and in some other interesting cases, pure adaptive analogies have been taken for relations of affinity. Without pretending to give a complete solution of these questions, which are too complex to be treated lightly, we shall esteem ourselves fortunate if we have indicated the nature of certain difficulties, and thus contributed to clear the road which our successors will have to traverse.

Convergence of Types by Pelagic Life.

In a previous memoir* I have dwelt upon the convergence of types by parasitism, and pointed out that this mode of existence gradually brought about in the most diverse animals organic modifications so profound as to cause the disappearance not only of the characters of orders and classes, but even of those of the great divisions or subkingdoms. Without the clue furnished by embryogeny we might easily be led to create families and genera including animals belonging to groups so distinct as the Trematoda, the Nudibranchiate Mollusca, the Cirripedes, and the Isopod and Copepod Crustacea. Since then, during the Scientific Congress at Lille, I have had the extreme satisfaction of learning that these opinions were shared by one of the most distinguished embryogenists of our time, Professor Carl Vogt. This eminent philosophical zoologist, without any knowledge of the memoir to which I have alluded, enunciated the same proposition, supporting it by precisely the same examples (*Sacculina*, *Entoconcha*, *Rediæ*).

Opinions of the same nature have also been expressed by Professor Martins (of Montpellier), one of the few French naturalists who have been able to understand the modern specific movement in the biological sciences. He says†:—"I cannot refrain from observing that the appearance of the same morphological type (of the same animal, so to speak) at various grades in the scale, is another argument in favour of community of origin combined with subsequent modifications. The

* Revue Scientifique, July 11, 1874, 4e année, 2e série, no. 2, pp. 32 & 33.

† See C. Martins, 'La Création du monde organisé d'après les naturalistes de la nouvelle École,' p. 15.

type of the monkey with hands and with a prehensile tail appears first of all in the chameleon—a reptile which does not creep but climbs, and twists its tail round the branch that bears it. This type reappears among the marsupials in the phalangers and opossums, among the rodents in the couendous (*Synetheres*), and among the plantigrade carnivores in the kinkajou (*Cercoleptes*), to become multiplied, diversified, and terminated in the prehensile-tailed monkeys of South America, such as the sapajous, howling monkeys, and spider monkeys. The flying dragon, among reptiles, is the first appearance of an animal which sustains itself in the air by means of a membrane stretched upon the sides of the trunk. The flying phalanger or *Petaurista* among marsupials, the flying squirrel among the rodents, and, lastly, the *Galeopithecus* or flying lemur are repetitions of the same morphological type from the reptiles up to the primates. . . . . . In the gradual evolution of living creatures, notwithstanding profound differences of organization, the same media and the same needs have induced the development of the same forms, which heredity has fixed and maintained by the reproduction of the species."

It will be seen that the learned Professor takes especially as examples organic arrangements relating to vital peculiarities of secondary rank. Thus we may say that some animals, such as the chameleon, the opossum, &c., present the same *ethological* type, rather than the same morphological type in the true sense of the word. It is the same with other animals with still more superficial resemblances due to direct mimetism, and not to parallelism of vital conditions*. The action of surrounding media is of course exerted from the exterior towards the interior, and does not succeed in modifying the morphological type in creatures which are already strongly differentiated until after a very long time, and only with the aid of very imperious physiological necessities. As a matter of course, however, these physiological necessities are powerless of themselves to induce the convergence of types; and whilst we render all justice to our immortal Lamarck, we must not lose sight of the part played by natural selection in the preservation of the forms which are best adapted to a definite *ensemble* of external conditions.

One of the most energetic factors of this convergence is certainly, as has already been said, parasitism, and especially parasitism in its most absolute form—that is to say, that which

* See, for more details upon the resemblances due to mimetism, my 'Recherches sur les Synascidies,' pp. 58 *et seqq.* The interesting investigations of Wallace and of some other zoologists are far from having exhausted this subject, which for many reasons deserves to be investigated afresh.

is combined with the permanent fixation and complete dependence of the parasite with relation to the affected organism. Parasitism in this sense produces results such that the zoologist, furnished only with the resources of anatomy and pure morphology, could never have referred certain animals to their true place in the classification.

But there are other groups of ethological conditions which, without acting in so remarkable a manner, nevertheless induce very interesting typical convergences, especially when they affect simple or feebly differentiated organisms. We shall pay attention at present only to pelagic life, and seek to determine with precision what are the modifications that this mode of existence may induce in the animals of various classes that are subjected to it. This will enable us to appreciate the value of the reasons which have led zoologists to place *Sagitta* in one group or another of the animal kingdom.

Pelagic animals are those which live in the open sea, generally near the surface of the water, and rarely approach the shore, upon which, however, they are sometimes cast by the winds. We find animals leading such an existence throughout the whole zoological series, from the Protozoa to the Vertebrata. If we leave out of consideration superficial currents and climatal zones, these animals live under very uniform and at the same time very special conditions, the action of which must impress upon the organism certain peculiar features, which may succeed in masking the morphological type, especially in the Invertebrata.

The characters of adaptation proper to pelagic life are:—

1. An extreme transparency of all the tissues, which renders the animal completely invisible, and enables it to escape easily from its enemies. This transparency exists in animals belonging to the most diverse groups. We observe it in the *Noctilucæ*, the Siphonophora, the Medusæ, the Ctenophora, the Heteropod and Pteropod Mollusca, the *Salpæ* and *Pyrosomata*; in *Sagitta*, *Tomopteris*, and *Alciope*; and, lastly, in the *Leptocephali* among fishes.

2. The considerable development of certain organs of the senses, which often constitute the sole visible points of the animal. In general it is the eyes that present an enormous development with relation to the rest of the organization, as may be observed in a great number of the examples just cited; sometimes also the auditory apparatus, as in the Medusæ and the *Appendicularia*, and in *Mysis*, in which this apparatus is situated upon the caudal laminæ.

3. A reduction of the digestive tube, which becomes considerable, although without being so marked as in parasitic

animals. Not to mention the numerous examples of this reduction that may be found among the Medusæ and Ctenophora, we meet in other groups with an atrophy of the digestive organs which may even reach complete disappearance absolutely, as in the Rhizostomes. This is what occurs, for example, in the curious genus *Monstrilla*, one of the pelagic Copepod Crustacea; the nucleus of the *Salpæ* and *Appendiculariæ* also represents a perfectly rudimentary state of the digestive tube of the Tunicata, if it be compared with the intestinal mass of the animals of that group which lead a sedentary life (Ascidia). The same may be said of the digestive tube of *Carinaria*, *Firoloides*, *Atlanta*, &c., when compared with that of the ordinary Gasteropoda. Finally, the *Sagittæ* also present an excessively reduced digestive tube, which occupies only a small portion of the length of the body.

This reduction of the digestive system in pelagic animals is evidently in relation with the precarious existence of these creatures, which are constantly pursued by numerous enemies. A voluminous stomach would impede their progress, which is generally very rapid, and would diminish the transparency which protects them.

4. A considerable development of the organs of generation and great fecundity. Here again it is sufficient, in order to ascertain this fact, to compare in the same group the pelagic animals with those which live attached. In *Appendicularia*, for example, the genital mass is much more voluminous than in the Ascidia, taking the proportion of this mass to the total volume of the body of the animal. This excessive multiplication of the pelagic animals must be attributed to the numerous chances of destruction to which creatures so badly protected are exposed, just as in the case of the parasites, among which the same fact is also observed.

5. A great number of pelagic animals present the phenomenon of phosphorescence, such as the *Noctilucæ*, many Medusæ, the *Pyrosomata*, and *Phyllirhoë bucephala*. This phosphorescence, which is manifested especially when the animals are excited or alarmed, no doubt acts as a protection, and stops the pursuit of some enemies*. I have not remarked that the *Sagittæ* are endowed with any such means of defence, which, moreover, is far from being peculiar to pelagic animals.

6. As an ethological character frequently observable in pelagic animals, we must cite social life: we know what

* Panceri and De Quatrefages have made the very interesting observation that phosphorescence is under the control of the nervous system.

numerous bands are almost always formed by the *Noctilucæ*, Medusæ, Ctenophora, *Sagittæ*, Copepod Crustacea, *Mysides*, Pteropod Mollusca, &c.

It is evidently the resemblances of adaptation that *Sagitta* presents to *Amphioxus*, to the Heteropoda, and to *Tomopteris* and other Annelida, that have determined zoologists to place the Chætognatha sometimes among the Vertebrata, and sometimes with the Vermes, at a time when neither their anatomy nor their embryogeny was sufficiently known.

The arrangement of the nervous system evidently removes all possibility of an immediate approximation of *Sagitta* and the Vertebrata. Leydig and Kowalevsky have justly indicated that the nervous system resembles that of the Mollusca. It may also be compared to that of the Annelida; and in this there is nothing surprising, from what we now know of the close relationship (demonstrated by embryogeny) between the group of Annelida and that of Mollusca (Brachiopoda, Chitons, *Dentalia*, &c.).

On the other hand, this same nervous system removes the *Sagittæ* from the true Nematoids; and their attempted approxition to *Chætosoma* does not appear to be completely justified by what we know of the organization of the latter.

The presence of chitinous setæ is another character in common with the Annelides; and indeed, from the anatomical point of view, the only serious argument that we can oppose to those who would unite the *Sagittæ* with ringed worms is the absence in the former of any metameral structure, even in the embryo. This character, on the other hand, approximates the Chætognatha to the phylum of the Mollusca, or, in a more general way, to the ancient animals from which have been derived on the one hand the Mollusca and on the other the Annelida. The presence of the vibratile disk and of the lateral invaginations also reminds us of the arrangement observable in groups allied to those inferior types of which we are speaking—for example, in the Rotifera or in the embryos of certain Annelids.

The very peculiar embryogeny of *Sagitta* (formation of a secondary general cavity), however, does not allow of our placing them directly among either the Mollusca or the Annelida. It is, in fact, a dilated embryogeny (without the formation, either primitive or secondary, of a nutritive vitellus) which is the indication of high antiquity of the type. It may, however, be the case that the development of the Annelides, which is not sufficiently known, represents the condensed form (with nutritive vitellus) of the evolution of the Chætognatha.

Thus it seems to us advisable to leave the *Sagittæ* in a special group, which, under the name of Chætognatha, must take its place at the base of the phylum of the Annelida, of which this group represents a divergent branch adapted for a pelagic existence.

Other examples will show still better the practical importance that may attach to speculative considerations such as those which we have expounded with regard to the convergence of types by pelagic life.

The illustrious Von Baer, in a memoir dated last year, has endeavoured to demonstrate that the Ascidia and the *Salpæ* are Mollusca presenting the same typical structure as the Heteropoda; but the smallest acquaintance with the development of these animals suffices to prove, as we have endeavoured to do elsewhere, that the resemblance between a *Biphora* and a *Firoloides* is a result of adaptation, and that the analogies of the Tunicata with the Gasteropoda are no more real than those which have been attempted to be established between the same animals and the Lamellibranchiata*.

Forbes thought he could find great affinities between the larvæ of the Ascidia and the Hydroida. On the other hand, Carl Vogt formerly placed the Ctenophora among the Molluscoida. An English naturalist, Macdonald, taking up a few years ago these ancient ideas, gave the following classification of the Molluscoida:—

MOLLUSCOIDA.

Intestine separated from the cavity of the body.	Curvature primitively hæmal, finally neural	*Ascidiozoa.*
	Curvature simply neural	*Brachiopoda* and *Polyzoa.*
Intestine straight and communicating with the cavity of the body		*Ctenophora.*

Macdonald regards the Ctenophora as a central type, from which are derived on the one hand, by progression, the Molluscoida, on the other, by degradation, the Hydrozoa. This curious classification also has evidently for its starting-point false homologies due to adaptation, which have appeared to the author of more importance than the fundamental differences presented by the embryogeny of these animals. The comparison of the pelagic types (natatory Tunicata, Ctenophora, and Hydroida) is evidently the starting-point of these lucubrations, which look as if they were a century old, and nevertheless were published in 1864.

* See Giard, "Embryogénie des Ascidies, et l'origine des Vertébrés," Revue Scientifique, 4e année, No. 2, July 11, 1874.

Under other circumstances adaptation to pelagic life causes certain adult animals to resemble embryonic forms of other animals belonging to higher types, or produces apparent analogies between larval forms pertaining to different groups. In his fine work on the Metamorphoses of Man and Animals (1862), M. de Quatrefages, speaking of the *Amphioxus*, says:—"It is allowable to ask ourselves whether this animal, which is placed in the lowest rank of Vertebrates, and which in many respects approaches the Annelida Errantia, is really a perfect animal. In some parts of its organization it reminds us of the *Ammocœtes* of our brooks. May it not be the larva of *Petromyzon marinus* or of some other species?" In 1867, in a memoir upon this singular vertebrate, M. Bert insisted on the facts which show that it is an adult creature; and in the same year Kowalevsky gave a complete embryogeny of it. Nevertheless in 1871, at the Academy of Boston, in presence of Louis Agassiz, the question whether *Amphioxus* is not the larva of a Myxinoid fish was discussed over again *.

We have several times observed, in the neighbourhood of Boulogne, troops of young *Clupeæ* of astonishing transparency, and resembling the *Leptocephali* in general aspect. Now it is well known that zoologists have not yet completely solved the question whether these *Leptocephali* are or are not adult forms. Gill and several other ichthyologists assert that they are embryonic forms; Peters, on the contrary, affirms † that they cannot be regarded as the embryos of the *Cepolæ* or of other fishes. According to Gill, *Leptocephalus Morrisii* is the young of *Conger vulgaris*, *Hyoproprus messinensis* belongs to *Nettastoma melanura*, and *Stomasunculus* is the larva of a Clupeoid ‡.

If such questions are difficult to solve in the case of animals so high as the fishes, it will easily be understood how much greater are the difficulties met with by the zoologist when he tries to establish the true homologies which may exist between the larvæ of the lower animals.

It seems to me that one of the most important and necessary investigations for the progress of embryogeny would be to distinguish what is due to heredity and what is the result of adaptation to pelagic life in embryonic forms, such as the larvæ of the Echinoderms, the *Pilidium* of the Nemertians, the *Actinotrochæ*, *Mitrariæ*, *Cyphonautes*, certain larvæ of Planariæ,

* Similar difficulties occurred formerly with regard to *Phyllosoma*, *Cuma*, &c.

† Monatsb. Akad. Wiss. Berlin, 1864, p. 399.

‡ Proc. Acad. Nat. Sci. Philad. 1864.

Annelides, &c. Upon organisms still so slightly differentiated external conditions act in a very energetic manner; and their action is multiplied by heredity in creatures with a free and dilated embryogeny. We must therefore keep watch against the apparent homologies which often mask real but yet only slightly marked differences of organization—"When we have to do with the starting-point of an angle, no modification in the divergence of the lines is indifferent."

Among those who will read the preceding pages there are some who will regard such researches as rash, as useless theories, or as facile dissertations; so great is even still the infatuation of certain naturalists for the exaggerations of the Cuvierian school, and for the ideal and artistic morphology of some of his successors. We have nothing to urge against those who persist, in contempt of embryogenic data, in seeking in adult forms for supposed homologies of connexion and an arbitrary plan determined beforehand. One cannot discuss matters with a partisan. To those who pretend that it is *easy* to reason upon known facts, and who prefer to seek and store up in their memoirs histological details and observations in descriptive anatomy, we say with Professor Häckel:—"Whoever has good eyes and a microscope, assiduity, and patience may now-a-days acquire a certain notoriety by microscopical discoveries, but without therefore deserving the name of a naturalist. This title must be reserved for the man who endeavours not only to see the particular facts, but also to grasp their ethological bond."

IX.—*Observations on the Genus* Platycrinus. By Fort-Major Thomas Austin, F.G.S.

Having for a long time remarked the anomaly of retaining in the genus *Platycrinus* those species which deviate from the typical character in having the mouth, or anal orifice, or whatever the office the aperture may have been intended to perform, placed *laterally* or nearly so, whereas the typical species and some others have the *centre* of the ventral dome elevated into a tube from one to two inches in height, it is therefore proposed to remove those species with *excentrical* apertures into a new genus, retaining *Platycrinus lævis* and all those with *proboscidiform central* tubes in the original genus.

By the proposed arrangement the two genera would stand in the following order.

PLATYCRINUS.

Platycrinus lævis.
—— *striatus.*
—— *elongatus.*
Platycrinus trigintidactylus.
—— *spinosus.*

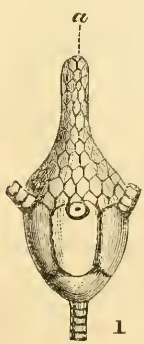
The generic formula of *Platycrinus* would be as follows:— Central dorsal plate pentagonal, whole and undivided; lateral or perisomatic plates five; ventral dome or proboscidiform mouth (?) elevated, rising in the centre to a column of some considerable height.

The formula of the dorsal part of the proposed new genus resembles *Platycrinus* in the number of lateral plates, but in shape they are somewhat different. The upper or ventral surface, however, is quite dissimilar, and presents a striking contrast to the elevated ventral elongated cone of *Platycrinus*—it being covered in with four, five, or more plates which are only slightly elevated above the upper margin of the perisomatic or lateral dorsal plates, while the mouth, anal orifice, or whatever its office may have been, is situated in the widest interradial space, and it is mostly on a level with the base of the arms, but never in the centre of the dome, and it could have been but slightly protruding.

It is proposed provisionally to name the new genus MEDUSACRINUS; and it contains the following species:—

Medusacrinus mucronatus.
—— *rugosus.*
—— *tuberculatus.*
Medusacrinus mammillatus.
—— *granulatus.*

The accompanying drawings of a specimen of each genus will convey a better idea of their characters than any written description. In each case they are represented without arms.



Platycrinus lævis.
a. Anal or oral tube.

Medusacrinus mucronatus.
b. Mouth or anal orifice.

X.—*List of the Species of the Homopterous Genus* Hemisphærius, *with Descriptions of new Forms in the Collection of the British Museum.* By ARTHUR GARDINER BUTLER, F.L.S., F.Z.S., &c.

[Plate IV.]

THE beautiful little genus of Fulgoridæ known by the name of *Hemisphœrius* is particularly interesting, from its general resemblance to the Coleopterous genus *Coccinella*; this similarity is best exemplified in *H. flavimacula*, *H. cruentatus*, and *H. flavus*, all of which, to an inexperienced eye, might pass for ladybirds.

Of the forty-two species now known to science, the types of no less than thirty-four are in the Museum collection, whilst we possess at the same time four other described forms, thus showing a deficiency of only four of the species hitherto named by naturalists. Under these favourable circumstances I thought it would be well to give a list of the species, separating them into sections by the colouring of their tegmina (rather than by structural characters), in order to their easier determination by fellow workers in the group. I am at the same time fully aware that this arrangement of the species is not a natural one; but I employ it as being a ready guide in the identification of the species.

I. *Tegmina red, with three yellow or green streaks on each side.*

1. *Hemisphœrius coccinelloides.* Pl. IV. fig. 2.

Issus coccinelloides, Burmeister, Meyen, Reise, Nova Acta Ph. Med. Soc. C. Leop. N. C. xvi. p. 305. n. 38, pl. 41. fig. 11 (1833).
Hemisphœrius coccinelloides, Schaum, Allg. Enc. Wissensch. Kunst. i. p. 51.

Hab. Philippines (*Wood & Cuming*). B.M.

II. *Tegmina piceous, with three testaceous streaks.*

2. *Hemisphœrius lunaris.*

Hemisphœrius lunaris, Walker, Journ. Linn. Soc. x. p. 132. n. 134 (1870).

Hab. New Guinea (*Wallace*). Type, B.M.

III. *Tegmina piceous, with two or three yellow streaks.*

3. *Hemisphœrius villicus.* Pl. IV. fig. 1.

Hemisphœrius villicus, Stål, Trans. Ent. Soc. ser. 3, i. p. 588. n. 9 (1863).

Hab. Mysol (*Wallace*). Type, B.M.

IV. *Tegmina clay-coloured, with two longitudinal green streaks.*

4. *Hemisphærius tæniatus.* Pl. IV. fig. 3.

Hemisphærius tæniatus, Stål, Trans. Ent. Soc. ser. 3, i. p. 587. n. 3 (1863).

Hab. Waigiou (*Wallace*). Type, B.M.

V. *Tegmina black, with two cream-coloured streaks.*

5. *Hemisphærius vittiger.* Pl. IV. fig. 4.

Hemisphærius vittiger, Stål, Trans. Ent. Soc. ser. 3, i. p. 586. n. 2 (1863).

Hab. Kaisa (*Wallace*). Type, B.M.

VI. *Tegmina black and castaneous, with yellow margins.*

6. *Hemisphærius pulcherrimus.* Pl. IV. fig. 5.

Hemisphærius pulcherrimus, Stål, Trans. Ent. Soc. ser. 3, i. p. 588. n. 10 (1863).

Hab. Batchian (*Wallace*). B.M.

7. *Hemisphærius submarginalis.* Pl. IV. fig. 7.

Hemisphærius submarginalis, Walker, Journ. Linn. Soc. x. p. 132. n. 135 (1870).

Hab. Gilolo (*Wallace*). Type, B.M.

Very like the preceding species, but broader.

VII. *Tegmina piceous, with narrow fulvous margins.*

8. *Hemisphærius nigrolineatus.* Pl. IV. fig. 6.

Hemisphærius nigrolineatus, Walker, Journ. Linn. Soc. x. p. 130. n. 129 (1870).

Hab. Mysol (*Wallace*). Type, B.M.

VIII. *Fulvous margins clouded, ill-defined.*

9. *Hemisphærius plagiatus.*

Hemisphærius plagiatus, Walker, Journ. Linn. Soc. x. p. 131. n. 131 (1870).

Hab. Sula (*Wallace*). Type, B.M.

IX. *Fulvous margins broad, well-defined.*

10. *Hemisphærius lativitta.* Pl. IV. fig. 8.

Hemisphærius lativitta, Walker, Journ. Linn. Soc. x. p. 130. n. 128 (1870).

Hab. Morty (*Wallace*). Type, B.M.

X. *Tegmina piceous, with yellow external margin.*

11. *Hemisphærius viduus.*

Hemisphærius viduus, Stål, Trans. Ent. Soc. ser. 3, i. p. 589. n. 11 (1863).

Hab. Mysol (*Wallace*). Type, B.M.

12. *Hemisphærius collaris.*

Hemisphærius collaris, Walker, Journ. Linn. Soc. x. p. 131. n. 133 (1870).

Hab. New Guinea (*Wallace*). Type, B.M.

13. *Hemisphærius latipes.*

Hemisphærius latipes, Stål, Trans. Ent. Soc. ser. 3, i. p. 588. n. 8 (1863).

Hab. Ceram. Coll. Stål.

14. *Hemisphærius dilatatus.* Pl. IV. fig. 9.

Hemisphærius dilatatus, Walker, Journ. Linn. Soc. x. p. 133. n. 137 (1870).

Hab. Flores (*Wallace*). Type, B.M.

XI. *Yellow marginal line leaving the costal edge of the tegmina long before reaching apex.*

15. *Hemisphærius subapicalis*, Walker, MS. Pl. IV. fig. 10.

Frons truncate, subconical, twice as broad in front as behind, as broad as long, nearly smooth; scutellum almost equilaterally triangular; tegmina rather narrow, not prominent in front, smooth and shining: frons black, with a transverse testaceous band at each end; collar testaceous; scutellum black, its apex testaceous; tegmina black, with costal stramineous line, which leaves the margin at basal fourth; abdomen brown, anus and margins of ventral segments ochreous; pectus testaceous; legs ochreous, femora of front pair scarlet, tibiæ of last pair tipped with black.

Length $5\frac{1}{2}$ millimetres.

Hab. Ceram and Dorey (*Wallace*). Type, B.M.

Variety. Frons with ochreous bands, collar ochreous; scutellum with central longitudinal ochreous line; tegmina with subcostal line ochreous at base, but castaneous from basal fourth to apex.

Hab. Amboina (*Wallace*). B.M.

16. *Hemisphærius pullatus.*

Hemisphærius pullatus, Stål, Trans. Ent. Soc. ser. 3, i. p. 587. n. 7 (1863).

Hab. Ceram. Coll. Stål.

This species, although it appears to have the sutural margin of the tegmina margined with testaceous, seems to belong to the same section with *H. subapicalis*.

XII. *Tegmina red, with external black submarginal band and yellow margin.*

17. *Hemisphærius contusus.* Pl. IV. fig. 11.

Hemisphærius contusus, Walker, List Homopt. Ins. ii. p. 378. n. 3 (1851).

Hab. Sula (*Wallace*). Type, B.M.

XIII. *Tegmina ochraceous, with broad black external border intersected longitudinally by a yellow line.*

18. *Hemisphærius circumcinctus.* Pl. IV. fig. 12.

Hemisphærius circumcinctus, Stål, Trans. Ent. Soc. ser. 3, i. p. 586. n. 1 (1863).

Hab. Mysol (*Wallace*). Type, B.M.

XIV. *Tegmina unicolorous, testaceous.*

19. *Hemisphærius chilocorides.*

Hemisphærius chilocorides, Walker, List Homopt. Ins. ii. p. 379. n. 4 (1851).

Hab. Hong Kong (*Bowring*). Type, B.M.

20. *Hemisphærius scymnoides.*

Hemisphærius scymnoides, Walker, Journ. Entom. i. p. 309 (1862).

Hab. Chentaboom, Siam (*Mouhot*). B.M.

21. *Hemisphærius torpidus.*

Hemisphærius torpidus, Walker, Journ. Linn. Soc. i. p. 155. n. 68 (1857).

Hab. Sarawak (*Wallace*). Type, B.M.

22. *Hemisphærius flavus*, Walker, MS.

General aspect and size of the preceding species, but opaque stramineous; the scutellum stramineous, with its anterior margin black; tegmina with black costal margin; abdomen ochraceous above; ventral surface purplish brown, segments margined with yellow.

Length 4 millimetres.

Hab. Mysol (*Wallace*). Type, B.M.

This species is more oval than the preceding.

XV. *Tegmina fulvous.*

23. *Hemisphærius rufovarius.*

Hemisphærius rufovarius, Walker, List Homopt. Ins., Suppl. p. 95 (1858).

Hab. Birmah (*Stevens*). Type, B.M.

24. *Hemisphærius bipustulatus.*

Hemisphærius bipustulatus, Walker, List Homopt. Ins., Suppl. p. 95 (1858).

Hab. Ceylon (*Cuming*). Type, B.M.

XVI. *Tegmina semitransparent, reddish or greenish.*

25. *Hemisphærius cassidoides.*

Hemisphærius cassidoides, Walker, Journ. Entom. p. 308 (1862).

Hab. Chentaboom, Siam (*Mouhot*). B.M.

XVII. *Tegmina uniformly green.*

26. *Hemisphærius viridis.*

Hemisphærius viridis, Walker, Journ. Linn. Soc. x. p. 133. n. 136 (1870).

Hab. Mysol (*Wallace*). Type, B.M.

XVIII. *Tegmina greenish testaceous, with a nearly perfect black ring on each side.*

27. *Hemisphærius signatus.* Pl. IV. fig. 13.

Hemisphærius signatus, Stål, Trans. Ent. Soc. ser. 3, i. p. 587. n. 4 (1863).

Hab. Batchian (*Wallace*). Type, B.M.

XIX. *Tegmina testaceous, with two irregular parallel transverse black lines.*

28. *Hemisphærius typicus.* Pl. IV. fig. 14.

Hemisphærius typicus, Walker, Journ. Linn. Soc. i. p. 155. n. 67 (1857).

Hab. Borneo (*Wallace*). Type, B.M.

XX. *Transverse bands piceous, very broad.*

29. *Hemisphærius fasciatus.* Pl. IV. fig. 15.

Hemisphærius fasciatus, Stål, Trans. Ent. Soc. ser. 3, i. p. 587. n. 6 (1863).

Hab. Mysol (*Wallace*). Type, B.M.

XXI. *Bands very slender, the upper one oblique.*

30. *Hemisphærius signifer.* Pl. IV. fig. 16.

Hemisphærius signifer, Walker, List Homopt. Ins. ii. p. 380. n. 5 (1851).

Hab. Hong Kong (*Bowring*). Type, B.M.

XXII. *Bands uniting behind and broad.*

31. *Hemisphærius dubius,* n. sp. Pl. IV. fig. 17.

Hemisphærius Schaumi, Walker, MS. (nec Stål).

Entire structure the same as in *H. bipustulatus*, of which it may be a variety; the frons is of the same fusiform shape, scarlet, with the margins and central ridge green; the head narrow, testaceous above; scutellum and basal margin of tegmina greenish testaceous; tegmina fulvous, with basal half of costal margin and apical margin edged with black; a broad sigmoidal black central band, and below it, connecting it with the inner margin, a mass of congregated black atoms; two or three brownish atoms towards the apex; venter creamy, with the anus and a broad transverse band black; legs reddish testaceous, longitudinally streaked with green and black at the knees.

Length 4½ millimetres.

Hab. Ceylon, Ramboddo (*Nietner*). Type, B.M.

I do not know how far the species of *Hemisphærius* are subject to variation; so far as I have seen they seem to be pretty constant; still, from the perfect identity in structure of this species with *H. bipustulatus*, I feel some doubt of its distinctness. The *H. Schaumi* of Stål is described as "dirty yellowish, with greenish yellow frons, a central red streak; hemelytra dirty subhyaline, the anterior part of costal margin black, and a small sutural black spot, two somewhat curved oblique submedian yellow lines: length 5, width 5 millimetres. Island of Taprobana." This may be another variety.

XXIII. *Brownish testaceous, with paler transverse irregular bands.*

32. *Hemisphærius cervinus.* Pl. IV. fig. 18.

Hemisphærius cervinus, Walker, Journ. Linn. Soc. x. p. 131. n. 130 (1870).

Hab. New Guinea (*Wallace*). Type, B.M.

33. *Hemisphærius Schaumi.*

Hemisphærius Schaumi, Stål, Œfvers. Kongl. Vetensk. Akad. Förhandl. xii. p. 191 (1855).

Hab. Ceylon.

Walker labelled an entirely distinct form in the Museum collection as this insect (see no. 31).

XXIV. *Tegmina darker or paler brown, spotted with yellow.*

34. *Hemisphærius flavimacula.* Pl. IV. fig. 19.

Hemisphærius flavimacula, Walker, List Homopt. Ins. ii. p. 378. n. 2 (1851).

Hab. Hong Kong (*Bowring*). Type, B.M.

XXV. *Tegmina piceous, with two irregular streaks on apical half and the apical margin testaceous.*

35. *Hemisphærius recurrens,* Walker, MS. Pl. IV. fig. 20.

Structure of *H. chilocorides*: frons rugulose, longer than wide, excavated above, gradually expanding downwards; lateral marginal ridge not prominent, punctured; head narrow; scutellum triangular, nearly equilateral, with central longitudinal and marginal ridges; tegmina with prominent shoulders, rugulose, semitransparent: body testaceous; tegmina piceous, apex, apical half of costal margin, a diffused subapical streak nearly parallel to the costa, and a straight transverse dash from the inner margin towards apex testaceous.

Length 6 millimetres.

Hab. Fowchowfoo, China (*G. T. Lay*). Type, B.M.

Evidently nearly allied to *H. chilocorides.*

XXVI. *Tegmina with four irregular streaks or spots, the apex and costal margin testaceous.*

36. *Hemisphærius variabilis,* n. sp. Pl. IV. fig. 21.

Allied to the preceding: frons longer, less excavated above, much smoother; scutellum much wider than long, without central ridge; tegmina much more rugose, shoulders much less prominent: body testaceous; tegmina piceous, with the base, apex, costal border, two ill-defined spots placed transversely on basal area, and two streaks (as in the preceding species) on apical area testaceous; the ground-colour towards the margins on apical half blackish; apical margin narrowly black.

Length 6 millimetres.

Var. Tegmina wholly testaceous.

Hab. Japan (*Fortune*). Type, B.M.

Var.? Smoother than the preceding, sordid testaceous, the pale testaceous markings obsolescent; two subcostal black spots towards apex of tegmina.

Hab. South Japan (*G. Lewis*). B.M.

XXVII. *Tegmina black, spotted with scarlet.*

37. *Hemisphærius cruentatus*, n. sp. Pl. IV. fig. 22.

Frons truncate-subconical, excavated at vertex, at its lower extremity nearly as wide as it is long, almost smooth; head rather broad, scutellum nearly equilaterally triangular; tegmina rather prominent at the shoulders, slightly rugulose, opaque: body scarlet, legs stramineous; tegmina black, shining, each with three large rounded scarlet spots, the largest almost in the centre, the second oval, on apical area, the smallest upon the centre of the sutural line and almost in a transverse line with the largest.

Length $4\frac{1}{2}$ millimetres.

Hab. —— ? (*from Mr. Saunders's collection*). Type, B.M.

This beautiful little species has more nearly the aspect of a *Coccinella* than any other member of the genus.

XXVIII. *Tegmina unicolorous, dark piceous, castaneous, or black.*

38. *Hemisphærius niger.*

Hemisphærius niger, Walker, Journ. Linn. Soc. i. p. 155. n. 66 (1857).

Hab. Malacca (*Wallace*). Type, B.M.

Walker gives no reason for inserting this species in his paper on Bornean Homoptera.

39. *Hemisphærius concolor.*

Hemisphærius concolor, Walker, Journ. Linn. Soc. x. p. 131. n. 132 (1870).

Hab. New Guinea (*Wallace*); Java (*E. India Company*). Type, B.M.

Very like the preceding species; but darker, with narrower head and much smoother tegmina. A small example of this species from Dorey has received from Mr. Walker the MS. name of *H. subconcolor*.

40. *Hemisphærius tristis.*

Hemisphærius tristis, Stål, Trans. Ent. Soc. ser. 3, i. p. 587. n. 5 (1863).

Hab. Batchian (*Wallace*). Type, B.M.

41. *Hemisphærius Walkeri*, n. sp.

Hemisphærius chilocoroides [sic, nec *chilocorides*], Walker, Journ. Entom. p. 308 (1862).

Hab. Siam.

This is not at all likely to be the male of Walker's Chinese species.

42. *Hemisphærius bacculinus*, n. sp.

Narrow, compressed, ovate; frons truncate, pyriform, transversely rugose at the sides and longitudinally depressed in the middle, nearly twice as long as broad; head rather wide; scutellum nearly equilaterally triangular; tegmina almost elliptical, appressed at the sides: frons piceous, paler on vertex; collar sordid testaceous; scutellum piceous; tegmina deep castaneous, paler at apex and at the extreme edge of the sutural margin; venter and legs testaceous.

Length 4 millimetres.

Hab. Borneo (*Wallace*). Type, B.M.

This species is even more compressed in appearance than *H. pulcherrimus*.

EXPLANATION OF PLATE IV.

The right tegmen of the following species is figured, to show the pattern.

Fig. 1. *Hemisphærius villicus*, Stål.
Fig. 2. —— *coccinelloides*, Burmeister.
Fig. 3. —— *tæniatus*, Stål.
Fig. 4. —— *vittiger*, Stål.
Fig. 5. —— *pulcherrimus*, Stål.
Fig. 6. —— *nigrolineatus*, Walker.
Fig. 7. —— *submarginalis*, Walker.
Fig. 8. —— *lativitta*, Walker.
Fig. 9. —— *dilatatus*, Walker.
Fig. 10. —— *subapicalis*, Walker.
Fig. 11. —— *contusus*, Walker.
Fig. 12. *Hemisphærius circumcinctus*, Stål.
Fig. 13. —— *signatus*, Stål.
Fig. 14. —— *typicus*, Walker.
Fig. 15. —— *fasciatus*, Stål.
Fig. 16. —— *signifer*, Walker.
Fig. 17. —— *dubius*, Butler.
Fig. 18. —— *cervinus*, Walker.
Fig. 19. —— *flavimacula*, Walker.
Fig. 20. —— *recurrens*, Walker.
Fig. 21. —— *variabilis*, Butler.
Fig. 22. —— *cruentatus*, Butler.

XI.—*On a Tertiary* Pleurotomaria. By FREDERICK M'COY, Professor of Natural Science in the University of Melbourne.

To the Editors of the Annals and Magazine of Natural History.

GENTLEMEN,

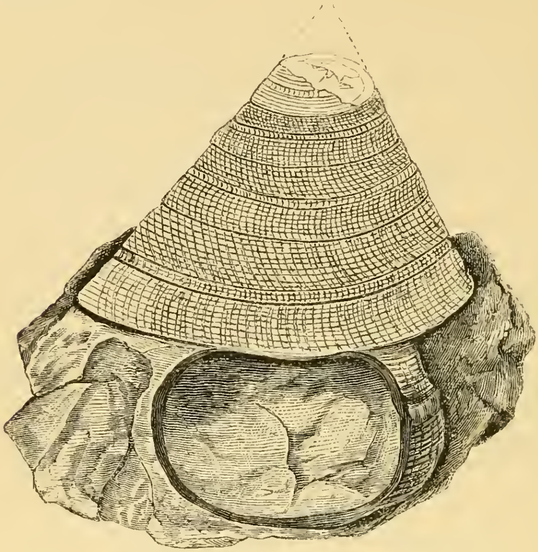
In former numbers of your Journal I have made known the existence in the Tertiary rocks of Victoria of three species of *Trigonia*, previously only known as an abundant Mesozoic genus, and represented by a few living species in Australasian seas, but, by its complete absence in the intervening Tertiary periods, forming a remarkable exception to the ordinary rule of the duration of a genus in time being always continuous. I have now the pleasure to announce a parallel discovery, which will, I have no doubt, be of interest to geologists and also to zoologists occupied with the general question of the duration of genera, as removing another conspicuous supposed exception to the general law.

The genus *Pleurotomaria*, like *Trigonia*, is a most abundant one in all the Mesozoic marine formations, but, like *Trigonia* also, has hitherto been remarkable for its sudden disappearance at the close of the Cretaceous period and being entirely absent in the well-searched Tertiary formations of Europe, Asia, and America, but reappearing in our recent seas, where it is represented by two excessively rare species.

I have recently found in a hard brownish or yellow limestone, which, from its other fossils, is undoubtedly of the Upper Miocene Tertiary age, a fine large species of *Pleurotomaria* almost intermediate in character between the two living ones, having the large size, more elevated spire, and more numerous and flatter whorls of the living *Pleurotomaria Adansoniana*, but the more nearly central band of the *P. Quoyana*, and having the close spiral thread, crossed by nearly equally prominent equidistant lines of growth. It differs from both in its more elevated acute spire, or much smaller apical angle, and more equal striæ. It may be characterized as follows:—

Pleurotomaria tertiaria (M'Coy).

Spec. char. Shell large, trochiform, apical angle 67°: whorls flat or very slightly convex; base moderately convex, with (?) a small umbilicus; band of moderate width, in the middle of each whorl, slightly depressed: surface with subequal prominent thread-like spiral striæ, rather less than their thickness apart (about ten or eleven above and the same number below the band), about three slightly smaller on the band, reticulated by arched striæ, narrower, but nearly as prominent, and slightly further apart than the spiral ones. Length about 2 inches 9 lines; proportional width $\frac{95}{100}$; length of last whorl $\frac{33}{100}$.



Pleurotomaria tertiaria, M'Coy.

Rare, in a hard yellowish limestone like lithographic stone, about 2 feet thick, interstratified with the upper part of a bed of older basalt about 100 feet thick, on east bank of Moorabool river, near Maude.

If this fossil had been found alone, or if the other fossils found with it had not proved the Upper Miocene Tertiary age of the stratum, it would in all probability deceive any geologist into the belief of its affording evidence of Oolitic strata at this place.

XII.—*A List of the Gasteropoda collected in Japanese Seas by Commander H. C. St. John, R.N.* By EDGAR A. SMITH, F.Z.S., Zoological Department, British Museum.

[Continued from vol. xv. p. 427.]

53. *Stylopsis rufo-fasciata*, sp. nov.

Testa subulata, elongata, lævis, nitida, sub epidermide tenui sordide albida alba, fasciis rufis ornata; anfractus circa 12 planiusculi, supremi 5–6 longitudinaliter plicati, omnes tenuissime obsolete spiraliter striati, sutura parum obliqua sejuncti; apertura ovata, superne acuminata, longitudinis totius $\frac{1}{4}$ paulo superans; columella aliquanto incrassata, rectiuscula, callo tenui labro juncta.
Long. 17 mill., diam. 5.
Var. Testa longe gracilior, epidermide flavida induta; anfr. 9–10.
Long. 12 mill., diam. $3\frac{1}{3}$.

Hab. East of Yesso, lat. 42° 52′ N., long. 144° 40′ E., 48 fathoms, sand and mud, temperature 37°–39°. Variety, Endermo Harbour, lat. 42° 20′ N., long. 141° 5′ E., 4–7 fathoms, sandy mud.

There are two reddish bands in the upper whorls, and three in the last, which are distinctly visible within the aperture.

Mr. A. Adams says that this genus "is most like *Syrnola*, but wanting the columellar fold." I have never seen a species of this genus; but the above remark of Adams applies exactly to this and the following species, so that probably they are rightly placed in this group.

54. *Trichotropis* (*Iphinoë*) *unicarinata*, Sow. Thesaurus Conch. iii. pl. 285. f. 10.

Hab. Yamada Harbour, 7 fathoms, bottom sand and broken shells.

The specimens of this rare shell dredged by Capt. St. John are 12 millims. long, and the upper part of the body-whorl 6 millims. in breadth. They are clothed with a thin horn-coloured epidermis, which is produced from the angle of the whorls in the form of little short spines.

55. *Trichotropis insignis*, Middendorff, Malacozool. Rossica, ii. p. 107, pl. x. f. 7, 8, 9; Thes. Conch. iii. pl. 285. f. 9.

Hab. Akishi, 3 to 4 fathoms.

56. *Hydrobia plicosa*, sp. nov.

Testa ovato-conica, fuscescens, infra suturam pallida; anfractus 6

convexiusculi, longitudinaliter subdistanter plicati, et liris spiralibus tenuibus costis interruptis ubique cincti, anfr. ultimus versus labrum pallidus; apertura ovata, superne leviter acuminata, longitudinis totius $\frac{3}{8}$ æquans; columella arcuata, aliquanto reflexa.
Long. 4 mill., diam. fere 2.

Hab. Avomori Bay, north of Niphon, in 7 fathoms.

The plications are about fifteen on a whorl, reaching from suture to suture in the upper whorls, and only to the middle of the last, and in some specimens they are entirely absent from it.

57. *Littorina grandis*, Middendorff, Malacozool. Ross. ii. p. 57.

Hab. Japan.

58. *Littorina brevicula*, Phil. Abbildungen, ii. pl. iii. f. 10; Conchol. Icon. x. f. 51 *a*, *b*.

Littorina balteata, Reeve, *l. c.* f. 71 *a*, *b*.
Littorina Souverbiana, Crosse, Journ. de Conch. 1862, x. p. 53, pl. i. f. 6, 7.

Hab. Endermo, Yesso.

Dr. Lischke, in his 'Japanische Meeres-Conchylien,' gives the above synonymy. After comparing the actual types of the two latter species in the National Collection with specimens of *brevicula*, I do not hesitate to say that *Souverbiana* is identical with the latter, and *balteata* but a slight variety of it.

59. *Planaxis sulcatus*, Born.

Buccinum sulcatum, Born, Mus. Vindobon. p. 258, pl. 10. f. 5, 6.
Planaxis buccinoides, Deshayes, Anim. s. Vert. ed. 2, ix. p. 237.
Var.=*Planaxis sulcata*, Lamarck, *l. c.* p. 236.
Var.=*Buccinum pyramidale*, Gmelin, Syst. Nat. p. 3488.
Var.=*Planaxis undulata*, Lamarck, *l. c.* p. 236.

Hab. Ooshima, on the shore.

60. *Lacuna unicarinata*, sp. nov.

Testa parva, umbilicata, cornea; anfractus 3, læves, primi duo parvi convexi, ultimus superne convexus, medio carina prominenti crassa cinctus, infra carinam aliquanto planatus; umbilicus mediocris, carina basi columellæ juncta circumdatus; columella tenuis, albida, paululum reflexa; apertura ovatiuscula.
Long. 3 mill., diam. vix 2.

Hab. On a littoral species of *Sargassum*, North Japan.

The whorls are smooth, with the exception of the very fine lines of growth. The keel encircling the body-whorl and that around the umbilical region are of a brownish colour.

61. *Diala simplex*, sp. nov.

Testa ovato-conica, lævis, polita, tenuis, rufo-cornea; anfractus $4\frac{1}{2}$ convexiusculi, superne infra suturam linea obscura marginati; apertura rotunde ovata, longitudinis totius circa $\frac{3}{7}$ æquans; columella rectiuscula.

Long. $2\frac{1}{3}$ mill., diam. $1\frac{1}{3}$.

Hab. Lat. 41° 12′ N., long. 140° 45′ E., in 43 fathoms, sand and mud.

This species is of a very simple structure. It has neither longitudinal nor transverse sculpture, and consequently may not belong to this genus; for Adams, in the 'Annals,' 1862, vol. x. p. 298, in characterizing the genus, says "transversim striata vel sulcata;" but, on the other hand, just below on the same page, he describes a species (*D. rufilabris*) which has smooth simple whorls.

62. *Diala tenuis*, sp. nov.

Testa ovato-conica, spira acuta, tenuis, pellucida, cornea, infra suturam maculis rufis ornata, interdumque lineis distantibus rufo-articulatis cincta; anfractus 6 convexiusculi, sutura subprofunda discreti, incrementi lineis tenuissime striati; apertura ovata, antice leviter effusa, longitudinis totius fere $\frac{1}{2}$ æquans; anfr. ultimus ad peripheriam obtusim angulatus; columella rectiuscula.

Long. 4 mill., diam. 2.

Hab. On a littoral species of *Sargassum*, North Japan.

The nearest ally of this species appears to be *O. inflata*, A. Adams, from O-Sima. It is very remarkable that all the numerous specimens of the present species which I have examined are covered with what, to an ordinary lens, appear to be minute grains of sand, but which I believe are the egg-capsules of something. Another peculiarity is that the majority of the examples have a very minute species of *Spirorbis* attached to them. In form it is very like *Litiopa melanostoma*.

63. *Cerithium* (*Vertagus*) *Kochi*, Philippi, Abbildungen, iii. *Cerithium*, pl. i. f. 3; Conch. Icon. f. 26, *a*, *b*.

Hab. Matoza Harbour, 6 fathoms, sand.

Philippi quotes "East Africa" as the habitat of this species; and there are examples in the Cumingian collection from "St. Nicolas, Island of Zebu, Philippine Islands, 4 fathoms, sandy mud (*H. Cuming*)." Most of the Japanese specimens are more highly coloured than Reeve's figure represents the species, many of the tubercles being brown.

64. *Cerithium* (*Vertagus*) *turritum*, Sowerby, Thes. Conchyl. vol. ii. *Cerithium*, pl. 180. f. 101; Conch. Icon. vol. xv. *Cerithium*, f. 88.

Hab. Ooshima harbour, 8 fathoms, sandy mud and broken shells.

The Japanese forms are larger than the types from the Philippine Islands, and of a darker colour. There is a whitish band below the suture, the rest of the whorls purplish brown, the nodules being yellowish; the aperture is brownish. The largest specimen is 25 millims. long and 6½ broad.

65. *Cerithium rugosum*, Wood; Kiener, Coq. Viv. pl. 15. f. 3.

Hab. Ooshima.

There is in the collection a very pretty variety of this species from the above locality. The ground-colour is ashy black, and the rows of nodules are connected by transverse lirations which are white, and likewise the nodules; those on the body-whorl are tinged with brown.

66. *Lampania zonalis*, Brug.; Kiener, Coq. Viv., *Cerithium*, pl. 8. f. 1; Reeve, Conch. Icon. vol. xv. pl. i. f. 5, *a*, *b*.

Hab. Ooshima.

There is one specimen only of a pretty variety of this species. It is of a greenish ash-colour, the spiral ribs being dotted with black; the white infrasutural zone has one orange liration around the middle of it.

67. *Triphoris corrugatus*, Hinds, Ann. & Mag. Nat. Hist. 1843, p. 18; Voyage 'Sulphur,' p. 29, pl. viii. f. 7.

Hab. Cape Sima, 18 fathoms, sand and broken shells.

68. *Triphoris conspersus*, sp. nov.

Triphoris conspersus, A. Adams, MS.

Testa parva, elongata, lateribus levissime convexis; anfractus circiter 16 granulorum seriebus tribus cincti (*suprema* albida, hic illic fusco-maculata, *mediana* quam cæteris longe tenuiore, albida, *infima* pallide violacea); sutura distincta, canaliculata; anfr. ultimus infra granula carinis tribus cinctus; apertura rotunde ovata; canalis brevis recurvus.

Long. 8½ mill., diam. 2.

Hab. Cape Sima, 18 fathoms, sand and broken shells.

This is a very pretty species, and appears to be undescribed hitherto, the above name being probably but a manuscript one attached to specimens in Cuming's collection.

69. *Turritella fascialis*, Menke; Reeve, Conch. Icon. 1849, v. f. 47.

Turritella gracillima, Gould, Proc. Bost. Soc. Nat. Hist. 1861, vol. vii. p. 386; Otia Conch. p. 140.

Hab. Goza Harbour, 6 fathoms, sandy mud.

There can be no doubt of the identity of Gould's species and that figured by Reeve, although the latter gives the west coast of Central America as the locality.

70. *Crepidula grandis*, Middendorff, Malacozool. Rossica, ii. p. 101, pl. xi. f. 8–10; Schrenck, Reisen im Amurl. p. 382.

Hab. Lat. 42° 58′ N., long. 145° 24′ E., at a depth of 48 fathoms, sand and stones; and at Akishi, Yesso, in 3 fathoms.

The Japanese specimens differ a little from those of more northern latitudes, as described by Middendorff, in being rather more rounded in form, perhaps a trifle more elevated, and brownish within.

71. *Nerita pica*, Gould, Otia Conch. p. 108.

Nerita japonica, Dunker, Malak. Bl. 1860, vol. vi. p. 233; Moll. Japon. p. 18, pl. ii. f. 23.
Neritina melaleuca, Martens, *l. c.* vol. vii. p. 52.

Hab. Ooshima.

The above synonymy, given by Lischke, 'Japan. Meeres-Conch.' p. 85, is, I think, quite correct.

72. *Globulus costatus*, Valenciennes; Kiener, Coq. Viv. *Rotella*, pl. ii. f. 5.

Hab. Endermo, Yesso.

73. *Buccinum mirandum*, sp. nov.

Testa ovata, crassa, perpallide roseo-fusca, maculis rufo-fuscis præsertim supra costas spirales irregulariter ornata, epidermide tenui fugaci pallide olivacea induta; anfractus 7, superne concavi et angulati, infra angulum concavi, longitudinaliter plicati, costis duabus spiralibus validis supra plicas nodosis cincti, spiraliter tenuiter sulcati, minutissimeque granoso-striati, infra suturam aliquanto rugosi; anfractus ultimus magnus, infra costis duabus validis nodosis, aliis 3–4 minoribus haud nodosis subæquidistantibus interrupte rufo-fuscis cinctus; apertura subovata, pallide fusco-lactea, longitudinis totius $\frac{1}{2}$ paulo superans; labrum parum expansum, ad carinas spirales sinuatum; columella tenuiter callosa, alba; canalis brevis, leviter recurvus.

Long. 53 mill., diam. 25; apertura long. 29 mill., diam. 16.

Operculum ovale, nucleo prope marginem sito, incrementi lineis striatum.

Hab. East Yesso, 11 fathoms.

The plications which produce nodules on the spiral elevations become almost obsolete on the last half of the body-whorl. The nodules number about ten on the penultimate whorl. The entire surface is spirally rather distantly striated, which is plainly visible to the naked eye, and also very minutely granosely striated, only apparent with the aid of a lens.

74. *Turbo* (*Marmorostoma*) *coronatus*, Gmelin.

Turbo coronatus, Gm. Syst. Nat. p. 3594; Chemnitz, Conch.-Cab. v. f. 1791–2 (corona reclusa); Reeve, Conch. Icon. iv. pl. v. f. 22; Kiener, Coq. Viv. pl. 12. f. 2, 2*a*.

Turbo reclusus, Chemnitz, and *Turbo spinosus*, Meuschen, fide Mörch, Yoldi Cat. p. 161.

Var. = *Turdo lugubris*, Reeve, *l. c.* f. 63.

Var. = *Turbo creniferus*, Kiener, *l. c.* pl. 34. f. 3–3*a*.

Var. *umbilicata* = *Turbo granulatus*, Gmelin, Syst. Nat. p. 3601; Chemnitz, *l. c.* fig. 1744–46; Kiener, *l. c.* pl. 28. f. 2.

Hab. Ooshima, on the shore (*St. John*); Port Natal (*Dr. Sutherland and J. Sanderson*).

After a careful study of this species, I do not feel justified in separating *T. coronatus* and *granulatus*, the former being the non-umbilicated and the latter the umbilicated variety. Usually the tubercles are much more strongly developed in the typical form; but in the large series in the Museum collection there are examples of both varieties which have the style of tuberculation identically the same, and differ only in the presence or absence of the perforation.

Lischke, in his 'Japanische Meeres-Conchylien,' p. 88, states that *T. coronatus* has only three principal series of elevations, whereas *T. granulatus* has four. But this only applies to the typical forms of both varieties; for there are some examples of the former with the lower series of nodules (that is, the one which encircles the body-whorl a little below the middle) very slightly developed or even entirely wanting; and, on the other hand, other specimens (*T. granulatus*, "var. *minor imperforata*" of Lischke, *l. c.*) have four principal series of nodules well developed.

Also with *T. granulatus* are found specimens having two, three, or four most prominent series. All specimens of every variety agree in having a scarlet apex, which is finely perforated; and down this perforation a fine pin can be thrust some considerable distance in the non-umbilicated forms, and completely through some specimens which possess the umbilicus.

75. *Turbo* (*Collonia*) *amussitatus*, Gould.

Turbo amussitata, Gould, Proc. Boston Soc. Nat. Hist. viii. 1861; 'Otia,' p. 160.
Collonia rubra, A. Adams, MS. in Mus. Cuming.
Turbo sangarensis, Schrenck, Bull. Acad. Sci. St. Pétersb. iv. p. 409; Reisen im Amurlande, p. 363, pl. xvi. f. 6–11.
Var. = *Turbo pumilo*, Schrenck, Bull. &c. p. 410; Reisen, p. 363.

Hab. Endermo Harbour, 4–7 fathoms, sandy mud; and lat. 41° 12′ N., long. 145° 45′ E., 43 fathoms, sand and mud.

A variety from Yamada Harbour, 7 fathoms, sand and broken shells.

76. *Turbo* (*Collonia*) *nocturnus*, Gould, Otia Conch. p. 160.

Testa ovato-conica, sordide albida vel fuscescenti-alba, liris fusco irregulariter punctatis ornata, imperforata; anfractus 5, convexi, sutura subprofunda discreti, liris spiralibus (in penult. 6–7, quarum infimis 3 sæpe quam cæteris crassioribus) cincti, anfr. ultimus infra paululum planulatus liris circiter 18 (quarum 4 circa medium frequenter quam cæteris majoribus, iis supra basim tenuissimis) ornatus; apertura circularis, margaritacea; columella alba, incrassata, medio unituberculata; operculum leviter concavum, fusco marginatum, sub microscopio minutissime corrugatum, ad marginem unisulcatum.
Long. $6\frac{1}{2}$ mill., diam. 5.

Hab. Lat. 41° 12′ N., long. 140° 45′ E., 43 fathoms, sand and mud.

Great care must be taken not to confound specimens of this species without opercula with *Trochus* (*Gibbula*) *yamadanus*; for the form, style of coloration, and general aspect are very similar. Nevertheless the absence of an umbilicus and the coarser spiral ribbing at once distinguish this species.

A variety from Yamada Harbour is almost entirely of a uniform purplish brown colour, only faint indications of the articulated dotting existing. A specimen in the Cumingian collection is encircled at the periphery with a plain white band.

77. *Liotia semiclathratula*, var., Schrenck.

Liotia semiclathratula, Schrenck, Bull. Acad. Sci. St. Pétersb. iv. p. 410; Reisen im Amurlande, p. 370, pl. xvi. f. 16–25.

Hab. Toba Harbour, lat. 34° 30′ N., long. 136° 50′ E., at a depth of 9 fathoms, among sand and broken shells.

The single specimen which appears to belong to this species is a dead shell. It differs from the typical form in having the longitudinal lirations produced beyond the periphery of the body-whorl (except towards the labrum) to the umbilicus, and giving the base of the shell the same cancellated aspect as the upper parts.

78. *Trochus rota*, Dunker.

Trochus rota, Dunker, Malak. Bl. 1860, vol. vi. p. 238; Moll. Japonica, p. 21, pl. iii. f. 4; Lischke, Japan. Meer.-Conch. pl. vi. f. 20, 21.
Polydonta gloriosum, Gould, Otia Conch. p. 158.

Hab. Ooshima.

A single young specimen which I have identified with this species has the spiral lirations of the base, which is white, dotted with pink. Dunker does not mention the colour of this part of the shell. *T. bicrenatus*, Gould (syn. *histrio*, Reeve), is very similar in general aspect.

79. *Trochus* (*Gibbula*) *fulgens*, Gould, Otia Conch. p. 160.

Trochus iridescens, Schrenck, Reisen im Amurlande, p. 356, pl. xv. f. 19–24.

Hab. Off Cape Blunt, lat. 41° 41′ N., long. 141° E., 35 fathoms.

In one of the specimens which I associate with this species the three principal keels on the body-whorl are articulated with brownish purple and whitish dots; and below the suture there are some short brownish-purple flammulations. Schrenck mentions this articulated painting on p. 357, but not in the diagnosis on the preceding page.

80. *Trochus* (*Gibbula*) *japonicus*, sp. nov.

Trochus japonicus, A. Adams, MS. in Mus. Cuming.

Testa late breviterque conica, valde perforata, albida maculis punctisque fuscis variegata, ad basim alba; anfractus 6, planiusculi, liris spiralibus granosis (infima in sutura profunda sita) cincti, et striis obliquis insculpti; anfr. ultimus supra leviter convexiusculus, medio acute angulatus et carinatus, infra carinam planus, lirisque circularibus granularibus circiter 13 (una circa umbilicum quam cæteris majore); umbilicus profundus, usque ad apicem attingens, lævis; apertura oblique subquadrata, intus margaritacea; columella leviter incrassata, callo tenui labro juncta.

Diam. max. 8 mill., diam. min. 7, alt. 5.

Hab. Gulf of Yado, lat. 35° 35′ N., long. 139° 48′ E., 6 to 25 fathoms, soft mud and hard sand.

The keel which encircles the body-whorl runs up the spire in the deep suture. Within the umbilicus, and adjacent to the large granular liration which surrounds it, there is another, but much finer one.

81. *Trochus* (*Gibbula*) *yamadanus*, sp. nov.

Testa ovato-conica, sordide albida, liris lilaceo-fusco aliquanto flammulatim tessellatis picta, leviter perforata; anfractus 5, convexi, sutura subprofunda sejuncti, liris tenuibus spiralibus lilaceo-fusco articulatis (in anfr. penultimo 5–6, in ultimo circiter 20) succincti, hic illic incrementi lineis obliquis insculpti; apertura circularis, longitudinis totius $\frac{1}{2}$ æquans, margaritacea; columella paululum incrassata, labro callo tenui juncta.

Operculum corneum.

Long. 6 mill., diam. $4\frac{1}{2}$.

Hab. Yamada Harbour, lat. 39° 32′ N., long. 141° 53′ E., 7 fathoms, sand and broken shells.

The elongate brownish-lilac spots on the lirations are situated somewhat irregularly underneath each other, so as to form flammulations.

82. *Trochus* (*Gibbula*) *corallinus*, sp. nov.

Testa corallino-rubra, minima, orbicularis, depressiuscula, profunde sed anguste umbilicata; anfractus 4, convexi, liris spiralibus confertis subgranulosis (in anfr. superioribus 4–5, in ultimo circiter 20) cincti, striisque oblique longitudinalibus distantibus insculpti; umbilicus profundus, lira magna, striis longitudinalibus transversim sulcata, succinctus; apertura circularis, intus tenuiter margaritacea.

Diam. max. 3, diam. min. $2\frac{1}{2}$, axis $2\frac{1}{2}$.

Hab. Japan.

This is a very pretty little shell with convex whorls, which are spirally striated, the interstitial lirations being somewhat granulous. This appearance is produced by their being cut across by rather distant striations.

83. *Trochus* (*Gibbula*) *redimitus*, Gould, Otia Conch. p. 159.

Testa depressa, orbicularis, anguste perforata, viridi-margaritacea, prismatica, liris spiralibus nigro articulatis ornata, ad apicem alba; anfractus $4\frac{1}{2}$, convexiusculi, liris vel potius carinis 3–4 (in anfr. ultimo circiter 12, iis infra medium quam cæteris tenuioribus) succincti; umbilicus albus, parvus; apertura magna, circularis, margaritacea; columella alba, supra umbilicum aliquanto reflexa, labro callo tenui juncta.

Operculum corneum.

Diam. max. 4 mill., diam. min. $3\frac{1}{3}$, axis $3\frac{2}{3}$.

Hab. Lat. 41° 12′ N., long. 140° 45′ E., in 43 fathoms, bottom sand and mud.

This very pretty species is at once recognized by its green pearly surface and the black-dotted spiral keels. The above description shows that this species varies as regards form and the perforation.

84. *Trochus* (*Chlorostoma*) *turbinatus*, A. Adams, Proc. Zool. Soc. 1851, p. 182.

Chlorostoma rugatum, Gould, Proc. Bost. Soc. Nat. Hist. 1861, vol. viii. p. 20; Otia Conch. p. 158.

Hab. Toba, South Niphon.

The only difference I can observe between Gould's species and that described by Adams is, that the base of the former is more finely spirally lirated than that of the latter, which has only five or six strong lirations.

85. *Trochus* (*Chlorostoma*) *subfuscescens*, Schrenck, Reisen im Amurlande, p. 350, pl. xv. f. 3–10.

Hab. Ooshima and Endermo, Yesso.

86. *Trochus* (*Chlorostoma*) *xanthostigma*, A. Adams, Proc. Zool. Soc. 1851, p. 183.

Trochus nigricolor, Dunker, Moll. Japon. p. 22, pl. iii. f. 2; Lischke, Japan. Meer.-Conch. pl. vii. f. 1, 2.

Hab. Ooshima, on the shore.

Although Mr. Adams does not state in whose collection the type of this species is, in all probability it belongs to the Cumingian, where several specimens are labelled "*xanthostigma*," one of which suits the description very well with regard to the "basi concentrice lirato luteo-carneolo; regione umbilicali callo luteo obtecta." In the remaining specimens the umbilical callosity is of a greenish colour, and the basal spiral lirations are almost obsolete.

87. *Dentalium sexcostatum*, Sowerby, Thes. Conch. vol. iii. pl. 223. f. 11.

Hab. Cape Sima, 18 fathoms, bottom sand and broken shells; Goza Harbour, 6 fathoms, sandy mud.

This fine species, the habitat of which has not been recorded previously, is closely allied to, if not identical with, *D. hexagonum*, Gould, from Hong Kong. The chief difference in the latter species appears to be the lack of sculpture between the angles, and the slightly narrower form.

88. *Dentalium octogonum*, Lamarck; Sow. Thes. Conch. vol. iii. pl. 223. f. 9.

Hab. Matoza Harbour, 6 fathoms, sand; Ooshima Harbour, 8 fathoms; and lat. 35° 7′ N., long. 136° 55′ E., 3 fathoms.

89. *Dentalium semipolitum*, Sowerby, Thes. Conch. vol. iii. pl. 224. f. 23.

Hab. Cape Sima, 18 fathoms; Matoza Harbour, 6 fathoms.

90. *Cylichna pertenuis*, sp. nov.

Testa parva, leviter umbilicata, tenuissima, sordide albida, pyriformi-cylindracea, ad verticem exigue perforata, parum nitida, longitudinaliter tenuissime et confertissime arcuatim striata; apertura superne perangusta, super verticem leviter producta, ad basim dilatata; columella rectiuscula, aliquanto incrassata, versus umbilicum paululum reflexa.
Long. $3\frac{1}{2}$, diam. fere 2 mill.

Hab. Lat. 42° 52′ N., long. 144° 40′ E., in 48 fathoms, sand and mud; temperature 37° to 39°.

The longitudinal striation is very minute, and only visible under a powerful lens. The form is scarcely sufficiently pyriform to warrant me in placing this species in the subgenus *Sao*.

91. *Cylichna concinna*, A. Adams, Thes. Conch. vol. ii. p. 593, pl. 125. f. 142.

Hab. Matoza Harbour, 6 fathoms, sand.

A single specimen, agreeing in every particular with the type of this species, with which it has been compared, measures 9 millims. in length, $3\frac{2}{3}$ in width.

92. *Volvula angustata*, A. Adams, Thes. Conch. vol. ii. p. 596, pl. 125. f. 153.

Hab. Endermo Harbour, 4 to 7 fathoms.

This species is described by Adams from a specimen from the Philippine Islands.

93. *Haminea grisea*, sp. nov.

Testa breviter cylindracea, superne subplanata, inferne rotundata, tenuis, imperforata, sub epidermide tenui grisea cæruleo-alba, versus apicem luteo tincta, nitida, spiraliter minutissime et confertissime striata, incrementi lineis arcuatis obsolete decussata; apertura superne angusta, super verticem vix producta, basi dilatata; columella oblique subtortuosa; labrum tenue, verticis medio junctum ibique incrassatum.

Long. 6, diam. 3 mill.

Hab. The same as *Cylichna pertenuis*.

H. corticata, Möller, is the nearest ally of this species; but the lateral outlines of that species are more convex, and the epidermis is of a more yellow colour. In *H. grisea* the columellar portion of the body-whorl is of a yellowish colour, and the termination of the slightly olive-grey epidermis is defined by a blackish edge.

94. *Atys porcellana*, Gould, Proc. Bost. Soc. Nat. Hist. 1859, vol. vii. p. 138; Otia Conch. p. 111.

Hab. Matoza Harbour, 6 fathoms, sand.

A single specimen, which I refer to this species, is 12½ millims. long and 6 broad. It is clothed with a very thin, pale horn-coloured epidermis.

95. *Patella nigrolineata*, Reeve, Conch. Icon. vol. viii. pl. 18. f. 43, *a*, *b*; Lischke, Japan. Meeres-Conch. pl. viii. f. 5–11.

Hab. Toba, south-east of the island Niphon.

This is the first time that this species has been recorded from the eastern shores of Japan. Only a single example was brought, which is the variety *b*, admirably figured in Dr. Lischke's excellent work, figs. 7 & 8.

96. *Patella pallida*, Gould, Proc. Boston Soc. Nat. Hist. 1859, vii.; Otia Conch. p. 115.

Hab. Yamada Harbour, lat. 39° 32′ N., long. 141° 53′ E., 7 fathoms, sand with broken shells.

Two specimens from the above locality, measuring 16 millims. long, 13 broad, and 7 high.

There are two other specimens of *Patella* in the collection, belonging to distinct species—the one from Nemero, East Yesso, and the other from Endermo—but in such a condition as to defy identification.

97. *Chiton* (*Lepidopleurus*) *Albrechti*, Schrenck, Reisen im Amurlande, p. 283, pl. xiii. f. 7–17.

Lepidopleurus granifilosus, Carpenter, MS. in Coll. Cuming.

Hab. Endermo Harbour.

The two fine Chitons, which may possibly be a very large variety of this species, are about 65 millims. long, and the central valves 28 broad. They appear to differ somewhat in the lirations on the lateral areas not being granulated, and all the valves being distantly concentrically sulcated.

98. *Cryptochiton Stelleri*, Middendorff, Bull. Acad. St. Pétersb. vol. vi. p. 116; Malacozool. Rossica, p. 93, pl. i. figs. 1, 2.

Chiton amiculatus, Sowerby. *C. sitkensis*, Reeve. *C. chlamys*, Reeve.

Hab. Endermo Harbour, south of Jesso.

There is a handsome specimen of this species from the above locality. It is of small size, about 3 inches in length; and the dorsal surface is completely clothed with the closely packed stars of spicules, which are mostly of a bright rust-red colour, but here and there are small patches of a greenish tint.

XIII.—*Descriptions of three additional Species of Crustacea from Kerguelen's Land and Crozet Island, with Remarks upon the Genus* Paramœra. By Edward J. Miers, Zoological Department, British Museum.

The following species of Crustacea from Kerguelen's Land and Crozet Island, in the collection of the British Museum, appear to be undescribed. The examination of a larger series of specimens enables me to correct an error into which I had fallen with regard to the genus *Paramœra* (see 'Annals' for July, p. 75).

Æga semicarinata, n. sp.

Elongate ovate, moderately convex, punctate, except upon the anterior half of each of the segments of the pereion; the punctures become larger and more numerous upon the segments of the pleon, especially upon the last segment. Eyes large, placed laterally. Each of the seven segments of the pereion with a faint impressed transverse line crossing it at about the middle; the sixth segment the largest. Coxæ somewhat acute and produced posteriorly, and marked with two oblique raised lines. Pleon composed of six segments, of which five are very short and subequal; the sixth and last about three fourths as long as broad at the base, with the sides converging posteriorly, truncate and slightly emarginate at the extremity, with a somewhat obscure, smooth, central longitudinal carina, which terminates before reaching the posterior margin, and a slight depression on either side of it near the base of the segment. Rami of the lateral appendages ciliate, not reaching to the extremity of the segment, subequal; the outer suboval and rounded at the extremity, the inner triangular, with the extremity broad and truncate.

Length of largest specimen $2\frac{1}{4}$ inches.

Hab. Kerguelen's Land (*coll. Brit. Mus.*).

This species resembles *Æga serripes*, M.-Edw., from the South Seas, in its truncate caudal segment, but differs in having the posterior margin of the thighs entire, and in the caudal appendages being shorter than the segment and not reaching to its posterior margin.

Serolis septemcarinata, n. sp.

Serolis quadricarinata, White, List Crust. Brit. Mus. p. 106, sine descr. (1847).

Depressed and rugose, especially towards the lateral margins of the segments. Segments of the pereion acute at the posterior angle; the fifth and sixth segments and the penultimate segment of the pleon produced backward, so that the extremity of the penultimate segment projects considerably beyond the base of the terminal segment of the pleon. Terminal segment of the pleon narrowed posteriorly, with the sides slightly concave, with a shallow emargination at its extremity, and with three straight longitudinal carinæ on either side of the central carina, the two inner of which are somewhat thickened posteriorly and terminate before reaching the margin of the segment. Rami of the lateral appendages of the pleon short, subacute at the extremity, the inner rather larger than the outer.

Length of largest specimen $\frac{1}{2}$ inch.

Hab. Crozet Island (*Lieut. A. Smith, R.N.*, Brit. Mus.).

The two inner of the lateral ridges on the last segment, on each side of the central carina, are more prominent than the rest, on which account probably White named this species *S. quadricarinata.*

Atylus australis.

Paramœra australis, Miers, Ann. & Mag. Nat. Hist. ser. 4, xvi. p. 75 (July 1875).

In the 'Annals' for July I established for this species a new genus, *Paramœra*, allied to *Melita* in having the inner branch of the caudal appendages short or rudimentary, but differing from it in the absence of a secondary appendage to the superior antennæ. The examination of a series of younger specimens has shown that the rami of the caudal appendages are in reality equally developed; but the inner ramus of the last pair, being very loosely articulated with the base, is frequently detached; this is the case with the two adult specimens in the collection brought home by the Rev. A. E. Eaton.

The species must now be referred to the genus *Atylus*, and is most nearly allied to *Atylus fissicauda* from Valparaiso (*Iphimedia fissicauda*, Dana, U.S. Explor. Exped., Crust. p. 929, pl. lxiii. fig. 4). It resembles that species in having reniform eyes and each lobe of the telson emarginate; but differs as follows: the telson is much longer, each lobe is somewhat narrowed to the apex, with the emargination very small and placed a little laterally; the gnathopoda are subequal; the fourth segment of the pleon is somewhat produced backward over the fifth, with the posterior margin straight; and the infero-posterior angles of all the segments of the pleon are rounded, not acute as in *Atylus fissicauda.*

The name *Paramœra* must still be retained for Dana's *Melita tenuicornis*, from New Zealand, unless it should prove that this species is also mutilated in the way above described.

Melita Fresnelii (Audouin) is probably incorrectly figured with exappendiculate superior antennæ.

Nymphon brevicaudatum, n. sp.

First (mandibular) pair of palpiform appendages well developed, three-jointed, terminating in slender chelæ. The seventh (first tarsal) and eighth (second tarsal) joints of the legs straight, subequal, very slender. Abdomen terminating posteriorly in a short process.

Length of body $\frac{1}{4}$ inch.

Hab. Kerguelen's Land (*Admiralty*, Brit. Mus.).

This species resembles *Nymphon styligerum*, described in my former paper, in all particulars except the foregoing. The specimens are nearly all females with ova, and are of much larger size than the two specimens of *N. styligerum.*

XIV.—*Description of a new Species of* Solenella *from South Patagonia.* By EDGAR A. SMITH, F.Z.S.

THE following species was collected by Dr. Robert O. Cunningham, the naturalist, during the cruise of H.M.S. 'Nassau,' under the command of Captain R. C. Mayne, R.N., who was sent to survey the Straits of Magellan in 1866. He dredged it at the Otter Islands, which are situated in a channel which branches northward from the Straits to the west of King William IV.'s Land and east of Queen Adelaide's archipelago. In his book entitled the 'Natural History of the Straits of Magellan,' p. 448, this species is mentioned as a *Yoldia*; but this no doubt arose from the circumstance that the specimens were only cursorily examined, for of course the presence of the external ligament at once distinguishes them from that genus. All the specimens, collected and excellently preserved by Dr. Cunningham, have been presented to the British Museum by the Admiralty.

Solenella magellanica, sp. nov.

Testa subelliptica, postice acuminata, mediocriter ventricosa, leviter inæquilateralis, epidermide politissima, flavicante seu olivaceo-flava amicta, intus alba, porcellana, incrementi lineis concentricis parum rugosis et striis ab umbonibus radiantibus tenuibus antice (interdum utrinque) sculpta; margo dorsalis utrinque declivis, antice curvatus, postice prope umbones aliquanto excavatus, deinde rectiusculus; ventralis fere regulariter, sed parum, arcuatus; latus anticum brevius subacuminate rotundatum, posticum subbreviter rostratum, superne leviter excavatum; ligamentum olivaceo-nigrum, subelongatum; dentes antici 10, postici circiter 25; pallii impressio lata profunda.

Diam. longit. 19 mill., diam. transversa 35, crass. 11.

In one very old and much thickened specimen the epidermis is of an olive colour, but in all the others it is yellowish. From the umbones to the end of the acuminate end there runs a faint keel, at a little distance from the dorsal margin, and between it and the margin the valves are slightly excavated. The epidermis, as is usual in species of *Solenella*, is reflexed slightly within the shell. The interior displays no trace of iridescence, but is thickened with a white porcellaneous deposit; and it is curious that the two most adult specimens have small pearls of this texture adhering to the centre of each valve.

As a guide to the form of this species, I may mention that the figure of *Yoldia Woodwardi* in the 'Thesaurus Conchyliorum,' vol. iii. pl. 226. f. 22, gives a very fair idea of it, except that the umbo is situated too near the acuminate end.

XV.—*On the Embryogeny of* Lamellaria perspicua. By M. A. Giard*.

The recent researches on the embryogeny of the Pectinibranchiate Gasteropods relate to a very small number of types—*Paludina vivipara* (Leydig), *Calyptræa sinensis* (Stefanoff and Salensky), and *Purpura lapillus* (Selenka). It was not, therefore, useless to undertake the study of the development of a sufficiently abnormal group, that of the Sigaretidæ.

Lamellaria perspicua lays its eggs at Wimereux during the months of February and March. This mollusk hollows out its nest in the colonies of the compound Ascidia, from which it derives its nourishment (*Leptoclinum maculosum* and *Polyclinum succineum*). The nest has been seen and described by Hennedy and Peach. I will only add that the transparent operculum, which closes it, presents circular and concentric striæ, indicating that the female turns on herself during oviposition, as also do a large number of nudibranchiate mollusks. Each capsule contains, besides the normal eggs, a certain number of rudimentary eggs, which serve at a later period for the nourishment of the embryo. The ovarian egg presents a vitelline membrane; the deposited egg is quite destitute of it. Its contents are formed chiefly of fatty globules, which do not allow one to see the germinal vesicle. Just as segmentation is about to commence, a spot of a dull white colour appears at the surface of the egg, to disappear soon after. The egress of the polar corpuscles could not be observed.

The egg separates into two parts, of which the largest divides in its turn into two and then into three. We have thus four spheres—namely, a large one (the still undivided primitive sphere) and three small ones. These four spheres are not arranged in a cross, but in a tetrahedron, like four cannonballs forming a pile. In the portion situated between the points of contact of the four spheres, each of them gives birth

* Translated by W. S. Dallas, F.L.S., from the 'Comptes Rendus,' 22nd March, 1875, p. 736.

to a much smaller cell, with finely granular protoplasm. Thus is effected the separation of the plastic vitellus from the nutritive vitellus. The plastic spherules have a nucleus and a nucleolus, and they soon multiply rapidly; while the number of large nutritive spheres augments, on the contrary, with extreme slowness. The plastic spherules not only form a mass at one point of the egg, as has been already described and figured in *Vermetus*, but they invade and cover up all the nutritive vitellus, forming the ectoderm. The nutritive spheres, the division of which takes place less rapidly, give origin to the endoderm. All this process resembles very closely that which has been observed in certain worms (for example in *Euaxes*) by Kowalevsky.

After segmentation the first modification that takes place is a thickening of the ectoderm, at a point near that where this lamella finally closes (*prostoma*). This thickening becomes covered with vibratile cilia and hollowed by a cavity (cephalic vesicle). At the same time the definitive mouth is formed by an invagination of the ectoderm situated on the anterior third of the embryo, below the cephalic vesicle. The cephalic expansion soon divides into three lobes, a median and two lateral lobes, forming a sort of trefoil open below where the buccal opening is situated. The median lobe is covered with very fine vibratile cilia; the lateral lobes are bordered by a row of large cylindrical cells provided with much longer cilia. The embryo turns rapidly on itself in the mucus which fills the nest. It absorbs the rudimentary eggs, and, even under the microscope, the matters proceeding from the diffluence of the neighbouring embryos. Some cells detach themselves from the ectodermic lamella in the median lobe, and emit processes which unite them on the one hand to this lamella and on the other to the œsophageal invagination. This is the first rudiment of the middle lamella that will produce the vascular system.

The lateral lobes soon become considerably developed, and unite to form an irregularly quadrangular ciliated collar, of which the lateral parts become forked and are formed at a later period into elegantly pigmented vela. No traces of tentacles are to be seen.

The foot is derived from a thickening of the ectoderm situated under the mouth; this thickening is ciliated at its free extremity. The nervous system appears under the form of an inflation of the ectoderm situated on each side at the point of junction of the lateral lobes with the cephalic vesicle; the two inflations afterwards approach the median line and are united by a commissure which becomes shorter and shorter. The eyes are formed at the inferior angle of these inflations, at the expense of the ectoderm; their development progresses *pari passu* with that of the subœsophageal nervous centres; at the time of hatching they enclose two refractive vesicles. The otocysts appear at the base of the foot at the time of the formation of the latter, and before the existence of any nervous organ; their wall is composed of very small cells belonging to the ectoderm.

As soon as the stomach is differentiated at the expense of the endoderm, its cavity and the lumen of the œsophagus are lined with very delicate vibratile cilia. At the same stage we see, on the right side of the embryo, a rounded mass of large cells, which will form the kidney. The residue of the endodermic spheres not differentiated is pressed back to the lower extremity of the embryo, and gives origin, not to the liver, which originates from the stomach, but probably to the genital organs. I have not been able to follow the formation of these last organs or of the anal gland, which is much developed in the adult *Lamellaria*.

The cavity of the mantle is formed by a very rapid development of the secretory pad of the shell. The pallial contour is pigmented with brown and yellow. The dorsal part of the mantle is finely ciliated. Above the digestive tube and along the lower part of the foot we find some contractile sinuses, the first indications of a circulatory system.

The preconchylian invagination, the general importance of which in the Mollusca was first pointed out by Ray Lankester, is not so strongly marked in *Lamellaria* as in certain nudibranchs (*Dendronotus arborescens*, *Goniodoris nodosa*) in which I have had the opportunity of observing it. We see in the lower part of the embryo, at that stage when the cephalic vesicle begins to be differentiated, the ectoderm become hollow very slowly and leave a thin cuticle free, which is the rudiment of the first shell. The cushion which borders this invagination ascends by degrees along the embryo, in the same way as a wave of liquid propagates itself, at the same time that the bottom of the invagination resumes its original form and position. The thickness of the cushion keeps the embryo away from the shell; and the ectodermic cells continuing their secretion, a second shell is formed inside the first, but closely applied to the body of the embryo. The first shell is of a nautiloid form, and presents two dorsal and two lateral keels; it resembles the shell of *Atlanta*. The second shell is more simple, and resembles in its appearance that of *Carinaria*, or of the embryos of the Nudibranchs. These two shells are united at their apertures by means of a very thin membrane. They have the same relations to each other and the same relative signification as the nauplian cuticle of the embryos of the Cirripedes and the carapace of the *Archizoëa* enclosed under that cuticle. I do not think that the second shell is the origin of the calcareous shell of the adult *Lamellaria*. I have been unable to ascertain this fact by direct observation; for the nautiloid embryos, after having swum some days in the aquariums, die without undergoing any other transformation.

The embryogeny of *Lamellaria* takes considerable time for its accomplishment (two or three weeks). The larvæ break down with great rapidity when they are removed from the mucus which bathes them. Nitric acid has been of great service to me in these delicate researches.

XVI.—*Description of a very large Species of* Scotophilus *from Western Africa.* By G. E. Dobson, M.A., M.B.

Scotophilus gigas, n. sp.

Ear-conch and tragus like those of *S. borbonicus*, Geoffr.; but the internal basal lobe of the ear is more rounded and its inferior horizontal margin is straight, not in the least degree concave; the upper third of the outer margin of the conch is slightly but distinctly concave; and the tragus has the narrow ridge, proceeding from the base of its inner margin across its front margin, as well developed as in *S. Temminckii*.

Wings to the metatarsus near the base of the toes; last two caudal vertebræ and half the third last vertebra free.

Fur above deep chestnut, beneath yellowish white. The fur on the upper surface is short and does not extend anywhere upon the membranes, terminating by a well-defined line, and not extending posteriorly as far as the root of the tail; beneath, the wing-membrane is thinly covered as far as a line drawn from the elbow to the knee-joint, and a band of fur passes outwards, posterior to the forearm, to the carpus, as in *Vesperugo noctula*. The face in front of the eyes is nearly naked.

Upper incisors with a posterior horizontal expansion of the cingulum, as in *S. borbonicus*; lower incisors crowded. The other teeth as in *S. Temminckii*.

Length (of an adult female preserved in alcohol), head and body 4·6 inches, tail 3·6, tail free from membrane 0·35, head 1·45, ear 0·9, tragus 0·45 × 0·1, forearm 3·4, thumb 0·7, second finger 5·75, fourth finger 4·15, tibia 1·4, foot and claws 0·75.

This is by far the largest species of the family Vespertilionidæ yet described, its forearm exceeding that of *Vesperugo molossus* (hitherto known as the largest species) by half an inch, and exceeding by quite one inch the forearm of the largest species of *Scotophilus*.

Hab. Lagos, west coast of Africa. Type in the collection of the British Museum.

XVII.—*Gigantic Squid on the West Coast of Ireland.* By A. G. More, Assistant Naturalist in the Museum of the Royal Dublin Society.

Several accounts having lately appeared in print respecting a very large cuttlefish which was lately captured off Boffin Island, Connemara, I have to offer a few notes made on those portions of the animal which fortunately were preserved by the care of Sergeant O'Connor, and by him forwarded to the Museum in Dublin.

This giant cuttle or squid was caught on the 25th of April by the crew of a "corragh," a slight narrow rowing-boat constructed of hoops and tarred canvas, such as is much used for line-fishing on the west coast of Ireland. The animal was found basking on the surface of the sea, and was attacked by the fishermen, who could not bear to think that so much good bait should be lost. Not until after a laborious chase and some danger, the arms were one by one dissevered, and at last the head. The body, being too unwieldy, was allowed to sink.

From the portions thus brought ashore, Sergeant O'Connor, being much interested in matters relating to fishing-operations and natural history, preserved what he could; and, in this instance, but for his care the whole prize might have been converted into bait for long-lines. A good part of both tentacles, one short arm, and the great beak entire, with some of the surrounding flesh attached, have reached Dublin; and there remains very little doubt that we have now to deal with a second example of the famous *Architeuthis dux* of Steenstrup. So little is known of the original specimen, and so imperfect are the fragments now obtained, that the identification must for the present remain incomplete. Enough, however, remains to show that our present specimen is quite distinct from the American *Megaloteuthis Harveyi* (Kent), which is described as having minute suckers on the margin of the tentacular club. The closely packed small suckers in six rows just below the main suckers of the palm offer another distinctive character, as do also the few small sessile suckers which are scattered along the length of the otherwise smooth peduncle in our specimen.

The following few particulars may be worth placing on record:—

Tentacles 30 feet long when fresh (14 and 17 feet can still be made up from the pickled pieces). A few distant, small, and nearly sessile suckers occur at long intervals along the inner surface of the peduncle. The club, measuring 2 feet 9 inches in its present shrunken state, is occupied in the centre of the palm by two rows of large stalked suckers nearly 1 inch in diameter, fourteen in each row; an alternating row of fourteen smaller suckers ($\frac{1}{2}$ an inch in diameter) occupies the margin on each side of the palm: thus there are twenty-eight large 1-inch suckers in the middle, and the same number of $\frac{1}{2}$-inch suckers along the outside edge. These outer suckers are each armed with a denticulated bony ring of some twenty-eight teeth pointing inwards; and no doubt the large inner suckers were similarly furnished; but their rings had fallen out or had been removed before the specimens were examined. Just beneath where the large suckers end there occurs a cluster of small suckers, $\frac{2}{10}$ of an inch in diameter; and these are arranged closely in six transverse rows for about 5 inches along the now narrowing wrist of the club; only a few of the uppermost of these are furnished with denticulate rings; the greater number, like the few small suckers of the peduncle, are sustained by rings with an entire or smooth edge. Above the large suckers of the palm the club tapers upwards, and is again clothed with a great number of small and apparently smooth-ringed suckers.

The short arm is quite spoiled for examination: all the horny rings are gone; and the suckers themselves are scarcely represented. This arm measured 8 feet in length, and 15 inches round the base, when fresh.

The beak has a strong wide tooth about the middle of the edge of the inner mandible, and a much narrower notch on the outer mandible, on each side. The head and eyes were unfortunately lost.

Museum of Royal Dublin Society,
July 3, 1875.

XVIII.—*Notice of two new Species of Mammals* (Propithecus *and* Hemicentetes) *from Madagascar.* By Dr. ALBERT GÜNTHER, F.R.S. &c.

MR. CROSSLEY has recently sent another collection from Madagascar*; among the specimens selected for the British Museum are two apparently undescribed species of Mammals. Two adult specimens of *Ericulus*, one of which is of blackish, the other of whitish colour, appear to correspond to the *E. spinosus* and *E. nigrescens* of Grandidier's List of Madagascar Mammals, in 'Rev. et Mag. Zool.' 1867, p. 318. Our specimens are of different sexes—the dark ones being males, and the light-coloured females. The spines of the latter are rather more slender than those of the other specimens. It is very probable that these differences in the colour and spines are merely sexual.

Propithecus holomelas.

Allied to and nearly of the same size as *P. Edwardsii*. Throat and all the lower parts covered with dense fine woolly hair. Male with a small patch of ferruginous hairs radiating from a centre in the middle of the chest, opposite to the manubrium sterni; in the female this patch is replaced by two smaller ones placed side by side, and the hairs are of a whitish colour. All the upper parts deep black, except the back of the root of the tail, which is brownish. Abdomen greyish brown. A few whitish hairs at the extremity of the tail.

	Male.	Female.
	in.	in.
Length of body	23	23
Length of tail	16	15

I have examined two adult males and two females; they were obtained at Fienerentova.

Hemicentetes nigriceps.

The upper part of the head black, without or with only a trace of the median white band by which *H. madagascariensis* is characterized. Body covered with woolly hair, slender spines being scattered almost uniformly over the back and sides; neck with a transverse band of closely set long spines or bristles, as in the other species, but the bristles are more

* See Proc. Zool. Soc. 1875, p. 78.

numerous. Upper parts black, with the neck and a short stripe in the middle of the back white; another white curved band on each side of the back. A more or less distinct black stripe along the middle of the abdomen.

In one specimen the white colour is replaced by pink.

Several adult and young examples from Fienerentova. Length 7 inches.

XIX.—*Notes Introductory to the Study and Classification of the* Spongida. By H. J. Carter, F.R.S. &c.

[Continued from p. 40.]

Part II. Proposed Classification of the Spongida.

In the general classification of the Spongida there is not much difficulty, as the skeleton (which too often is the only part that reaches us, from the inaccessible places in which many of them grow and the accidental circumstances under which they reach the shore) consists of durable material which, in structure and composition, admits of very easy arrangement; while where there is no skeleton at all, this alone for such sponges is sufficiently characteristic of the order.

But in the more particular classification there are peculiar difficulties, inasmuch as there is no expression in sponges as in other animals and in plants; that is, there is nothing like a *calice*, as in the coral, and nothing like a *flower*, as in the plant, to guide us—what there is in this respect, viz. the *spongozoon*, being microscopic in size, undistinguishably alike and so protean in form as only in its *active* living state *in situ*, or just after it has been eliminated from the sponge, distinguishable from a common amœban animal.

Again, as regards the general form of the sponge itself, there are many instances where the same form may be assumed by totally different species, and the same species assume different forms, so that a microscopical examination of the "proper spicule" can alone determine the species; thus a fan-shaped and a vase-like form respectively may have at one time the same, and at another a different form of spicule. And yet again the aid derived from the form of the "proper spicule" is confined to sponges so provided, while those which have nothing but foreign objects instead of the "proper spicule" are even without this aid. So that, after all, we may be thrown back upon structural peculiarities in combination with general form, and perhaps sometimes colour, for ultimate distinction. (This will be found to be particularly the case with the *Hircinida.*)

Still there are many instances where the same species may be hastily recognized by its outward features; but as this can only be done after much experience, it is of no use to a beginner. At the same time, from what has been above stated, it would always remain uncertain, even to the experienced, without a microscopical examination.

A fresh sponge, too, described in its natural state (that is, with the sarcode on) differs greatly from that in which the sarcode is off, or where the skeleton only remains. As, however, by far the greater number of sponges come to us in the latter state, and, indeed, all must be divested of the sarcode before they can be usefully described for classification, seeing that, as before stated, there is no animal expression (so to term it) externally or internally that can be made use of for this purpose, it seems best to describe the skeleton naked, rather than under cover of the sarcode—that is, to describe the skeleton only, although, of course, where this can be done with the sarcode on as well as off it is best of all. But there is no doubt that a description of the sponge with the sarcode on will never serve to recognize its skeleton, which is at once the most characteristic and frequently the only part that we can or are ever likely to obtain from the inaccessible localities in which many grow; so after all we are not so badly off with the skeleton only, provided it has not been worn away by much attrition. Hence the fundamental divisions of my arrangement will be based on the characteristic features presented by the elementary composition of the skeleton or organ of support. It should not be forgotten, however, that with the sarcode of course the flesh-spicules disappear, falling through the skeleton, as before stated, like small pebbles through the meshes of a fishing-net, when the sarcode passes into dissolution. Nor should it be forgotten that there may be a great difference between a sponge in its "fresh" and in its dried state, in size, colour, and general appearance. As the sarcode in all assumes the characters of glue when dry, those which, like the Carnosa, are without horny skeleton can only be described when fresh or preserved in some aqueous solution. Also sponges possessing a skeleton sink down in many instances to half their original size by the shrinking up of the sarcode, which, clinging round the skeleton, destroys the original plumpness of the sponge, and thus alters considerably its general appearance externally as well as the structure internally. Lastly, the colour under drying, as before stated, may fade in part or altogether. Still there are some things in a sponge which are seen better when dry than when fresh.

Such difficulties beset no other classification in natural history. But what is to be expected otherwise, when, in addition to this, the protean character of the sponge, whose transformations are endless in the soft parts, and only approached in number by being stereotyped in the harder ones, is considered? Hence the unsatisfactory and indefinite characters, especially of the families, which will be found in the following classification.

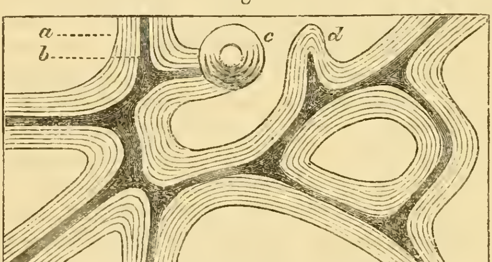
Class SPONGIDA, Huxley.

Order I. CARNOSA.

Without evident skeleton*.

Order II. CERATINA.

Fig. 1.



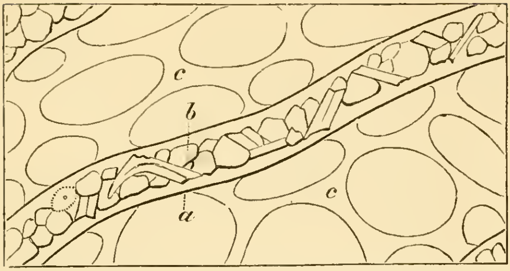
Fibre of Ceratina: *a*, horny fibre; *b*, core; *c*, transverse section of fibre, showing concentric laminar structure around the core; *d*, bud of fibre.

Possessing a skeleton composed of horny fibre with a granular, chiefly hollow, core, containing for the most part no foreign bodies.

* Here and henceforth it should be remembered that the diagnoses respectively refer to the *general characters*. And as regards priority in my Classification, it must be considered quite empirical. But that fibreless spiculeless sponges might pass by gradation into fibrous spiculous ones I have no other grounds to go upon.

Order III. PSAMMONEMATA.

Fig. 2.

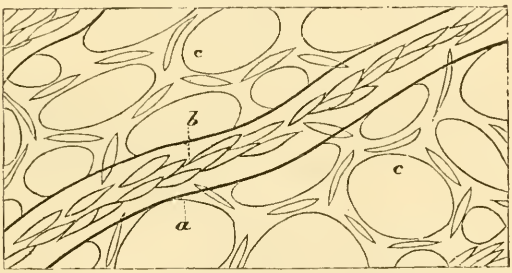


Fibre of Psammonemata: *a*, horny sheath of vertical or large fibre; *b*, core; *c c*, horizontal, lateral, or small fibre*.

Possessing a skeleton composed of solid fibre more or less cored† with foreign bodies.

Order IV. RHAPHIDONEMATA.

Fig. 3.



Fibre of Raphidonemata: *a*, horny sheath of vertical or large fibre; *b*, core; *c c*, horizontal or small fibre.

Possessing a skeleton composed of horny fibre with a core of "proper spicules." Form of spicule chiefly simple acerate, and chiefly confined to the interior of the fibre.

* To show that the general outline of the fibrous structure is the same in the Orders 3, 4, 5, and 6, all the figures (viz. 2 to 5 inclusive) will be observed to be alike, differing only in the accessories. Thus by referring to the most simple one, viz. fig. 2, the rest will be easily understood.

† The substantive "core" is here used verbally for brevity.

Order V. **ECHINONEMATA.**

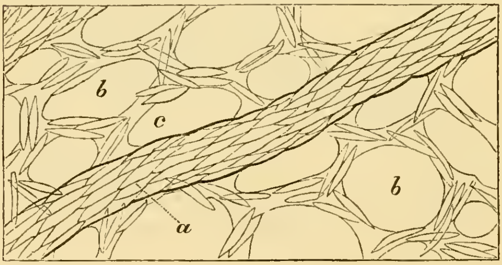
Fig. 4.

Fibre of Echinonemata: *a*, horny sheath of vertical or large fibre; *b*, core; *c*, echinating spicules; *d d*, horizontal or small fibre.

Possessing a skeleton composed of horny fibre cored with proper spicules internally and echinated with proper spicules externally. Form of spicule chiefly acuate.

Order VI. **HOLORHAPHIDOTA.**

Fig. 5.

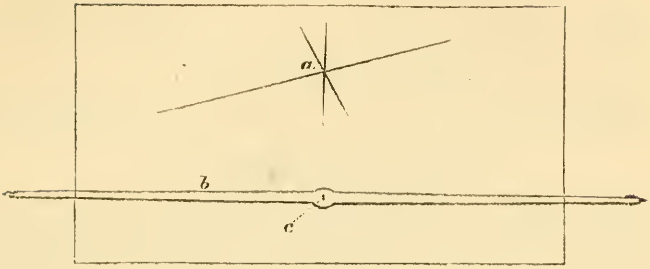


Fibre of Holorhaphidota: *a*, vertical or large spiculo-fibre; *b b*, horizontal or small spiculo-fibre; *c*, film of sarcode accompanying spiculo-fibre.

Possessing a skeleton whose fibre is almost entirely composed of proper spicules bound together by a minimum of sarcode. Form of spicule variable.

Order VII. **HEXACTINELLIDA.**

Fig. 6.

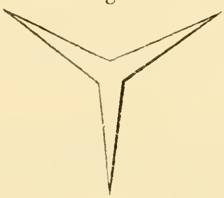


Spicules characteristic of the Hexactinellida: *a*, sexradiate type; *b*, acerate type; *c*, sexradiate cross in the centre.

Possessing a skeleton charged with proper spicules. Spicules all based on a sexradiate type, as indicated by their forms and the presence of a sexradiate cross at the centre of the spicular canal.

Order VIII. **CALCAREA.**

Fig. 7.



Characteristic spicule of the Calcarea.

Possessing calcareous spicules only.

*Families**.

CARNOSA.

Family 1. HALISARCIDA.

Possessing no spicules.

Family 2. GUMMINIDA.

Possessing spicules.

* In endeavouring to carry out what I proposed in my "Prefatory Remarks" respecting the classification of the Spongida into "Orders, Suborders, and Families," I find, on arriving at this point, that our knowledge of these beings is not sufficient for doing it further than the eight

CERATINA.

Family 1. Luffarida.

Rigid fibre, with opaque, white, granular core mostly hollow.

Family 2. Aplysinida.

Subrigid or flaccid fibre, with wide, hollow, granular core.

Family 3. Pseudoceratida.

Fibre of either of the foregoing families sparsely cored with foreign bodies—or passing into a dermal layer of foreign bodies, or one of "proper spicules" like that of the Rhaphidonemata.

PSAMMONEMATA.

Family 1. Bibulida*.

Solid fibre chiefly without core of foreign objects.

Family 2. Hircinida.

Solid fibre chiefly cored with foreign objects.

Family 3. Pseudohircinida.

Solid fibre cored with foreign objects and proper spicules, sometimes also echinated with proper spicules.

RHAPHIDONEMATA.

Family 1. Chalinida.

Digitations solid, vertical or procumbent.

Family 2. Cavochalinida.

Tubular, vasiform, aculeated patulous, or compressed flabellately; plane and frondose or dactyloid.

Orders with any likelihood of certainty. Hence I now propose to divide them, after these orders, into Families and Groups provisionally, which, on a better acquaintance with the species, might be changed to Suborders and Families as the occasion may require.

Where, however, among the Groups I have to a certain extent been able to anticipate this change, each has been named after a typical genus; but where no typical species has yet been described, the Group has been named adjectively after its most striking characters.

* This family has been placed among the Psammonemata, because I have never failed in good specimens to find here and there a fibre cored with foreign bodies. But as this is likely to escape observation from its scantiness, I have given the family the character of "simple solid fibre," although I cannot, from the fact mentioned, make it an order.

Family 3. ACERVOCHALINIDA.

Massive clathrous, or compact and isodictyal.

Family 4. PSEUDOCHALINIDA.

Digitiferous, composed of fibre cored with proper spicules and foreign objects.

ECHINONEMATA.

Family 1. ECTYONIDA.

Echinated with proper spicules *on* the fibre.

Family 2. AXINELLIDA.

Echinated with proper spicules projecting from the *interior* of the fibre.

HOLORHAPHIDOTA.

Family 1. RENIERIDA*.

Spicules more or less arranged in a fibrous form. Structure yielding to pressure like crumb of bread.

Family 2. SUBERITIDA.

Tissue chiefly cork-like; spicules matted felt-like; cancellous and crushable, or radiated compact and hard; spicule chiefly pin-like, with the sharp ends projecting from the surface velvet-like.

Family 3. PACHYTRAGIDA.

More or less corticate, with a cancellous, more or less radiated structure internally well differentiated.

Family 4. PACHASTRELLIDA.

Without cortex; densely spiculiferous, even to stony hardness (Lithistina). Structure confused; no fibre.

Family 5. POTAMOSPONGIDA, Gray.

Fragile sponges bearing seed-like bodies or statoblasts, and inhabiting fresh water.

* After Etienne-André Renieri, of 1793.

HEXACTINELLIDA.

Family 1. VITREOHEXACTINELLIDA.

Fibre vitreous spiculiferous.

Family 2. SARCOHEXACTINELLIDA.

Sarcospiculiferous.

Family 3. SARCO-VITREOHEXACTINELLIDA.

Partly fibro-vitreous, partly sarcospiculiferous.

CALCAREA*.

Groups†.

CERATINA.

Family 1. **Luffarida.**

Forms only a single group.

Sarcode chiefly purple or dark red-brown throughout, darkest on the surface. Skeleton composed of a uniform reticulation of horny, crisp, rigid, anastomosing transparent fibre, of a bright golden or brown amber-colour‡; cored throughout continuously with an opaque white, granuliferous, mostly tubular membrane, less in diameter than half that of the fibre; terminating by anastomosis just above the level of the surface. Structure reticular. Texture hard, resistent, brittle§. Forms massive, lobed, tubular, single or grouped; or branched dichotomously, branches round, solid.

* For a classification of the Calcareous sponges, together with illustrations, see Häckel's monograph entitled 'Die Kalkschwämme,' 1872.

† The *characters* of the groups have been deduced from descriptions generally of the genera and species, which will be found in the last part of this communication.

‡ The colour of sponges, as before stated, is for the most part evanescent; it may be general or confined to the dermal sarcode, and here only to those parts which are most exposed to the sun. What has been stated in the Anatomy and Physiology of the Spongida as regards the specific value, not only of colour, but of form, should be here remembered.

§ Texture is not always to be depended on, as resilient or elastic fibre if much bruised may become tow-like or cottony, and stiff fibre, if the specimen has not had all its salt extracted by soaking in fresh water, may, on the least dampness in the air, become flaccid, like glue under similar circumstances. Indeed some sponges, like certain Fungi, expand so much under the influence of damp or moisture, that they appear to be *hygrometric*.

Family 2. **Aplysinida.**

Forms only a single group.

Sarcode colourless, black-purple or madder-brown throughout, darkest on the surface. Skeleton composed of an irregular reticulation of subrigid or flaccid, horny, anastomosing translucent fibre, of a dark amber-colour; cored interruptedly here and there with a granuliferous tubular membrane, much more than half the diameter of the fibre in width, and presenting here and there a fragment or two of foreign objects. Fibre of two kinds, viz. vertical or large, and horizontal* or small fibre, the former terminating on the surface in small points or whip-like filaments. Structure reticular. Texture soft, resilient. Forms incrusting, or massive, or tubular, or flabellate, or foliaceous, sometimes proliferous.

Family 3. **Pseudoceratida.**

Forms only a single group.

Sarcode madder-brown or brownish yellow throughout. Skeleton mostly the same as in the Aplysinida. Vertical fibre terminating on the surface in whip-like filaments among a crust of foreign bodies, or in a dermal reticulation of horny fibre charged with "proper spicules." Structure reticular. Texture resilient and open, or soft and compact. Forms massive, lobed, or rising into a group of tubular digitations.

PSAMMONEMATA†.

Family 1. Bibulida.

Group 1. **Euspongiosa.**

Sarcode black, purple, or brown externally, pale amber within. Skeleton composed of a reticulation of solid, horny,

* The term "horizontal" here must be considered equal to "lateral," as the main or vertical fibre often assumes a radiating or plumose form, in which its direction may become horizontal.

† The collection of sponges in the British Museum, which has chiefly served to form the families of this order, came from all parts of the world, where, from their consisting for the most part exclusively of the skeleton, they have apparently been picked up on beaches, having probably, from their great size, originally grown in deep-sea caverns, from which they could not have been obtained in any other way. Hence their mostly unsatisfactory state for this purpose.

The principle in arrangement has been to begin with horny fibre sparingly cored with foreign bodies, then to go to that in which the core is more general, and finally to end with that in which the horny element is scarcely visible, and the core of foreign bodies only held together by a minimum of sarcode, like the spicules in the Holorhaphidota.

The family "Pseudohircinida" has been added for such species of the Psammonemata as have "proper spicules" in addition to the core of foreign objects.

anastomosing, transparent fibre of different shades of pale amber-colour, with no obvious core. Fibre of two kinds, viz. vertical or large and horizontal or small fibre, the former terminating on the surface subpenicillately. Structure vertical or radiating. Texture varying from compact, fine, and woolly to rigid, open, and coarse. Forms incrusting or massive lobed, or hollow tubular or funnel-shaped, branched or foliated.

Group 2. **Paraspongiosa.**

Sarcode the same. Skeleton the same, but with the large fibre terminating on the surface in penicilli cored with minute foreign objects. Structure the same. Texture variable also. Forms incrusting or massive lobed, or hollow vasiform, or massive flattened simply or lobed and branched.

Family 2. HIRCINIDA.

Group 3. **Hirciniosa.**

Sarcode brown or pink on the surface, pale internally. Skeleton composed of a reticulation of horny, anastomosing translucent fibre of a pale grey or amber-colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small fibre; the former terminating on the surface in more or less prominent aculeations, between which the horizontal fibre is stretched in straight lines, so as to present a polygonal appearance. Dermal sarcode enveloping minute foreign objects which, for the most part, following the course of the dermal reticulation cover the "polygonal" interspaces with a white lace-like layer*. General structure vertical or radiating. Texture more or less coarse and open. Forms massive lobed, or hollow vasiform, or flattened, or branched†.

* Where there is a core of foreign objects, it is most prevalent in the vertical or large fibre and least so in the horizontal or small fibre, which, on this account, is for the most part solid and simple—that is, coreless.

† N.B. In this family the sarcode is often replaced by a filamentous alga, which so much resembles it in form and position that Lieberkühn based his family of "Filifera" upon its presence (Archiv f. Anat. u. Phys. 1859, pl. x. fig. 2). See also good figures of the specimens so affected, under the name of "Polytherses" (Duch. de Fonbressin et Michelotti, "Spongiaires de la Mer Caraïbe," Natuurk. Verh. Holland. Maat. Wet. te Harlem, vol. xxi. 1864).

For this alga I have proposed the name of "*Spongiophaga communis*," on account of having found it in different sponges from all quarters of the world, although chiefly in *Hircinia* ('Annals,' 1871, viii. p. 330). It is often almost impossible to say to which group of the Hircinida the species affected by this alga belongs, especially when the alga has entirely replaced the sarcode, and has thus concealed the skeleton.

Group 4. **Callhistia.**

Sarcode brown (and other colours?). Skeleton composed of a uniform reticulation of horny anastomosing transparent fibre of an amber-colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating on the surface in more or less prominent aculeations, cored with minute foreign objects, while the horizontal for the most part is without them. Structure vertical or radiating. Texture fine, elastic, uniform (in this respect the skeleton of these sponges surpasses all others in beauty and regularity, hence their designation). Forms massive lobed, or hollow funnel- or vase-shaped, or massive flattened simply or in branches.

Group 5. **Penicillata.**

Sarcode dark brown externally, pale amber within. Skeleton composed of a reticulation of more or less rigid, horny, anastomosing transparent fibre of a light or deep amber-colour, cored more or less with minute foreign bodies. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating on the surface in large, prominent, penicillate aculeations. Structure vertical or radiating. Texture more or less rigid, coarse and open. Forms massive, simple or lobed, or flattened and lobed.

Group 6. **Rigida.**

Sarcode? (absent)*. Skeleton composed of a reticulation of coarse, thick, rigid, horny, anastomosing translucent wiry fibre of a dark amber-colour, more or less cored with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the latter ladder-like. Surface? (too much worn away for description). Structure vertical or radiating. Texture wiry, reticulate, open. Forms hollow, vase-like.

Group 7. **Subrigida.**

Sarcode? (absent.) Skeleton much the same as the last; but fibre less coarse and more resilient, of two kinds—viz. vertical or large, and horizontal or small—more or less cored with foreign objects. Surface? (too much worn away for description.) Structure vertical, radiating plumose. Texture fine, open, resilient, wiry. Forms hollow, with short, hollow, conical tubular branches like buds or offshoots.

* Where there is "?" or the word "absent" it means that the British-Museum specimens, from which this classification has chiefly been made, are deficient. Nearly all the specimens are dry; so that where the sarcode is present it is for the most part described under this aspect.

Group 8. **Foliata.**

Sarcode ? (absent.) Skeleton composed of a dense reticulation of short-jointed, small, horny, anastomosing translucent fibre of a brown or yellowish tawny colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating at the surface in small cored aculeations which are closely approximated. Structure vertical, radiating or plumose. Texture firm, dense, tough, fine. Forms digitate; digitations laterally united and flattened, proliferous, foliate.

Group 9. **Dactylifera.**

Sarcode ? (absent.) Skeleton, fibre, structure, and texture the same as the foregoing. Forms digitate; digitations simple or branched.

Group 10. **Fenestrata.**

Sarcode ? (absent.) Skeleton, fibre, structure, and texture the same as the foregoing. Forms hollow and clathrous, or massive lobed, or branched and fenestrate.

Group 11. **Platyfibra.**

Sarcode ? (absent.) Skeleton composed of a reticulation of flaccid, flattened, horny, anastomosing translucent fibre, of a light or brown colour, cored more or less with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the latter arranged ladder-like between the former, flattened and expanded, so as to present a clathrous structure formed of circular holes of different sizes. Surface ? (too much worn away for description.) Structure vertical, radiating. Texture loose, flaccid, shreddy. Forms massive lobed or branched simply, or simply flattened.

Group 12. **Peraxiata.**

Sarcode ? (absent.) Skeleton composed of a reticulation of horny, anastomosing opaque fibre of a light grey colour, cored throughout with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small. Surface ? (too much worn away for description.) Structure vertical, radiating, plumose. Texture firm, rather compact. Forms branched, lobed, and flattened.

Group 13. **Incrustata.**

Sarcode ? (absent.) Skeleton composed of a reticulation of horny anastomosing fibre, cored with minute foreign objects and incrusted with the same. Fibre of two kinds—viz. vertical or large, and horizontal or small. Surface ? (worn away.) Structure vertical, radiating, or plumose. Texture open, resilient. Forms massive and lobed, or flat and palmate.

Group 14. **Otahitica.**

Sarcode colourless, yellowish, or purple throughout. Skeleton composed of a reticulation of horny, short-jointed, anastomosing fibre, colourless, pale yellow, or purple ; more or less covered with minute foreign objects, chiefly towards the surface. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former chiefly cored towards the surface, where, by anastomosing with the latter, it ends in a minutely reticulated and granulated even plane, more or less divided by furrowed reticulation. Structure vertical reticulate. Texture more or less hard and compact. Forms incrusting, massive lobed, branched lobed anastomosing, branches round or compressed; or flattened generally, open and flabelliform or closed and vasiform ; leafy, exfoliate or proliferous*.

Group 15. **Sarcocornea.**

Sarcode ? (absent.) Skeleton composed of a reticulation of sarcocornean or sub-horny anastomosing fibre of a pale yellow colour, more or less cored with minute foreign objects. Fibre of two kinds—viz. vertical or large, and horizontal or small; the former terminating on the surface in subaculeations, which are united by reticulation into meandriniform ridges or polygonal subdivisions presenting a uniform even character. Structure reticulate. Texture firm, compact. Forms massive lobed.

Group 16. **Arenosa.**

Sarcode colourless throughout or purplish on the surface. Skeleton composed of minute foreign objects, formed by the aid of a thin film of sarcode into a fibrous reticulation, of a pale

* N.B. This group, based upon Ellis's *Spongia othaitica,* may afford forms in which a core of foreign bodies in the fibre seems to be entirely absent, as in Esper's *Sp. papyracea*, Taf. 65,=*Spongionella Holdsworthii*, Bk. (Proc. Zool. Soc. 1873, pl. v.), thus bearing the same relation to the typical structure of *Sp. othaitica* that the Bibulida bear to "Hircinida;" while among the Cavochalinida we have still another similarly flattened form where the horny fibre is cored with "proper spicules."

yellow or light grey colour. Fibre thus formed of two kinds —viz. vertical or large, and horizontal or small; terminating externally in a more or less minutely reticulated even surface. Structure vertical. Texture compact, more or less fragile. Forms massive, lobed.

Family 3. Pseudohircinida.

Group 17. **Pseudoarenosa.**

Sarcode the same as in the foregoing group. Skeleton also composed in the same way, but with the addition of "proper spicules" to the foreign objects. Fibre, structure, texture, and form as in the foregoing.

Group 18. **Chalinohircinina.**

Sarcode ? (absent.) Skeleton composed of a reticulation of horny, anastomosing, transparent fibre of a light or dark amber-colour, cored with a mixture of minute foreign objects and "proper spicules." Fibre of two kinds—viz. vertical or large, and horizontal or small; the latter chiefly cored with the "proper spicules." Surface ? (worn off.) Structure vertical, radiating, or plumose. Texture open, resilient, easily compressed. Forms massive, lobed or branched, or flat*.

Group 19. **Armatohircinina.**

Sarcode? (absent.) Skeleton the same as in the foregoing group, but with the fibre echinated also with "proper spicules." Fibre, structure, texture, and form the same as in the foregoing.

RAPHIDONEMATA.

Family 1. Chalinida.

Group 1. **Digitata.**

Sarcode pale tawny, pink, or purple throughout. Skeleton composed of a reticulation of anastomosing transparent fibre of a pale yellow colour, more or less cored with "proper spicules." Fibre of two kinds—viz. vertical or large, and horizontal or small; terminating externally in anastomosis, where it is connected with and covered by a minutely reticu-

* It is questionable whether the family "Pseudochalinida" (at the end of the Raphidonemata) should not come in here. If the presence of foreign objects in the core is to determine this, it should; if the *form*, then it should remain where it is.

lated dermal layer, that gives the surface a smooth or even uniform aspect. Vents well marked, scattered*. Spicules chiefly of one kind, viz. simple acerate, more or less finely pointed, and confined to the *interior* of the fibre. Texture fine, compact, or coarse and open, varying with the size of both spicule and fibre. Forms vertical, branched dichotomously or polytomously, stipitate; branches digitiform, cylindrical, *solid*, terminating in rounded extremities, separate, or united laterally and interruptedly (*i. e.* fenestrately), or united laterally and generally throughout (*i. e.* flabellately), lobed or proliferous.

Group 2. **Palmata.**

The same as the foregoing, but with flattened massive digitations and large scattered vents.

Group 3. **Reptata.**

The same as the foregoing, but procumbent, more or less sessile throughout or at intervals, with large crateriform or well-marked vents.

Group 4. **Spinifera.**

The same as the foregoing, but with the branches more cylindrical, defined, and prickly or aculeate.

Family 2. Cavochalinida.

Group 5. **Tubulodigitata.**

Similar to "Digitata" and "Reptata," but with the digitations tubulate. (When the vents are prolonged upwards from a reptant solid branch, they become tubular digitations.)

Group 6. **Aculeata.**

Sarcode pale tawny or grey when dry. Skeleton the same as the foregoing. Fibre the same, but growing out from the external surface into more or less prominent aculeations or conical eminences like prickles, sometimes an inch high, linked together here and there by angular ridges which, radiating from their sides, tend to an irregularly polygonal division of the otherwise smooth surface; divisions more or less cup-like,

* "Pores." As these are too small to be seen by the unassisted eye (being generally about a 1000th of an inch in diameter), and always situated in the sarcode tympanizing the interstices of the dermal reticulation, while their smallness for the most part renders them of no specific value, they will be seldom mentioned.

depressed. Structure, spicules, and texture the same as in the foregoing families. Vents on the internal surface of the excavation. Forms hollow, tubular, funnel- or vase-like; single or in groups; or hollow compressed, vase-like or flabelliform; smooth and even internally, but covered externally with aculeations or prominent eminences, as before mentioned.

Group 7. **Subaculeata.**

The same as the foregoing, but with the aculeations much less marked or prominent.

Group 8. **Ciliata.**

The same as the foregoing, but with the excavations tubular, separate or united pandeanpipe-like into a compressed massive form, fringed round the orifices of the tubular excavations.

Group 9. **Bivalvata.**

The same as the foregoing, but with the external surface more or less covered with rugose eminences; the form vase-like, compressed, and thus rendered double flabellate or bivalvate; texture leathery.

Group 10. **Complanata.**

The same as the foregoing, but cup-like, expanded, and without rugæ—that is, smooth on each side; with a leathery texture and, for the most part, papyraceous thinness. Allied *in form* to some of the Otahitica, among the Hircinida (see footnote, p. 139).

Group 11. **Plicata.**

The same as the last, but frond-like, thick, papyraceous, plicated, tending to vasiform, in a large undulating continuous cloth-like sheet. Allied in form to some of the Otahitica.

Family 3. Acervochalinida.

Group 12. **Solida.**

The same in structure &c. as the foregoing, but massive, lobed, and amorphous.

Group 13. **Clathrata.**

The same in composition, but with a clathrous structure.

Group 14. **Dictyalia.**

The same, but with the horny element of the fibre decreased and the spicular element increased*.

Family 4. Pseudochalinida.

Group 15. **Digitifera.**

The same as "Digitata," but cored with foreign objects, alone or more or less mixed with "proper spicules" (viz. the simple acerate) in the same individual.

Group 16. **Fistulodigitata.**

The same as the foregoing, but tubular.

ECHINONEMATA.

Family 1. Ectyonida.

Group 1. **Pluriformia.**

Sarcode pale tawny, or pink, or purple throughout. Skeleton composed of a reticulation of horny, anastomosing, transparent fibre of a pale yellow colour, echinated with proper spicules externally and cored with proper spicules internally. Fibre of two kinds (viz. vertical or large, and horizontal or small), often passing into fenestrated flattened fibre, in which the two kinds become indistinguishable; often terminating on the surface in a reticulated form, whose interstices are more or less filled by tufts of projecting echinating spicules, based upon the surface of the fibre sometimes to such an extent as, by contact, to form a uniform continuous crust. Surface often growing outwards into characteristic projections of a massive tubercular or compressed form, which, interuniting with each other, produce a clathrous structure. Vents for the most part small, numerous, and indistinct, consequent on the number of the excretory canal-systems, of which they are respectively the outlets. Spicules, as before stated, of two kinds, viz. axial and echinating: the latter smaller than the axial spicule, for the most part club-shaped, spinous, having its large end imbedded in the surface of the horny fibre. Axial spicule for the most part different in form from the echinating

* Here it is that the Raphidonemata run into the Holoraphidota, so much so that there is a species of *Reniera* (*fibula*, Sdt.) which at Ceylon is a *Reniera* and at the Cape a *Chalinia*, according to our empirical distinctions of the two orders mentioned.

one; generally a simple acuate. Often accompanied by one or more forms of flesh-spicule. Texture exceedingly and characteristically dense in the axis and stem, diminishing in compactness towards the surface, which, when hirsute, is, in the dried state, often characterized by the presence of stiffened sarcode matting together the long projecting spicules of the surface. Forms massive and lobed, or digitate, branched, stipitate; branches uniting clathrously or continuously, so as respectively tô produce globular or compressed flabellate heads; sometimes foliate and proliferous; occasionally hollow, vasiform, or tubular.

Group 2. **Plumohalichondrina.**

Here there are two forms of axial spicules, viz.:—1, simple acuate, smooth or spined; 2, more or less pointed or inflated at the ends, which are often microspined scantily or sparsely. Echinating spicule club-shaped and spined. Flesh-spicule for the most part that termed by Dr. Bowerbank "angulate equianchorate" (that is, with bow-shaped shaft and alæform arms), sometimes accompanied by a bihamate or C-shaped flesh-spicule, sometimes without any flesh-spicule at all. Forms massive, lobo-branched; branches compressed, dichotomous, separate or anastomotic, flabellate proliferous.

Group 3. **Microcionina.**

Here the chief character is incrusting, spreading, extremely thin, laminiform, hirsute. Spicules simple acuate (not fusiform), with terminal subspherical inflation more or less spined and fixed scopiformly in the cornified sarcode of the lamina, mixed with or surrounded by smaller forms which are smooth. Echinating spicule club-shaped and spined throughout. Flesh-spicules, a minute navicular equianchorate and a tricurvate in variable quantities respectively. Forms incrusting, thin, laminar.

Group 4. **Echinoclathrata.**

Structure massive, clathrate, reticulate, with echinated fibre. Echinating spicule acuate, smooth or spined. Forms massive, lobed.

Group 5. **Baculifera.**

Here the chief characters are the corky nature of the tissue and the peculiar pin-like spicule, whose head is globular or circular compressed, terminal, and applied to the shaft perpendicularly, so as, *en profile*, to resemble the head of a crutch. But there being distinct fibre, and this being echinated as well as cored by the same form of spicule, induces me to place these sponges among the Ectyonida. Had there been no fibre, but the spicules massed felt-like as in the Suberitida, I should have placed them, from their cork-like nature, among the latter. Forms clathrous, branched, branches verticillately clathrous; mesenteric, or flat round and perfoliate, caulescent; or vasiform, thin, open and round, or compressed flabellately; stipitate.

Axinellida.

Group 6. **Multiformia.**

These have all the characters of the Plurifomia, with the exception of the "echinating spicule," which here projects outwards from the core or axial spicules, and not from the surface of the fibre. Moreover both the axial and the subechinating spicules are for the most part alike in form, viz. simple acuate; and the former frequently also the largest, instead of the smallest as in the Pluriformia.

Group 7. **Durissima.**

For want of the sarcode (in which there might have been a flesh-spicule), I do not know where to place these vase-like skeletons, whose structure, composed of coarse, rigid, open reticulated fibre cored with sub-pinlike fusiform acuates, is very like that of an Australian sponge as yet undescribed (whose flesh-spicule and texture very much resembles that of *Axos Cliftoni*, Gray); but the absence of sarcode about these skeletons prevents the identification.

[To be continued.]

MISCELLANEOUS.

On the Occurrence of a Superorbital chain of Bones in the Arboricolæ (*Wood-Partridges*). By James Wood-Mason, of Queen's College, Oxford.

In his elaborate paper "On the Osteology of the Gallinaceous Birds and Tinamous," read before the Linnean Society on November 25th, 1862, Professor W. Kitchen Parker announced the remarkable discovery, in *Tinamus robustus*, "of a whole row of superorbital bones, the like of which must be sought for, not amongst birds, but in a group of creatures a long way down in the scale," viz. in the Skinks and Blindworms. Further on in the same paper, the presence of a similar chain of superorbitals in *Psophia crepitans*, "only in an enfeebled form," is mentioned. The same author, in a memoir "On the Structure and Development of the Skull in the Ostrich Tribe," read before the Royal Society on March 9th, 1865, records the occurrence of a double row of these bones extending all along the superorbital margin from the lacrymal to the postfrontal process in *Tinamus variegatus*.

I have now to announce the occurrence of a similar chain of ossicles in four out of the eight recognized species of *Arboricola*, a genus of Indian partridges, viz. in *A. torqueola*, *atrogularis*, *rufogularis*, and *intermedia*; and I look forward with especial interest to the examination of skulls of the two of the remaining species which have been referred by some authors to the subgenus *Peloperdix*, and which inhabit the Tenasserim provinces and the Malay peninsula.

Mr Parker has pointed out how in the lapwing (*Vanellus*) the frontal in the young bird sends out square denticles of bony substance under and beyond the nasal gland, which coalesce with one another, with the lacrymal in front, and with the postfrontal process behind, so as to form beyond the gland a secondary frontal margin, which acts as a smooth eave to the eyeball—and that the superorbital chain of bones in the tinamou takes the place of this secondary frontal margin and the denticles in the lapwing, the same end being attained by different means. But in the *Arboricolæ* the arrangement is totally different: in them the margins of the combined frontals, so far from being bevelled or scooped for the reception of the nasal gland, are rather prominent, and the internal edges of the ossicles composing the chain come into close relation of apposition with them.

I have examined a considerable number of species of Gallinaceous birds, small and great, including, by the kindness of my friend Major Godwin-Austen, a species of *Bambusicola*, but have hitherto failed to detect so much as a single grain of bone in the superorbital membrane of any one of them.

The *Arboricolæ*, I may add in conclusion, differ from all in not having the temporal fossa bridged by bone, the zygomatic process of the squamosal being quite rudimentary.—*Journal of the Asiatic Society of Bengal*, vol. xliii. part 2, 1874.

On the Helminthological Fauna of the Coasts of Brittany. By M. A. Villot.

The shores of Roscoff, so rich in the lower animals, offer to shore-birds an easily attainable lodging and food as abundant as it is varied. These are, in fact, very numerous there, and certainly play an important part in the economy of the fauna. The species most commonly met with are the following—*Tringa canutus*, *T. alpina*, *Charadrius hiaticula*, *Pluvialis apricarius*, *Calidris arenaria*, *Strepsilas interpres*, *Totanus calidris*, *Limosa rufa*, *Numenius arquata*, *N. phæopus*, *Hæmatopus ostralegus*, *Ardea cinerea*, *Larus ridibundus*, *Carbo cormoranus*, *Sterna paradisea*, *S. hirundo*, *S. minuta*, *S. fissipes*, *Uria troile*, and *Fratercula arctica*. The greater number of these birds, especially the smaller ones, harbour a multitude of Helmintha, which are easy to procure, and which I have been able to examine while alive. Their study, from the point of view of habitat, has already furnished me with a great mass of facts which fully confirm the general considerations of my preceding note.

I will first cite three species of Nematoids :—*Ascaris spiculigera*, Rudolphi; *Ascaris heteroura*, Creplin; and *Spiroptera aculeata*, Creplin. *Ascaris spiculigera* was found by Creplin in the digestive tube of the guillemot (*Uria troile*); and it is there also that I have myself met with it at Roscoff; but it has been noticed in many other sea-birds (divers, grebes, mergansers, auks, sea-gulls, pelicans, cormorants). The *Ascaris heteroura* is not uncommon in the intestine of the golden plover. As for *Spiroptera aculeata*, it is found abundantly in the proventriculus of the variable sandpiper.

The *Echinorhynchi* are very irregular in their habitat, but they are also unfortunately very difficult to characterize. The sanderling (*Calidris arenaria*) and the common turnstone (*Strepsilas interpres*), in which no species of Acanthocephala were previously known, have furnished me with two probably new species. That of the sanderling has an oval body, very much swollen and regularly folded across; that of the turnstone is distinguished, on the contrary, by a very long linear body armed with prickles on its anterior parts, and by a very short trunk. A species allied to the latter, but still more elongated, inhabits the intestine of the laughing-gull; it is perhaps *Echinorhynchus linearis*, Westrumb. I have often obtained *Echinorhynchus inflatus*, Creplin, in the ringed plover, and in the variable sandpiper *Echinorhynchus polymorphus*, Bremser, which is very common in ducks. On the other hand, *Echinorhynchus striatus*, Goeze, which usually lives in the intestines of waders, and particularly in those of the heron, is found at Roscoff in a totipalm Palmipede, the common cormorant. This *Echinorhynchus*, of which we possess as yet only two bad specimens, is distinguished from all its congeners by its strange forms and its mode of fixure. The anterior part of its body, which is very much inflated and covered with prickles, becomes, when the trunk is retracted, a true sucking-disk, by the aid of which it fixes itself to the walls of the intestine. In this state it resembles certain spinous *Distomata*, such as the *Distoma ferox*, Zeder, which likewise inhabits the intestine of the herons, and with which one might at first sight confound it.

The Cestoids are also numerous, and not less interesting. The species belonging to the genus *Tænia* may be divided into two groups, plainly distinguished by the relative size of the hooks with which their trunk is armed. *Tænia crassirostris*, Krabbe, and *Tænia filum*, Goeze, have the hooks very short, and are therefore easy to distinguish. The first is found in the ringed plover, the second in the variable sandpiper. The species with large hooks are less distinct and less easy to recognize. *Tænia retirostris*, Krabbe, lives in the intestine of the common turnstone; *Tænia nymphæa*, Schrank, a form very nearly allied to the preceding, is peculiar to the curlew; the *Tænia ericetorum*, Krabbe, is only found in the golden plover; *Tænia* *inversa*, Rudolphi, may almost be said to line the intestine of *Sterna fissipes*. A very common species, which is perhaps *Tænia lævigata*, Rudolphi, but which may perhaps be new, develops itself indifferently in the curlew, the sanderling, the common turnstone, the variable sandpiper, and the knot. The genus *Ophryocotyle*, established by Friis in 1869, is represented at Roscoff by two species. *Ophryocotyle proteus*, Friis, is found in the variable sandpiper and the sanderling as well as in the ringed plover; the other species is new, and lives in the godwit.

The parasites of the Cetacea of the suborder Cetodontes have been lately carefully collected; but it is probable that we are still far from knowing all. In a common dolphin, dissected in the laboratory of Roscoff on June 22nd, 1874, we found at the base of the pectoral fins, between the fat and the muscles, a singular worm, which I have been unable to determine, and of which I will shortly give a description. This curious parasite seemed to me to resemble the *Pseudalii*; but it certainly differs from all the species of this genus at present known. The same dolphin contained in its stomach a prodigious quantity of *Ascaris simplex*, Rudolphi, in all stages of development.

I may also notice as being found at Roscoff two unpublished *Cercariæ*, the *Rediæ* of which live in marine Mollusca. One of them, discovered by Professor de Lacaze-Duthiers, is a parasite of *Calyptræa sinensis*, and is distinguished by its tail, which is furnished with two membranous lateral expansions, regularly plaited across. The other, which much resembles two *Cercariæ* described by Müller (*C. setifera* and *C. elegans*), is a parasite on *Nassa reticulata*.

We have still to study the migrations and metamorphoses of all these species. The subject is without doubt very attractive; but it requires much method and circumspection and a long series of observations. It will be this year the principal object of my researches. Some experiments I have made in this direction on the parasites of the birds have not been unfruitful, and I hope soon to be able to communicate to the Academy the results obtained.—*Comptes Rendus*, April 26, 1875, p. 1098.

On the Action of Borax in Fermentation and Putrefaction. By M. J.-B. Schnetzler.

In the scientific discussion which took place before the Academy between MM. Pasteur and Fremy on the theory of fermentation M. Dumas intervened, stating that there are two sorts of ferments:—those of which beer-yeast is the type, which live and multiply during the fermentation; and those represented by diastase, which, on the contrary, are destroyed during their action*.

Restricting the name to the chemical action produced by ferments

* Revue des Cours scientifiques, 1872.

of the first type, M. Dumas arrives at this conclusion, that fermentation is a chemical phenomenon accomplished under the necessary influence of the life of the ferment. After investigating the action of a great number of substances on yeast, the illustrious chemist examines the properties of borax. This substance coagulates yeast, dissolves the membranes which remain in suspension in an unfiltered solution of white of egg, prevents the conversion of the sugar by the water of the yeast, arrests the action of diastase, and paralyzes synaptase. M. Dumas expects that the study of borax will lead to consequences of the highest importance.

M. Dumas's communication forms the starting-point of the following observations and experiments.

I. *The Action of Borax on the Protoplasm of Vegetable Cells.*

1. Some leaves of *Elodea canadensis* (the rotation of the protoplasm in the cells of which is readily observed) were immersed in a concentrated solution of borax. The plasmatic current continues for some minutes, then becomes slower and stops altogether. The protoplasm contracts, retires from the cell-wall, and condenses into one or two rounded masses enclosing grains of chlorophyl. The borax has killed the living material of the cell.

2. In observing the issue of the spores of *Vaucheria clavata* in water, I was able to verify, in the long tubular cell of some individuals which did not possess spores, movements of contraction of the protoplasm, which became differentiated into green balls moving in different directions in the interior of the cell. When, by a slight pressure, the protoplasm is expelled from the cell, either in balls or in shapeless masses, there are still perceived in it for a little time lively molecular movements.

On immersing fresh and intact *Vaucheriæ* in a concentrated solution of borax, the protoplasm coagulates and retires from the cell-wall, which becomes perfectly hyaline.

The action produced by borax on the globules of chlorophyl is striking; they contract, and bend themselves into the shape of a crescent.

The spores of *Vaucheria*, after coming out of the mother cell, execute in water rapid movements of translation by means of their minute vibrating cilia. In a borax solution these movements are almost instantly arrested, the protoplasm of the spore contracts and is transformed into a finely granular mass within the cell.

3. I watched the effect of a solution of borax upon *Oïdium Tuckeri*, which had attacked some grapes. In pure water, molecular movements are observed within the hyphæ and spores, independent of the plasmatic currents. The material contained in the cells of the fungus exhibits the same molecular movements when by a slight pressure it is diffused in water. Under the influence of a solution of borax the spores and hyphæ of the *Oïdium* contract; the latter twist, while their contents coagulate into a granular mass: the fungus is killed. The molecular movements of the substance that

has come out of the cells continue in the borax solution. It is in the same manner that borax produces coagulation of the protoplasm of the cells of yeast, moulds, &c.

II. *The Action of Borax on the Animal Organism.*

1. Infusoria, Rotifera, and Entomostraca, placed in the same drop of water, to which is added concentrated solution of borax, soon cease their movements and die. The contraction and coagulation of the sarcode of the Infusoria is distinctly perceived.

2. Young tadpoles rendered very transparent by a prolonged stay in darkness, placed in solution of borax, exhibit convulsive contractions in the muscular fibres of the tail; the circulation of the blood (so easy to observe in these animals) gradually slackens; the plasma of the blood coagulates; and in less than an hour the animal is dead.

The preceding observations show that borax puts an end to the properties by which the life of protoplasm, vegetable and animal, is manifested. If fermentation is a chemical phenomenon effected under the influence of the life of the yeast, borax must necessarily counteract fermentation.

III. *The Action of Borax on Fermentable Substances.*

1. In the month of October 1872, I placed some very ripe grapes in a concentrated solution of borax, as well as an entire bunch of grapes; the whole was put into a bottle and corked up. The liquid, at first colourless, browned slightly; but the separate berries, as well as the bunch, present the same appearance to-day (February 1875) that they did more than two years since. There has been no trace of fermentation. Nevertheless, although the grapes are well preserved, they are not eatable. There has been diffusion: a large portion of the sugar has passed through the membranous husk of the grapes, while the borax has penetrated into the interior, where it has coagulated the albuminous matter of the cells.

I made the same experiment with some gooseberries, and obtained the same result. When the bottles are well corked, not a trace of mouldiness can be seen; but when the air has free access, or even a limited access, a mouldiness forms (*Mucor*) without fermentation accompanied by disengagement of gas. When, as a countertest, grapes are placed in a well-corked bottle filled with water, fermentation takes place at the end of a time which varies according to the temperature, and carbonic acid is liberated.

2. 30 cubic centims. of fresh milk was put into a test-tube with 1 gramme of borax. The cream soon formed a pretty thick layer at the surface. In spite of the stopper which closed the test-tube, mould formed on the cream; but the rest of the liquid underwent no acid fermentation, and retained during several months the look of skimmed milk, very clear. Afterwards, under the influence of

the heat of summer, the liquid became quite limpid, while a soft white substance (caseine) was deposited at the bottom of the tube; but neither the liquid nor the precipitate had any acid taste; at the end of three months they exhaled the odour of fresh milk.

Some fresh milk, without the addition of borax, put into a well-corked test-tube, underwent the acid fermentation after two or three days; it became quite thick by the coagulation of the caseine.

3. A fragment of sheep's cerebellum was sprinkled with borax. Eight days afterwards it gave out a spermatic odour; later, sulphuretted hydrogen was liberated, without putrefaction proper being perceptible. The substance, after presenting during several months a soft consistence, became hard and void of any unpleasant smell.

4. A pound of beef was placed in a concentrated solution of borax in a tin box not hermetically sealed. The red colouring-matter of the blood became diffused in the surrounding liquid, as well as a part of the soluble nitrogenous substances of the meat. After a few weeks the liquid assumed a brown colour and emitted a very unpleasant odour, although there was no putrefaction of the meat, which, when removed from the liquid and washed with cold water, certainly had a peculiar smell, but quite unlike that of putrefying meat. To-day, after more than a year and a half, notwithstanding the summer heats of 1873 and 1874, the liquid having been renewed three times, the flesh presents not the slightest odour of putrefaction. Its colour is yellowish; but it is soft and tender like fresh meat. Taken out of the preserving-liquor, it retains its condition unchanged in the air.

5. Some beef, veal, and fragments of sheep's brains were placed in a borax solution in a jar filled with the liquid, and hermetically closed. The liquid was soon tinged bright red; and this colour remained unchanged during several months. The meat did not present the slightest unpleasant odour as long as the access of air was prevented. Some meat placed in water, even in an hermetically closed bottle, was rotten in a few days.

The odour *sui generis* presented, on contact with the air, by meat which has been preserved for a time in the borax solution, seems to me to arise from the decomposition of the materials resulting from the metamorphosis of the substances composing either the muscular fibre or the intermuscular plasma.

Without wishing to infer from the preceding an application to the preservation of viands for culinary use, there flows from it another—the preservation of anatomical preparations by means of concentrated solutions of borax in well-closed jars. A great saving of the alcohol used in such cases would evidently result.

As we have demonstrated that protoplasm (that is to say, the living substratum of the lower organisms) is killed by borax, this substance might probably be utilized in the dressing of wounds, &c. —*Annales de Chimie et de Physique*, April 1875, pp. 543–549.

Investigation of the Phenomena of Digestion in Insects. By M. Félix Plateau. (An abstract of his paper in the 'Mémoires de l'Acad. Roy. de Belgique,' tome xli. 1874. Communicated by the author.)

The necessity of having recourse to animals possessing an organization resembling our own for the purpose of solving the various problems of human physiology has led to the carrying out of a multitude of experimental researches, the results of which when brought together and discussed constitute the comparative physiology of the Vertebrata, which, however, still exhibits important gaps arising from the preponderance that has been given to the study of certain classes to the neglect of the rest. The division which has received most attention next to the Vertebrata is that of the Arthropoda. We already possess valuable treatises on the locomotion, the innervation, the circulation, the animal heat, the secretory phenomena, and especially the embryonic development of these animals; but it will be remarked that digestion has been left almost entirely in the shade.

Attracted by the novelty of the subject, but without losing sight of the difficulty of the task, we have endeavoured to fill up this gap by repeating on a small scale what so many others have done on a large scale for the Mammalia—by feeding Articulate animals, following, often step by step, the modifications of their food in the digestive tube, analyzing as far as possible the liquids secreted by the walls and glandular appendages of the latter, attempting artificial digestions, &c.*

Although our investigations have for several years embraced the whole of the group, we have thought it better at present to publish only what relates to the Insects†; and we do this with the confidence derived from work performed with minute care, but also with the conviction that we have done no more than to place a landmark as the starting-point for future studies.

Our observations, and especially our experiments, have led us to results some of which are in complete disagreement with what we find stated in recent classical treatises. Could it well be otherwise? The authors of the works of which I speak had before them as materials nothing but almost exclusively anatomical data, of which they have taken the best advantage in their power by depending upon analogies of form.

To be as brief as possible, I shall confine myself to an abstract of the summary which concludes my memoir.

When the *salivary glands* are not diverted from their original function to become silk-glands, poison-glands, &c., they secrete a neutral or alkaline liquid, possessing, at least in the case of one of

* Respect for priority makes it our duty to point out to the reader that the first experiments in artificial digestion by means of the digestive liquids of an Arthropod were made by M. Emile Blanchard in his researches on the Scorpion ('Organisation du Règne Animal,' Arachnides, p. 66).

† The description of the phenomena of digestion in the Myriopoda, the Crustacea, and the Arachnida will appear hereafter.

the pairs of glands, the characteristic property of the saliva of the Vertebrata, of rapidly converting feculent aliments into soluble and assimilable glucose.

In a great many cases (carnivorous insects, Orthoptera, &c.) the œsophagus is dilated into a *crop* terminated by a narrow valvular apparatus. The food, more or less divided by the organs of the mouth, accumulates in this crop, which is very dilatable, is there impregnated by peculiar neutral or alkaline liquids, and undergoes an evident digestive action, the result of which, in carnivorous insects, is the transformation of the albuminoid materials into soluble and assimilable substances analogous to the peptones, and, in insects which feed upon vegetable substances, an abundant production of sugar at the expense of starch. This digestion in the crop is very slow; and until it is terminated the following part of the alimentary tube remains empty.

When the digestion in the crop has come to an end, the materials, subjected to a strong pressure on the part of the walls of the organ, glide or filter, by degrees, through the *valvular apparatus* (gizzard of authors), being directed in their course by the furrows and chitinous projections of the latter. The vascular apparatus is not a trituratory organ auxiliary to the buccal organs; for in the carnivorous beetles and in the Locustina, in which it affects a classical form, the animal or vegetable matters which have traversed it are found after the passage in portions of the same size and form as before the operation.

In the insects which have neither a crop nor a valvular apparatus, the food passes continuously into the middle intestine.

In the *middle intestine* (chylific stomach of authors) the alimentary materials which have resisted the action of the crop, or those which have penetrated into it directly in the insects which do not possess the crop and the valvular apparatus, are submitted to the action of an alkaline or neutral, but never *acid* liquid, secreted either by special local glands, as in the Orthoptera, or by a multitude of small glandular cæca, as in many Coleoptera, or by a simple epithelial lining. This has no analogy with the gastric juice of Vertebrates; its function is different according to the group to which the insect belongs: in the carnivorous Coleoptera it is an active emulgent of fatty matters; in the Hydrophilian Coleoptera it continues the transformation of starch into glucose which commenced in the œsophagus; in the Scarabæida it also gives rise to glucose, but this action is local, taking place in the middle intestine and nowhere else; in the caterpillars of Lepidoptera it determines a production of glucose and at the same time acts as an emulgent of fatty matters; lastly, in the herbivorous Orthoptera there seems to be no further formation of sugar in the middle intestine, but this body is produced and absorbed entirely before passing the crop.

The middle intestine is generally evacuated slowly and continuously into the *terminal intestine*, the first portion of which, usually long and slender, is very probably the seat of an active absorption. The epithelial lining of the walls in some species seems, however, to indicate that secondary digestive phenomena may take place in it. The reaction of the contents is neutral or alkaline.

The second, wider portion of the terminal intestine only performs the function of a stercoral reservoir. It is associated, for example in the Dytiscidæ, the *Nepæ*, and the *Ranatræ*, with a voluminous cæcum, which is not a natatory bladder as has been supposed. It may be empty or full of liquid, but never contains any gas. The liquid product secreted by the Malpighian tubes accumulates there, and, under certain circumstances, deposits in it calculi which may be of considerable size.

Some substances resist the digestive action and are passed with the excrements. Such are the chitine of the integuments of insects, vegetable cellulose, and chlorophyl; the microspectroscope enables us to detect the last at all parts of the alimentary tube of herbivorous insects.

Insects have nothing resembling the chyliferous ducts. The products of digestion, dissolved salts, peptones, sugar in solution, and fatty emulsions, traverse the comparatively thin coats of the digestive tube by a phenomenon of osmosis, and mix with the blood outside this tube.

The Malpighian tubes are exclusively depuratory and urinary organs, which free the body from the products of the wear of organic elements. The liquid that they secrete contains urea (doubtful), uric acid, urates in abundance, hippuric acid (doubtful), chloride of sodium, phosphates, carbonate of lime, oxalate of lime in quantity, leucine, and colouring-matters.

As to the so-called *anal glands*, the product they secrete is very variable in different groups; but it has no part to play in digestion, and is not urinary.

On the Structure and the Development of the Sting and Ovipositor of some Hymenoptera and of Locusta viridissima. By Dr. H. Dewitz.

It has generally been admitted, until within the last few years, that the parts which are found at the posterior extremity of the bodies of insects, and which constitute nippers, cerci, the ovipositor, and the sting, are formed by the transformation of certain segments, or at least of some arches of segments. However, new views as to the origin and signification of these organs were introduced into science in 1866 by Packard and Weissmann. Memoirs directly or indirectly relating to this subject have been published more recently by Ganin in 1869, and lastly by Oulianin and Kräpelin in 1872 and 1873.

The embrylogical researches of M. Dewitz, which relate to *Locusta viridissima*, *Apis mellifica*, *Bombus* sp., *Vespa vulgaris*, and *Cryptus migrator*, have led him to the discovery of some important facts, which confirm, in a general way, the opinion of the anatomists whom we have just mentioned, completing and rectifying certain points of their observations. To give an idea of the results at which the author has arrived we think we cannot do better than translate the most essential part of the summary which terminates his memoir.

"In all the insects observed, the body is composed of thirteen segments behind the head. Nevertheless this number presents in the Hymenoptera an apparent reduction, arising from the invagination of the last segment; while in the *Locustæ* there seems to exist, on the contrary, one segment more than usual, because, in the course of development, the last segment divides into two parts—namely, a posterior anal piece and an anterior annular piece *.

"Both the sting and the ovipositor are formed of six principal parts, of which, however, the number is reduced to five in the Hymenoptera which the auther has been able to observe, in consequence of the soldering together of two of them. These six parts originate from six papillæ, four of which belong to the penultimate segment (12th behind the head) and two to the antepenultimate. These papillæ originate from disks (*Imaginalscheiben*) similar to those which Weissmann has described in connexion with the formation of the appendages of *Corethra*; but while in the Hymenoptera observed these disks originate from an invagination of the hypoderm, which thrusts itself into the cavity of the body in the shape of hollow demispheres, we can recognize in *Locusta* only a thickening and projection of the hypoderm exteriorly. The time of the appearance of the six papillæ is not the same in all cases: in the bees, at the commencement of the larval period the two papillæ of the antepenultimate segment and the two intermediate ones of the penultimate appear simultaneously, while the two lateral papillæ of the latter do not show themselves until later; on the other hand, in the grasshoppers, while still in the egg the two lateral papillæ of the penultimate segment are already very much advanced in development, the two of the antepenultimate segment are indicated in the form of disks; and the two intermediate ones of the penultimate segment appear only when the animal has quitted the egg for some time. We consequently see here, as in other cases of the development of the Articulata, that homologous parts do not always appear in the same order, but show themselves sooner or later according to the dimensions which they have to acquire or the importance which they will have in the sequel.

"In the Hymenoptera observed, the sheaths result from the development of the two lateral papillæ of the penultimate segment, the

* M. H. de Saussure, who has carefully studied the abdomen of the adult Orthoptera, has only found nine segments in these latter insects, besides the intermediate segment, which has no ventral arch and belongs rather to the thorax than to the abdomen. The body, therefore, would possess, according to him, thirteen segments without counting the head (see 'Mémoires pour servir à l'Histoire Naturelle du Mexique &c.,' tome i. p. 263, and 'Mission scientifique au Mexique &c.,' Orthoptères, p. 2, pl. i.). In the Hymenoptera the intermediate segment closes the thorax behind, and forms that which has been wrongly called the metathorax. It is then entirely separated from the thorax.

channel from the development of the intermediate papillæ of this same segment, and the bristles serving to sting or to perforate proceed from the two papillæ of the antepenultimate. As the parts of the ovipositor in *Locusta* have the same origin, we ought to consider them homologous with the parts of the sting of the Hymenoptera; and the upper sheaths of the grasshopper consequently correspond to the sheaths of the sting, the lower ones to the piercing-setæ, and the annexed sheaths to the channel.

"The segments take part in the formation of the sting only inasmuch as the chitinous bands forming in the parts of the sting are attached to them and partly soldered to them. Some particular points of the surface of the segment also present a stronger deposit of chitine, and thus attach themselves to parts of the sting; this is the case with the flattened plates and the angle (*Winkel*) of the Hymenoptera, as well as with some of the pieces which occur at the base of the ovipositor in *Locusta*, and which have not yet received a name.

"The sting is distinguished in a remarkable manner from the ovipositor of the grasshoppers by the number as well as by the attachment of the muscles which move these apparatus.

"In *Apis* &c. these last are fixed only on the anterior part of the sting, which is inserted into the body; while in *Locusta* they penetrate also into the pieces of the ovipositor. However, the differences arise above all from the dimensions, the forms, and the adherences of homologous parts, and particularly from the different relations which the sheaths of the sting and the upper sheaths in *Locusta* bear to the other parts. The setæ of the Hymenoptera and the lower sheaths of *Locusta* present very different forms; the former have only one groove, the latter have two. The appendages which in the Hymenoptera form the channel, undergo in *Locusta* an arrest of development.

"The cheliform and foliaceous appendages which constitute the external copulatory organs of the males of the bees and Ichneumonidæ, as well as the two styliform appendages of the anal piece of the penultimate segment in the males of the grasshoppers, originate from two papillæ situated on the penultimate segment.

"Embryogeny therefore teaches us that the parts of the sting and of the ovipositor represent appendicular organs. It only remains to inquire if we ought to regard the four appendages of the penultimate segment as representing two pairs of members, or as two members having undergone a longitudinal division. This latter interpretation is preferable, since each group of two appendages arises from one disk only, which proves its unity. However, to decide this question with certainty, we must have more numerous observations than we possess up to the present time on the formation of the appendages of articulated animals."—*Zeitschr. für wiss. Zool.* Band xxv. 1875, pp. 174–200; *Bibl. Univ.* April 15, 1875, *Arch. des Sci.* p. 343.

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XX.—*On the Primary Origin of the Sexual Products.* By M. HERMANN FOL*.

A MEMOIR of great importance from the point of view of embryogenic morphology appeared at the end of last year†. This memoir is the fruit of the investigations made by E. van Beneden on the mode of formation of the testis and ovary in *Hydractinia echinata* and *Clava squamata*.

The *Hydractinia* is particularly well adapted for this investigation, because its colonies are male or female; each colony contains individuals in different stages of development, the sex of which is thus known beforehand. To this we must add the simplicity of organization of the Cœlenterata, especially the Hydroida, which consist during the whole of their life principally of the two primitive lamellæ, the ectoderm and entoderm—the mesoderm, represented by muscular fibres and connective tissue, being very little developed. The results of researches made upon an object so favourable must have an almost absolute certainty, and deserve our full confidence.

Van Beneden saw the testis form at the expense of a mass

* Translated by W. S. Dallas, F.L.S., from the 'Bibliothèque Universelle, Archives des Sciences Physiques et Naturelles,' June 15, 1875, pp. 104–111.

† E. van Beneden, "De la distinction originelle du testicule et de l'ovaire; caractère sexuel des deux feuillets primordiaux de l'embryon; hermaphrodisme morphologique de toute individualité animale &c.," Bull. Acad. Roy. de Belgique, 3e sér. tome xxxvii. 1874.

of cells, which results from a hollow or solid invagination of the outer lamella. The ova, on the contrary, descend directly from a certain number of cells of the entoderm. The two organs are sketched out in each of the two sexes; but the testis is atrophied afterwards in the reproductive individuals of the female colonies and the ovary in those of the male colonies.

Waldeyer had previously found that the superficial epithelium of the ovary of certain Vertebrata is derived from the peritoneal epithelium which covers the middle lamella, which itself appears to be a dependency of the entoderm. The testis is formed at the expense of the Wolfian canal, which appears to be derived from the ectoderm.

Bringing together his own and these latter results, Van Beneden sees in them a confirmation of his ideas, and considers it probable that they will be verified for the animal kingdom in general. It will be admitted that it is going rather quickly to conclude the universality of these phenomena throughout the animal kingdom from two observations so isolated, and only one of which, founded upon the investigation of *two species* of Hydroid polypes, presents the character of scientific certainty!

These conclusions must certainly have appeared very bold, to say no more of them, to many readers. Indeed we know that none of the authors who have paid attention to the primary origin of the sexual products in various sections of the animal kingdom, with the exception of the Vertebrata, have observed any facts which could be in accordance with these views. Their generality is so far from being demonstrated, that even among the Cœlenterata there are some of which the sexual products appear to be formed at the expense of the entoderm alone. Häckel is explicit upon this point with regard to the Geryonidæ. In *Cordylophora* and in *Hydra* the sexual products are derived from the ectoderm, according to the careful researches of F. E. Schultze and Kleinenberg. Moreover are not the results of the recent investigations in embryogeny of a nature to inspire us with prudential feelings? Have not very great and quite unexpected differences in the mode of formation of the lamellæ and organs been observed even in allied genera?

Hence it was with absolute scepticism that I, for my part, received M. van Beneden's generalizations. Without throwing the least doubt in the world upon the result of his researches upon two species of Hydroid polypes, I could not admit as probable that this mode of development of the organs of generation was universal, or even very widely diffused. All that I could recall to mind of my own observations upon the Ctenophora, the Geryonidæ, and the Mollusca was in favour of Häckel's ideas; and in the Pteropoda especially I had clearly seen what I took to be the entire genital gland formed by a scission of part of the inner lamella. These observations on the Pteropoda are recorded in a memoir which will appear immediately.

Nevertheless the perusal of M. van Beneden's memoir and certain contradictions to be met with in those authors who have paid attention to this subject for the Mollusca, made me wish for an opportunity of verifying afresh the correctness of my opinions. Thus it is well known that most authors represent the hermaphroditic gland of the Mollusca as originating from the posterior part of the liver—that is to say, from the entoderm. My own observations were in support of this view, as I had seen the gland in question separate by scission from the wall of the nutritive sac in the Pteropoda. Now the nutritive sac gives direct origin to the liver in many Cephalophora, although this is not the case in the Pteropoda.

But one author, whose opinion weighs heavily in the balance, did not share this opinion. J. Müller describes the genital organs in *Creseis* as originating from a pyriform organ which is suspended by the side of the stomach and the origin of the nutritive sac. What is the origin of this organ? and what are the modifications it undergoes in order to give origin to the sexual organs? The observations of the great anatomist give no answer to these questions.

Being at Messina during the months of February and March in the present year, my first care was to resume the question *ab ovo.* Chance was in my favour; the larvæ and young of *Creseis* abounded in the sea at a depth of from 5 to 10 fathoms.

I had no trouble in finding the pyriform body described by J. Müller in young animals which had recently undergone metamorphosis. It was moreover already indicated in some of my previous drawings. A careful study of its structure and relations showed me that it was composed of a great number of not very distinct small cells, and connected with the ectoderm by sarcodic prolongations of its substance. The largest of these prolongations was attached to the ectoderm in the region near the anus, and to the anus itself, by means of a quantity of branched filaments of extreme tenuity. The other sarcodic processes were attached to the portion of the ectoderm that surrounds the branchial or pallial cavity.

This body, which is situated, as well described by J. Müller, on the left side of the stomach, afterwards takes on a very rapid development; it is this circumstance that previously prevented my recognizing it in the organ of large dimensions which it has become in individuals but little larger than the preceding ones. It then presents the form of a thick elongated body, lobulated on its surface, and surrounding the base of the nutritive sac like a half-cylinder. The spermatozoids speedily form in the lobules of this organ; it is the testis.

It remained to discover the primary origin of the pyriform body of J. Müller. The youngest larvæ of *Creseis* that I met with already possessed it. It was globular and very small, composed of a few cells, and situated near the anus. Sarcodic filaments attached it to the anus and the neighbouring part of the ectoderm. It is well known that most of the larvæ of the Cephalophora possess by the side of the anus two cellular masses which project into the cavity of the body, and originate by proliferation from the ectoderm of the anal region. One of these cellular bodies gives origin to the kidney. The other some authors regard as the origin of the genital organs—an opinion which is not founded upon any positive observation, but only on the fact that they did not know what other signification to attribute to it. This cellular body is no doubt the origin of the pyriform body, which is nothing but the rudiment of the testis. The testis, therefore, originates from the ectoderm.

The ovary is formed in the manner that I have described in my memoir on the Pteropoda. The only error into which I have fallen with regard to it has been that I have taken the rudiment of the ovary for the origin of the entire hermaphroditic gland. Each of the brownish cells, a single layer of which composes the wall of the nutritive sac, divides crosswise into an exterior transparent cell and an interior brown cell. This scission takes place only on the right side of the sac. The inner layer of brown cells continues to form the epithelium of the nutritive sac, whilst the exterior layer envelops it in the form of a half-cylinder. The cells of the latter layer multiply slowly, then begin to enlarge; and each of them becomes an ovule. But these ovules do not attain their maturity until after the more or less complete evacuation of the semen accumulated in the testis.

I have ascertained the same facts in an orthoconchal Pteropod, *Styliola subulata*.

In *Creseis* the male and female parts of the hermaphroditic gland are simply applied to each other throughout their length, and their contact does not become intimate until after the absorption of the nutritive sac. But the ovary and the testis do not mingle so intimately as in the other Cephalophora;

it was therefore an interesting matter to ascertain whether things went on in the same way in the latter. Unfortunately all the Gasteropoda that I had at my disposal became very opaque at the close of the larval period, and time did not allow me to commence a series of researches upon this point by means of dissections. I was obliged to content myself with ascertaining that the same mode of development occurs in a Heteropod with distinct sexes, the larvæ and young of which were frequently met with, namely *Atlanta Peronii.*

It is therefore admissible that even those of the Cephalophora which have distinct sexes are originally hermaphrodite. However, as my investigations relate only to a single genus, it would be premature to pronounce an opinion upon this point. Even as regards *Atlanta*, in order to be sure that the two sexes are originally identical, it would be necessary to have proof that some of the young animals that I observed were destined to become males and others females; and this proof is wanting.

At any rate the formation of the male sexual products at the expense of the ectoderm, and of the female products at the expense of the entoderm, is ascertained positively in three genera of Cephalophora, belonging to two different orders of that class.

In the *Appendicularice* I have been unable to follow the primary formation of the sexual organs. But in very young individuals of the genus *Fritillaria* the ovary was found to be applied against the digestive tube, whilst the testis was contiguous to the posterior extremity of the body. Subsequently these two organs came into contact with each other, but without becoming united. However, I only give these facts as a simple indication; they are too incomplete to prove any thing.

This confirmation of Van Beneden's views is the more striking, as I was so sceptical when I commenced the examination of the question, and especially because the Cephalophora, with their sexual products intimately mixed in their hermaphroditic gland, are precisely the animals in which *à priori* we should least expect to see these views confirmed.

The primary origin of the testis and the ovary in the two primitive lamellæ of the embryo is now ascertained positively in cases taken from two great divisions of the animal kingdom, the Cœlenterata and the Mollusca; it is rendered very probable by examples taken from the two divisions of the section of the Chordata—namely, the Tunicata and the Vertebrata.

The question whether this fact of prime importance is general for all animals has made another step towards its solution. Nevertheless, for the present I shall abstain from sharing the assurance with which Van Beneden deduced his generalization. But whether this mode of formation is universal, or only of very general occurrence, the able Belgian observer will always have the merit of having not only discovered the fact, but grasped its whole bearing. Observations so important and so valuable to science may well lead us to pardon bold theories. Would that all who launch imperfectly founded hypotheses under the pompous title of theories had so good an excuse!

XXI.—*Note on Entomostraca from Kerguelen's Land and the South Indian Ocean.* By George Stewardson Brady, C.M.Z.S., Professor of Natural History in the College of Physical Science, Newcastle-on-Tyne.

Two gatherings of Entomostraca, belonging to the order Copepoda, have been submitted to me for examination by the Rev. A. E. Eaton. One gathering, from a lake which must, in all probability, have been brackish from communication at infrequent intervals (possibly at very high tides only) with the sea, contained only *Harpacticus fulvus*, Fischer, a species very commonly distributed over Europe in pools at or above high-water mark. The other gathering was made by the towing-net in the open sea, and contained likewise only one species, apparently undescribed and belonging to the genus *Centropages*, Kröyer. Females only were taken.

Centropages brevicaudatus, nov. sp.

Length $\frac{1}{10}$ of an inch. Upper antennæ equal in length to the first two cephalothoracic segments, 25-jointed, shortly setose, and tapering slightly to the distal extremity. Swimming-feet having both branches 3-jointed, inner branch short; first pair much shorter than the three following; outer branch of the fifth pair having its second joint produced internally into a strong denticulated spine; marginal setæ of both branches extremely short. Abdomen short; caudal setæ short, plumose, subequal, length equal to half that of the abdomen.

Hab. Lat. 33° 13′ S., long. 37° 37′ E.

XXII.—*Revision of the Subfamily* Pericopiinæ *of the Lepidopterous Family* Arctiidæ, *with Descriptions of new Species.* By Arthur Gardiner Butler, F.L.S., F.Z.S., &c.

In the year 1872 I published a list of *Pericopiinæ* in the 'Transactions' of the London Entomological Society; but owing to the confusion in which Mr. Walker had left the genera, and to the slight acquaintance which I then had with the allied subfamilies, I admitted into my paper several forms which are more properly to be referred to other groups, whilst at the same time I excluded a few which should have been admitted.

The above-mentioned list was compiled under pressure, as an appendix to a paper describing new species; I therefore did not attempt to arrange the genera or species in any thing like a natural series, nor did I examine into the value of the genera or species which I quoted. The whole of these failings, however, will now be corrected.

Notwithstanding the constancy with which Mr. Kirby persists (in each volume of the 'Zoological Record') in referring the *Pericopiinæ* to the Lithosiidæ, I still assert that they are unquestionably Arctiidæ, and that their true position is (as I have always said) near to *Hypercompa*. What appears to me to be their most natural place is after *Anaxita* (a genus of the *Halesidota* group) and before *Hypercompa*; they thus form a connecting link between the Zygænoid Arctiidæ and the Arctiidæ proper.

The genus *Stenele*, which I formerly included in this group, is clearly more nearly allied to *Chrysauge*.

All the *Pericopiinæ* are from the New World.

Genus Pericopis, Hübner.

Subgenus 1. Thebrone, Boisduval.

The author of this (uncharacterized) group states that its types are the *sacrifica* of Hübner and the *Aglaura* of Cramer; the first of these will, however, find its true position in *Daritis* of Walker, which will leave as type *P. Aglaura*, thus restricting the typical group of *Pericopis* to *P. Zerbina* of Stoll and *P. eurocilia* of Cramer. Dr. Boisduval, not being aware that the sexes of the *P.-Aglaura* group are quite dissimilar, has suggested for "*tricolora* of Cramer (*turbida*, Hübner)"* the subgeneric appellation of *Aphisaon*. The new species described

* In this he has followed an error in Hübner's 'Verzeichniss:' the two species, though nearly allied, are distinct; the males especially differ in colour.

under this subgenus belongs to the next group, the sexes being almost alike; I shall therefore adopt the name for that section of the genus.

1. *Thebrone Jansonis* ♀, Butler, Lep. Exot. pl. xvii. figs. 4, 5 (1870).

? *Thebrone Arema* ♂, Boisduval, Lép. Guat. p. 85 (1870).

Hab. Nicaragua. ♀, B.M.

It is possible that *T. Arema* may belong to the hyaline group of typical *Pericopis*. Without seeing the insect, it is impossible to determine.

2. *Thebrone Aglaura*, Cramer, Pap. Exot. pl. 263. fig. F, ♂ (1782).

Hab. Venezuela. ♂ ♀, B.M.

The female has an oblique whitish band across the centre of the primaries; in other respects it approaches *T. Jansonis* in colouring.

3. *Thebrone turbida*, Hübner, Zutr. ex. Schm. figs. 529, 530, ♀ (1806).

Pericopis lunifera, Butler, Ann. & Mag. Nat. Hist., Oct. 1871, p. 288.

Hab. "Bahia" (*Hübner*); Brazil. ♂ ♀, B.M.

The male is very like *P. Aglaura*, excepting that the central oblique blackish bar of the primaries is obsolete.

4. *Thebrone tricolora*, Sulzer, Gesch. pl. xxii. fig. 5, ♀ (1776).

Hab. Pará (♂ ♀); Brazil (♀). B.M.

The male chiefly differs from the preceding in the yellow colouring of the secondaries; the blackish bar of the primaries is obsolescent.

5. *Thebrone formosissima*, Butler, Ann. & Mag. Nat. Hist., Oct. 1871, p. 288.

Hab. Columbia and Ecuador. ♂ ♀, coll. Hope, Oxford.

Subgenus 2. Aphisaon (part.), Boisduval.

1. *Aphisaon? Rosina*, Butler, P. Z. S. p. 82 (1871); Lep. Exot. pl. xxx. fig. 1, ♀.

Hab. Ega. B.M.

This species has much the aspect of the preceding group, to which it may be referable; but without seeing the male it is impossible to be certain either way.

2. *Aphisaon larvata*, Walker, Cat. Lep. Het. vii. p. 1654, ♀ (1856).

Hab. Amazons. Coll. Hope, Oxford.

Seems nearly allied to the preceding species.

3. *Aphisaon Salvatoris*, Boisduval, Lép. Guat. p. 86 (1870).

Hab. Honduras and Guatemala.

4. *Aphisaon leucophæa*, Walker, Cat. Lep. Het. ii. p. 352, ♂ ♀ (1854).

Thebrone rubrimargo, Boisduval, Lép. Guat. p. 89 (1870).

Hab. Mexico. B.M.

5. *Aphisaon Flora*, Butler, Cist. Ent. vi. p. 127, ♂ ♀ (1873); Lep. Exot. pl. lxi. fig. 9, ♀.

Hab. Guatemala. ♂, B.M.; ♀, coll. Hope, Oxford.

6. *Aphisaon Holofernes*, Butler, Ann. & Mag. Nat. Hist. p. 289, ♀ (Oct. 1871).

Hab. Minas Geraes. ♀, coll. Hope, Oxford.

7. *Aphisaon subapicalis*, Walker, Cat. Lep. Het. ii. p. 352, ♀ (1854).

Pericopis tristis, Walker, Characters of Het. Lep. p. 7. n. 8 (1869), ♀.

Hab. Brazil. ♀, B.M.

Subgenus 3. Dysschema, Hübner (restricted).

1. *Dysschema parnassoides*, Walker, Cat. Lep. Het. ii. p. 350, ♂ (1854).

Hab. Brazil. ♂, B.M.

2. *Dysschema rorata*, Walker, Cat. Lep. Het., Suppl. i. p. 154 (1864).

Hab. Bogota. Coll. Birchall.

3. *Dysschema noctuites*, Butler, Trans. Ent. Soc. Lond. p. 50. n. 1 (1872).

Hab. Minas Geraes? Coll. Hope, Oxford.

4. *Dysschema Sibylla*, Butler, Cist. Ent. vi. p. 127 (1873); Lep. Exot. pl. lxi. fig. 12.

Hab. Espirito Santo. Coll. Hope, Oxford.

5. *Dysschema hypoxantha*, Hübner, Zutr. ex. Schmett. figs. 191, 192 (1806).

Hab. Surinam.

6. *Dysschema fantasma*, Butler, Cist. Ent. vi. p. 126 (1873); Lep. Exot. pl. lxi. fig. 2.

Hab. Bogota. Coll. Hope, Oxford.

7. *Dysschema Lucifer*, Butler, Cist. Ent. vi. p. 126 (1873); Lep. Exot. pl. lxi. fig. 1.

Hab. Espirito Santo. Coll. Hope, Oxford.

8. *Dysschema submarginata*, Walker, Cat. Lep. Het. ii. p. 350 (1854).

Hab. Brazil. B.M.

Subgenus 4. Pericopis (typical), Hübner.

1. *Pericopis dissimulans*, Walker, Cat. Lep. Het., Suppl. i. p. 155, ♂ (1864).

Hab. Bogota. ♂ ♀, B.M.

The female differs very little from the following species, and was placed with it in the Collection.

2. *Pericopis marginalis*, Walker, Cat. Lep. Het. iii. p. 618 (*Daritis*), ♀ (1855).

Hab. Venezuela. ♀, B.M.

3. *Pericopis Neda*, Klug, Neue Schmett. königl. zool. Mus. Berlin, pl. iv. figs. ? 3, 4 (1836), "*Euprepia.*"

Hab. Brazil.

I have been unable to examine the plate upon which this species is figured; but I suspect it to be nearly allied to the preceding species.

4. *Pericopis Iscariotes*, Boisduval, Lép. Guat. p. 91 (1870).

Hab. Honduras and Guatemala.

Nearly allied to *P. marginalis*, apparently chiefly differing in the colouring of the secondaries.

5. *Pericopis humeralis*, Walker, Cat. Lep. Het. vii. p. 1655 (1856).

Hab. ——? ♂, B.M.

6. *Pericopis nubila*, Walker, Cat. Lep. Het. ii. p. 349 (1854).

Hab. Brazil. ♀, B.M.

7. *Pericopis Amphissa*, Hübner, Zutr. ex. Schmett. figs. 753, 754 (1806).

Pericopis subguttata, Walker, Cat. Lep. Het. ii. p. 347 (1854).

Hab. Rio Janeiro. ♀, B.M.

8. *Pericopis Leonina*, Butler, Cist. Ent. p. 89 (1872); Lep. Exot. pl. lxi. fig. 10.

Hab. Cartago, Costa Rica. ♀, B.M.

9. *Pericopis Lucretia*, Butler, Ann. & Mag. Nat. Hist. p. 340 (May 1875).

Hab. Veragua. ♀, B.M.

10. *Pericopis fulgorata*, Butler, Ann. & Mag. Nat. Hist. p. 287 (Oct. 1871).

Hab. Pará. ♀, coll. Hope, Oxford.

11. *Pericopis bivittata*, Walker, Cat. Lep. Het. ii. p. 348 (1854).

Pericopis disjuncta, Walker, *l. c.* vii. p. 1655 (1856).
? *Chetone Aorsa*, Boisduval, Lép. Guat. p. 90 (1870).

Hab. Venezuela. ♀, B.M.

12. *Pericopis eurocilia*, Cramer, Pap. Exot. ii. pl. 178. fig. C (1779).

Hab. West Indies.

13. *Pericopis Zerbina*, Stoll, Suppl. Cramer, pl. lxx. fig. 3.

Hab. South America. ♀, B.M.

14. *Pericopis indecisa*, Walker, Cat. Lep. Het. ii. p. 347 (1854).

Hab. Rio Janeiro. B.M.

Ground-colour of the wings hyaline.

15. *Pericopis dissimulata*, Walker, Cat. Lep. Het., Suppl. i. p. 155 (1864).

Hab. Bogota. ♀, B.M.

16. *Pericopis Thyridina*, Butler, Ann. & Mag. Nat. Hist. p. 289 (Oct. 1871).

Hab. Ecuador. Coll. Hope, Oxford.

Subgenus 5. Chetone, Boisduval (restricted).

The species mentioned as types being referable to other groups already named, I retain as type *C. histrio* of Felder, which is noted amongst the forms referable to the genus, and which now has the advantage (not possessed by many of the species quoted) of not being a mere MS. name. What the *Euprepia Lycaste* of Klug's 'Neue Schmetterlinge' is I cannot say; I have not had an opportunity very lately of examining the work in which the species is figured, and I do not remember the character of the insect represented.

1. *Chetone histrio*, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 5 (1874).

Hab. St. Paulo (*Bates*). B.M.

2. *Chetone heliconides*, Boisduval, Lép. Guat. p. 91 (1870).

Hab. Guatemala.

3. *Chetone? Hazara*, Butler, Ann. & Mag. Nat. Hist. p. 287 (Oct. 1871).

Hab. Villa Nova and Ecuador. Coll. Hope, Oxford.

4. *Chetone Felderi*, Boisduval, Lép. Guat. p. 91 (1870).

Hab. Nicaragua.

5. *Chetone Salvini*, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 8 (1874).

Hab. Polochic valley. Coll. Hope, Oxford.

6. *Chetone angulosa*, Walker, Cat. Lep. Het. ii. p. 345 (1854).

Hab. Venezuela. B.M.

7. *Chetone Irenides*, Butler, Cist. Ent. p. 88 (1872); Lep. Exot. pl. lxi. fig. 11.

Hab. Cartago, Costa Rica. ♂ ♀, B.M.

8. *Chetone Ithomia*, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 7 (1874).

Hab. "Nicaragua" (*Boisduval*).

9. *Chetone Hydra*, Butler, Ann. & Mag. Nat. Hist. p. 286 (Oct. 1871).

Hab. Ecuador. Coll. Hope, Oxford.

Subgenus 6. PHALOË, Guérin.

1. *Phaloë mimica*, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 6 (1874).

Hab. Upper Orinoco. Coll. Hope, Oxford.

2. *Phaloë Ithrana*, Butler, Ann. & Mag. Nat. Hist. p. 286 (Oct. 1871).

Hab. Amazons. Coll. Hope, Oxford.

3. *Phaloë Phœba*, Boisduval, Lép. Guat. p. 90 (1870).

Pericopis Isse, Walker (nec Hübner), Cat. Lep. Het. ii. p. 344. n. 2 (1854).

Hab. Ega. B.M.

4. *Phaloë Isse*, Hübner, Zutr. exot. Schmett. figs. 507, 508 (1806).

Pericopis decisa, Walker, Cat. Lep. Het. ii. p. 345. n. 3 (1854).

Hab. Bogota. B.M.

5. *Phaloë Kenara*, Butler, Ann. & Mag. Nat. Hist. p. 287 (Oct. 1871).

Hab. Santa Marta. Coll. Hope, Oxford.

6. *Phaloë Catilina*, Cramer, Pap. Exot. i. pl. 79. figs. E, F (1779).

Phalæna catilinaria, Fabricius, Sp. Ins. p. 250 (1781).
Papilio nasica, Fabricius, Ent. Syst. iii. p. 169 (1793).
Pericopis perspicua, Walker, Cat. Lep. Het. ii. p. 344 (1854).

Hab. Ega, Pará. B.M.

7. *Phaloë ignita*, Butler, Fabr. Cat. p. 291; Lep. Exot. pl. xvii. fig. 3.

Hab. Tapajos. B.M.

8. *Phaloë cruenta*, Hübner, Zutr. exot. Schmett. figs. 329, 330 (1806).

Hab. "Bahia" (*Hübner*). Sp. ead. ♀?, Brazil. B.M.

I much doubt our examples being representatives of Hübner's species; they differ considerably in size and in the upper-surface markings of the primaries; moreover the author distinctly states that his figures represent a female.

9. *Phaloë Lorzæ*, Boisduval, Lép. Guat. p. 90 (1870).

Hab. Venezuela. ♂ ♀, B.M.

10. *Phaloë patula*, Walker, Cat. Lep. Het. ii. p. 349 (1854).

Hab. Bolivia. B.M.

This species differs from all its allies in having the body broadly banded with white.

Subgenus 7. Sermyla, Walker.

Sermyla transversa, Walker, Cat. Lep. Het. ii. p. 461. n. 1 (1854).

Hab. Rio Janeiro. ♂, B.M.

Subgenus 8. Daritis, Walker.

1. *Daritis Thetis*, Klug, Neue Schmett. königl. zool. Mus. Berlin, pl. iv. figs. 1, 2 (1836).

Hab. Mexico. ♂ ♀, B.M.

2. *Daritis fenestrata*, Butler, Trans. Ent. Soc. Lond. p. 50. n. 3 (1872).

Hab. San Geronimo. Coll. Hope, Oxford.

3. *Daritis Woodii*, Butler, Ann. & Mag. Nat. Hist. ser. 3, vol. xx. p. 218, pl. iv. figs. 2, 3 (1867).

Hab. Bahia. Coll. T. W. Wood.

4. *Daritis rubripicta*, Butler, Trans. Ent. Soc. Lond. p. 50. n. 2 (1872).

Hab. Bogota. Coll. Hope, Oxford.

5. *Daritis sacrifica*, Hübner, Zutr. exot. Schmett. figs. 473, 474, ♀ (1806).

Taxila crucifera, Walker, Cat. Lep. Het. iii. p. 765. n. 1 (1855).

Hab. Venezuela. B.M.

Genus Phaloësia, Walker.

1. *Phaloësia saucia*, Walker, Cat. Lep. Het. ii. p. 359 (1854).

Hab. Nicaragua. B.M.

2. *Phalœsia fulvicollis*, n. sp.

Differs from the preceding in having the collar, shoulder-spot, and basal costa of primaries orange instead of scarlet; the white discoidal spots completely crossing the cell, and the macular postmedian fascia slightly constricted in the centre.

Expanse of wings 52–59 millimetres.

Hab. Santa Marta. Two examples, B.M.

3. *Phaloësia gentilis*, Boisduval, Lép. Guat. p. 88 (1870).

Hab. Mexico. B.M.

4. *Phaloësia Venezuelæ*, n. sp.

Subapical band much broader than in the three preceding forms; in other respects it agrees with *P. fulvicollis*.

Expanse of wings 53–58 millimetres.

Hab. Venezuela. Two examples, B.M.

The four preceding forms are local modifications of one type.

5. *Phaloësia chalybea*, n. sp.

Dark steel-blue, with greenish reflections, a brilliant basal subcostal streak green-shot: markings otherwise somewhat as in the four preceding forms, with the following differences:—only three ochreous (not white) spots or lituræ upon the costal area just beyond the scarlet spot; subapical band divided into five distinct testaceous spots, and placed much closer to the margin.

Expanse of wings 51 millimetres.

Hab. Vera Cruz. B.M.

6. *Phaloësia melanchroia*, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 14 (1874).

Hab. Guatemala.

Genus Composia, Hübner.

1. *Composia Sybaris*, Cramer, Pap. Exot. i. pl. 71. fig. E (1779).

Bombyx credula, Fabricius, Ent. Syst. iii. 1, p. 475 (1793).

Hab. Jamaica, Haiti. B.M.

2. *Composia Olympia*, Butler, Ann. & Mag. Nat. Hist. p. 290 (Oct. 1871).

Hab. Brazil. Coll. Hope, Oxford.

I think it possible that the two preceding genera will have eventually to be united.

Genus Hyelosia, Hübner.

1. *Hyelosia Clio*, Hübner, Verz. bek. Schmett. p. 174. n. 1797 (1816).

Phalæna Tiresias ♂, Cramer, Pap. Exot. iv. pl. 400. fig. B (1782).

Hab. Pará. B.M.

2. *Hyelosia heliconides*, Swainson, Zool. Ill. 2nd ser. pl. 124. fig. 2 (1832–33).

N. Absalon, Boisduval, Lép. Guat. p. 87 (1870).

Hab. Brazil. B.M.

3. *Hyelosia Tiresias*, Cramer, Pap. Exot. i. pl. 85. fig. B, ♀ (1779).

Hab. Surinam.

Genus Esthema, Hübner.

1. *Esthema bicolora*, Sulzer, Gesch. Ins. p. 161, pl. xxii. fig. 6 (1776).

Esthema dichroa, Hübner, Samml. exot. Schmett. i. pl. 187 (1805).

Hab. Pará, Ega, Brazil. B.M.

2. *Esthema Uraneides*, Butler, Ann. & Mag. Nat. Hist. p. 285 (Oct. 1871).

Hab. Cayenne. Coll. Hope, Oxford.

3. *Esthema simulata*, Walker, Cat. Lep. Het., Suppl. p. 1872 (1866).

Esthema mimica, Walker, *l. c.* p. 1874 (1866).

Hab. Bogota. B.M.

4. *Esthema Aletta*, Cramer, Pap. Exot. iv. pl. 396. fig. C (1782).
Hab. Surinam.

5. *Esthema speciosa*, Walker, Cat. Lep. Het., Suppl. p. 1873 (1866).
Hab. Bogota. B.M.

6. *Esthema confluens*, Butler, Trans. Ent. Soc. Lond. p. 49 (1872); Felder, Reise der Nov., Lep. iv. pl. 103. fig. 9 (1874).
Hab. Villa Nova. Coll. Hope, Oxford.

7. *Esthema plagifera*, Felder, Wien. ent. Monatschr. vi. p. 230; Reise der Nov., Lep. iv. pl. 103. fig. 10 (1874).
Hab. Rio Negro.

8. *Esthema Celadon*, Cramer, Pap. Exot. ii. pl. 132. fig. E (1779).
?*Esthema Herrona*, Butler, Ann. & Mag. Nat. Hist. p. 285 (Oct. 1871).
?*Chetone Anacharsis*, Boisduval, Lép. Guat. p. 89 (1870).
Hab. Surinam (*Cramer*); Bogata. Coll. Hope, Oxford.

9. *Esthema euplœodes*, Butler, Ann. & Mag. Nat. Hist. p. 285 (Oct. 1871).
Hab. Colombia. Coll. Hope, Oxford.

10. *Esthema uranigera*, Walker, Cat. Lep. Het., Suppl. p. 1874 (1866).
Hab. St. Paulo. B.M.

Genus Eucyane, Hübner*.

1. *Eucyane Pylotes*, Drury, Ill. ex. Ent. ii. pl. v. fig. 3.
Calepidos Celina, Boisduval, Lép. Guat. p. 89 (1870).
Hab. Mexico. B.M.

2. *Eucyane excellens*, Walker, Cat. Lep. Het. ii. p. 362. n. 2 (1854).
Hab. Venezuela. B.M.

I inadvertently omitted this from my list of species.

* *Eucyane glauca* will be the type of this genus, *E. Celadon* being an *Esthema*.

3. *Eucyane uranicola*, Walker, Cat. Lep. Het., Suppl. p. 1875 (1866).

Hab. Bogota. B.M.

The example noted by Walker from Ega is distinct, the pattern being different as to position of white bands &c. It cannot be the female of the New-Granadan species, as supposed by Walker.

4. *Eucyane Diana*, n. sp.

Female. General pattern and coloration of the preceding; but the white band of primaries slightly broader, much more oblique, cut by the subcostal nervure, discocellulars, commencement of lower radial, and median branches; the scarlet costal spot larger, almost inclosed by the white band; scarlet and white streak of secondaries only half as wide, more oblique, placed halfway between the metallic basal area and the apex: below, green area much more restricted, scarlet spot of secondaries larger and more vivid in colour.

Expanse of wings 58 millimetres.

Hab. Ega (*Bates*). B.M.

5. *Eucyane glauca*, Cramer, Pap. Exot. ii. pl. 107. fig. E (1779).

Hab. Para. B.M.

6. *Eucyane temperata*, Walker, Cat. Lep. Het. vii. p. 1656 (1856).

Var. *Eucyane egaensis*, Butler, Ent. Month. Mag. xi. p. 77 (1874).
Eucyane jucunda, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 12 (1874).

Hab. "Tapajos" (*Walker*); Ega. B.M.

Considering that we have both forms here united from Ega, it seems most probable that *E. egaensis* is a simple variation.

7. *Eucyane Hystaspes*, Butler, P. Z. S. p. 82 (1871); Lep. Exot. pl. lxi. fig. 6.

Eucyane calida, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 11 (1374).

Hab. Venezuela and New Granada. B.M.

Subgenus Calodesma, Hübner.

(*Pyrodesma*, Boisduval.)

1. *Calodesma marginata*, n. sp.

Nearly allied to *C. fida*, but larger; collar not spotted with scarlet, band of primaries and border of secondaries much broader and paler in tint, margin of secondaries black.

Expanse of wings 60 millimetres.

Hab. —— ? B.M.

This is Walker's *E. amica*, but not Cramer's.

2. *Calodesma fida*, Hübner, Zutr. exot. Schmett. figs. 445, 446 (1806).

Hab. Rio Janeiro.

3. *Calodesma amica*, Cramer, Pap. Exot. iv. pl. 370. fig. H (1782).

Hab. Surinam.

This may not be a Pericopid, in which case it can be separated as type of *Pyrodesma*.

Subgenus Ephestris, Hübner.

(*Lama*, Walker.)

Ephestris melaxantha, Hübner, Samml. exot. Schmett. i. pl. 188 (1805).

Hab. Brazil. B.M.

The *Phalæna militta* of Cramer, placed in this genus by Mr. Walker, appears not to be a Pericopid. I doubt if Walker's *Lama trifera* (Char. Lep. Het.) is a Pericopid.

The *Eucyane uranophila* of Walker is a species of *Histiœa* (Zygænidæ).

Genus Hyalurga, Hübner.

(*Gyara*, Walker.)

1. *Hyalurga fenestra*, Clerck, Icones, tab. 55. fig. 41 (1759–64); Linn. Mus. Lud. Ulr. p. 372. n. 7 (1764).

Hyalurga fenestrigera, Hübner, Verz. bek. Schmett. p. 174 (1816).
Sphinx Egeon, Cramer, Pap. Exot. i. pl. 59. fig. B (1779).

Hab. Venezuela. B.M.

2. *Hyalurga amazonica*, n. sp.

Differs from the preceding in the deeper colour of the ochreous margins and band of primaries, which are also broadly bordered with dull black, the much broader black border of secondaries, with less-defined central white streak.

Expanse of wings, ♂ 57 millimetres, ♀ 73.

Hab. Ega (*Bates*). Type, B.M.

3. *Hyalurga Uria*, Butler, Ann. & Mag. Nat. Hist. p. 286 (Oct. 1871).

Hab. Peruvian Amazons. Coll. Hope, Oxford.

We have an example of what may be this species from Ega; but unfortunately I only have a slight sketch of the type with which to compare it; it agrees very fairly with the description.

4. *Hyalurga fenestrata*, Walker, Cat. Lep. Het. iv. p. 915, ♂ (1855).

Hab. Rio Janeiro. B.M.

The example mentioned from Pará is distinct.

5. *Hyalurga pura*, n. sp.

Male. Allied to the preceding, but considerably smaller, much whiter, with a comparatively rather broader paler yellow costal border to primaries, the bases of the median and submedian veins not blackened, no indication of an internal yellowish marginal line or of a transverse dusky line.

Expanse of wings 46 millimetres.

Hab. Pará. Type, B.M.

6. *Hyalurga clara*, Butler, Cist. Ent. vi. p. 128 (1873); Lep. Exot. pl. 61. fig. 13.

Hab. Espirito Santo. Coll. Hope, Oxford, and B.M.

7. *Hyalurga albovitrea*, Walker, Cat. Lep. Het., Suppl. i. p. 159 (1864).

Hyalurga irregularis, Felder, Reise der Nov., Lep. iv. pl. 103. fig. 16 (1874).

Hab. Ega. B.M.

Genus Coborisa, Walker.

1. *Coborisa fenestrata*, Walker, Cat. Lep. Het. iv. p. 915. n. 1 (1856).

Hab. Mexico? B.M.

2. *Coborisa vestalis*, Butler, Ann. & Mag. Nat. Hist. p. 289 (Oct. 1871).

Hab. Brazil. Coll. Hope, Oxford.

I have very little doubt that this is congeneric with the preceding species; but Walker's genus having been placed close to the end of the Liparidæ, I overlooked it when formerly working at the group, and therefore described the species as an aberrant *Pericopis*. I have to thank Mr. Stretch, of San Francisco, for directing my attention to this genus and to *Sermyla* of Walker.

The late Dr. Herrich-Schäffer, in the Correspondenz-Blatt zoolog.-min. Ver. Regensb. vol. xx. p. 131 (1867), described a species of *Pericopis* from Cuba, under the name of *P. cubana*; but all the diagnoses in that paper are so abbreviated as to be incomprehensible to me, so that I cannot attempt to determine its position.

The present group may be conveniently followed up by *Hypercompa* (or *Callimorpha*), the white-winged species forming a convenient transition to the typical Arctiidæ.

XXIII.—*Notes Introductory to the Study and Classification of the* Spongida. By H. J. Carter, F.R.S. &c.

[Continued from p. 145.]

HOLORHAPHIDOTA.

Family 1. Renierida.

Groups 1–4. **Amorphosa, Isodictyosa, Thalyosa**, and **Crassa.**

Sarcode colourless, pale tawny, or dark brown. Skeleton consisting of spiculo-fibrous reticulation filled up with areolar flaky sarcode, like crumb of bread when dry. Fibre composed of spicules held together by a minimum of sarcode; areolar sarcode charged with the spicules of the species and ampullaceous sacs. Surface even, for the most part covered with a fine dermal reticulation like that of the Rhaphidonemata; sometimes without any, and then cancellous. Colour pale tawny, dark brown or white, when dry. Vents large, distinct, scattered, on a level with the surface, or more or less projecting on mammiform or mamillary prolongations of the sponge when external; or on a level with the cloacal surface in the tubular or excavated specimens—that is, when internal. Branched excretory canal-system generally well pronounced. Pores in the sarcode which tympanizes the interstices of the dermal reticulation. Spicules of one kind only, viz. the skeleton-spicule, for the most part consisting of a simple acerate, long or short, thick or thin, finely or abruptly pointed shaft varying with the species; or cylindrical, curved, round at the ends sausage-like, of various sizes in the same specimen. Forms incrusting or massive, solid or excavated, or branched; branches solid.

In the Amorphosa the acerates are for the most part long and fine-pointed.

In the Isodictyosa the acerate spicules are for the most part short and more or less attenuated towards the points; arranged "net-like, "isodictyal."

In the Thalyosa the spicules are much the same in size and shape as in the foregoing family, but the specimens for the most part branched and large; the branches solid and subcylindrical, also white like chalk when dry. Very subject to a parasitic polype sunk into the surface.

In the Crassa the spicules are robust, and the specimens chiefly large and massive. Forms often excavated cup-like or crateriform.

Group 5. **Fibulifera.**

Sarcode colourless. Skeleton composed of fine spiculo-fibre whose interstices are filled by an areolar sarcode like crumb of bread. Surface uniform, openly reticulate, cancellous, or covered with a fine network. Colour pale tawny, white, or brown. Vents distinct and scattered, on a level with the surface when external; and when excavated, on a level with the internal surface or that of the excavation. Pores in the sarcode which tympanizes the interstices of the dermal reticulation. Texture open, delicate. Spicules of two kinds, viz. skeleton- and flesh-spicules: skeleton-spicule of one form only, viz. simple acerate, more or less attenuately pointed; flesh-spicule also of one form only, viz. simple C-shaped or bihamate ("fibula," Sdt.). Forms incrusting, parasitic, or massive and lobed; or cylindrical, branched, solid; or funnel-shaped and excavated. Much subject to a parasitic polype sunk into the surface.

Group 6. **Halichondrina.**

Sarcode pale tawny or brown-purple. Skeleton composed of reticulate spiculo-fibre whose interstices are filled up by an areolar sarcode which, when dry, resembles crumb of bread. Surface uneven, cancellated, reticular, rough. Colour tawny, ochre-yellow, or brown-purple. Vents distinct, scattered, on a level with the surface or on the prominent parts of mammiferous lobes. Pores in the dermal sarcode which tympanizes the interstices of the cancellated surface. Texture crumb-of-bread-like, soft, crushable. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule for the most part of two forms, viz.:—1, simple acuate, smooth or more or less spined; 2, acerate, curved, fusiform, smooth; or subcylindrical, substraight, or subfusiform; terminated by more or less inflated extremities, which may be simply attenuated or conically pointed, spearhead-like, or the same truncated, or simply round, or more or less bulb-like; or the ends may be more or less microspined. Flesh-spicules for the most part of two forms, viz. equianchorate and bihamate: the former shuttle-like or naviculiform, or angulate (that is, bow-shaped) with falcated spreading arms, or elliptical with linear arms; the latter or bihamate spicule simple, smooth, C-shaped, more or less spirally contort. Sometimes the skeleton-spicule may be simply cylindrical, curved and smooth, with rounded extremities; and sometimes the flesh-spicules may be altogether absent or not discoverable. Forms for the most part incrusting or massive, lobed, sometimes lobo-branched.

Group 7. **Hyndmanina.**

The same as the foregoing, but with dark brown sarcode and an equianchorate like that characterizing the next group (viz. the Esperina), together with a short, little, grotesque form of the same kind, much curved upon itself, with the ends unequal and each three-lobed, terminating in the centre in a little point; occasionally bihamates, C-shaped and contort.

N.B. This may be viewed as a hybrid between the Halichondrina and Esperina—that is, possessing the two forms of skeleton-spicule of the former, together with the inequianchorate and simple bihamate of the latter; added to which is the "grotesque spicule" above described, which again looks like a hybrid between the inequianchorate and bihamate, but nevertheless is a constant attendant, so must be regarded as a distinct feature.

Group 8. **Esperina.**

Sarcode pale tawny, or yellow or vermilion-red when fresh. Skeleton composed of an anastomosing reticulation of thick round spiculo-fibre, of a greyish colour when fresh, opaque white when dry, part of which is frequently naked or devoid of sarcode, and the rest filled up with areolar sarcode. Fibre of two kinds, viz. vertical or large and horizontal or small. Surface even or undulating, presenting an exquisitely beautiful polygonal, lacy or star-like reticulation, which is generally characteristic of the group; sometimes villous, or villous and placoid. Vents distinct and scattered. Pores in the sarcode which tympanizes the interstices of the dermal reticulation. Texture of the skeleton coarse, fibrous; that of the areolar sarcode delicate, crumb-of-bread-like. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. sub-pinlike, with the inflated end for the most part less in diameter than the shaft; the shaft fusiform, and the inflation elliptical, mostly elongate and terminal. Flesh-spicules of two or three forms, viz.:—1, inequianchorate of different shapes; 2, simple bihamate; 3, simple tricurvate or bow-like. Forms massive, lobular, for the most part incrusting and amorphous; sessile or stipitate, and fixed by stem-like enlargement of the spiculo-fibre.

Group 9. **Hymedesmina.**

Sarcode pale yellowish. Skeleton composed of reticulate spiculo-fibre whose interstices are filled up by areolar sarcode, which when dry resembles crumb of bread. Surface substelliform, heterahedrally reticulate, like that of *Esperia*. Colour pale yellowish white. Vents and pores —— ? Texture crumb-of-bread-like, delicate, crushable. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule simple acerate, subacuate fusiform, also like that of *Esperia*, or simple acuate, according to the species. Flesh-spicules anchorate, tricurvate, and bihamate, according with the species; the anchorate peculiar, consisting of a straight shaft trenchant and notched circularlyin the centre and at each end on the inner aspect, terminated respectively by a *single* arm recurved, also trenchant on the inner border, pointed and turned toone side at each end in opposite directions. Forms incrusting, massive, lobed, amorphous.

Family 2. Suberitida.

Group 10. **Cavernosa.**

Pale tawny yellow or purple. Skeleton cavernous, multilocular; walls of the cavities consisting of a felt-like accumulation of the spicule of the species; cavities filled with the same kind of material, but loose, open, areolar, and more sarcodic than spiculous. Surface even, undulating, or nodular. Dermal layer compact. Vents and pores situated in areolated papillæ, which are single and separate, or arranged in patches or groups united hexagonally; or with the vents simply grouped together over the nodular eminences, and the pores generally diffused throughout the intervals in the interstices of the dermal reticulation. Texture essentially cork-like. Spicule of one kind only, viz. that of the skeleton, and of one form only, viz. pin-like; shaft smooth, curved, fusiform, more or less taperingly pointed; head as large or larger in diameter than the thickest part of the shaft, subterminal and elliptical, or terminal and bulb-like, subspherical and subterminal, or almost spherical and terminal. Free or floating forms massive, waterworn, more or less rounded: fixed forms spreading horizontally, clathrously, and dendritically in the substance of shells, especially those of the oyster, here and there provided with papillary heads which project through the surface of the shell; or fixed and unconnected with shells, massive, hemispherical, nodular; or crest-like, compressed, with parallel sides, thick and semicircular; or vase-like, poculous, stipitate, ribbed nodosely (Neptune's cup).

Group 11. **Compacta.**

Sarcode colourless, pale yellow, ochraceous. Skeleton compact, and so minutely cancellated as to form with its sarcodal contents a homogeneous soft, dense, fine, felt-like structure, interrupted only by the branching canal-systems, which are correspondingly reduced in calibre, and thus rendered more or less indistinct. Surface smooth, compact, often villous or asbestiform, from the projection of the ends of the dermal spicules. Vents not prominently marked. Pores in the interstices of the dermal reticulation. Texture compact, cork-like. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. pin-like; shaft smooth, curved, fusiform, more or less taperingly pointed; head elliptical and subterminal; with every variety between this and the simple acuate, in which there is no inflation at all. Flesh-spicule minute, smooth, curved, cylindrical, centrally or subcentrally inflated. Or the skeleton-spicule may be smooth, acerate, fusiform, more or less sinuous, especially towards the centre, from which in the larger kinds a third sinuous arm may be developed at right angles to the other two. Forms massive, sessile, compressed pedicelled, bacillary or fig-shaped; or free and waterworn, more or less rounded, when growing over and absorbing deciduous univalve shells; or branching coalescently, branches solid, terminating in rounded extremities singly, or united laterally so as to present short digitated (toe-like) extremities; separated or united into a general mass which is sessile; sometimes parasitic on Fuci.

Group 12. **Laxa.**

Sarcode colourless, pale tawny, red, bright carmine, and purple. Structure crumb-of-bread-like, more or less open and cancellated. Surface uniformly granular or corrugated, villous, or smooth and pustular. Vents scattered over the surface generally, or distinct, on mammiform projections; excretory canal-systems largely developed, sometimes cavernous. Pores dispersed throughout the interstices of the dermal reticulation generally, or congregated into pustular heads. Texture light, cellular, cork-like, or like crumb of bread. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule pin-like, with smooth, fusiform, curved shaft and subterminal elliptical inflation; or simple acuate; or pin-like, with conical shaft (that is, not fusiform) and terminal inflation, which is subspherical or bulb-like. Flesh-spicule of various forms, sometimes two or more forms in the same species: it may be acerate curved, simple or spined; straight, sinuous, subspiral, cylindrical, smooth or spined, long or short, depending upon the size and number of bends; or openly spiral and spined; or stelliform. Forms massive, lobed.

Group 13. **Donatina.**

Sarcode of the cortex orange-red and of the body pale yellow or colourless in *Donatia lyncurium* when fresh, ? pale yellow in the rest. Surface hirsute, villous, asbestos-like; even or uniformly nodose; pavement-like, with hexahedral or polyhedral divisions; sometimes (as in *Polymastia*) furnished with tubular appendages open or closed at the extremities; or hard, stony, and placoid. Structure essentially radiate, consisting of thick bundles of stout spicules extending from the centre or base to the circumference, where they are joined by a corticular layer of much smaller spicules of a similar form, or by globular stellates, or simple globular bodies, or simple stellates like those of *Geodia* and *Stelletta* respectively. Intervals between the bundles of spicules filled up by an areolar sarcode more or less charged with the spicules of the species. Colour when fresh pale or cream-yellow or orange-red on the surface only; when dry light brown or snow-white. Vents indistinct when on the surface of the body in the dead or dried specimens, but evident when at the extremities of the tubular appendages. Excretory canal-system more or less cavernous, well pronounced. Pores in the sarcode which tympanizes the interstices of the villous dermal reticulation. Texture fine, smooth, and villous on the surface, harsh, hard, and coarse internally. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. very stout, simple, curved or nearly straight acerate, or simple acuate, or pin-like with fusiform shaft and subterminal inflation. Flesh-spicule acuate or pin-like, fusiform, with subterminal inflation like that of the skeleton-spicule; or globular, spined stellately, globo-stellate, or simply globular, or simply stellate as in *Geodia* and *Stelletta* respectively,—each in the aggregate forming in their respective species a cortical layer, through which the skeleton-spicules project, the former arranged vertically, the latter massively. Forms massive, globular, conical, hemispherical, sessile; or sessile, spreading, simple or appendiculate, branched, stipitate.

Family 3. Pachytragida.

Group 14. Geodina.

Massive, incrusting; or globular and lobed, sessile; or globular and free or floating. Structure hard externally, more or less reticulate, radiated, and soft internally; may be divided into a cortical, a zonular, and a body- or internal substance. Cortex consisting of a hard, stony crust composed of close-packed little siliceous bodies of a globular or ellipsoidal shape, sometimes more or less compressed, even to discoid thinness; radiated in structure, becoming when mature solid and crystalline throughout, presenting an ornamented surface, in one part of which is a hiliform depression; combined with minute stellates or minute, sinuous, spined, bacilliform spicules; or straight ones more or less inflated in the centre, skittle-like, and spined; or minute, curved acerates more or less inflated in the centre and microspined; or minute, simple acerates or acuates,—all of which are flesh-spicules. Zone consisting of a subjacent cortical mass of spicules arranged parallel to each other and vertical to the body or internal substance, respectively supporting and piercing the cortex, composed of:—1, the "zone-spicule" *par excellence*, very robust, consisting of a shaft and three arms expanded under the cortex, which it thus tends to support; 2, the body- or staple spicule of the whole surface, consisting of a large, smooth, more or less curved acerate, which pierces and passes through the cortex for a short distance; 3, the anchoring-spicule, consisting of a very long delicate shaft and three short terminal arms, which are extended fork-like or recurved anchor-like, more or less plentifully mixed with the foregoing, and often traversing the cortex for some distance, for anchoring; heads often broken off outside, and therefore only found perfect, for the most part, inside the cortex; when outside, the fork-like form has often *four* prongs, opposite, expanded. Body-substance consisting of an areolar sarcodic structure more or less charged with the large acerate spicule before mentioned, together with more or less of the flesh-spicules of the species. Surface even, granular, semitransparent, and grey when fresh, opaque white when dry. Vents well marked, scattered singly or in groups. Pores in the depressions or small pits of the cortex. Excretory canal-system largely developed, giving the body-substance an open cancellous structure. Texture compact, stony on the surface, more or less tough within when fresh, but light, cellular, and crumb-of-bread-like when dry. Spicules of two kinds, viz. skeleton- and flesh-spicules,—the latter noticed in the description of the cortex, and the former in that of the "zone" and the "body-substance" respectively. Forms mentioned at the commencement.

Group 15. **Stellettina.**

The same, but with no "globular siliceous bodies" on the surface, and therefore no stony cortex, but with a thick dermal layer composed of long fusiform contractile (muscular?) cells; charged with stellates and the flesh-spicules of the species.

Group 16. **Tethyina.**

Hemispherical or globular, fixed by an extended or contracted base; or globular and free; or ellipsoidal and fixed, root-like, by tufts of long anchoring-spicules. Surface hirsute from the ends of the spicules, which project through the dermal layer to a greater or less extent, arranged in separate tufts; or reticulately or in lines tending in a spiral direction towards the summit. Dermal layer thick and tough, with or without the flesh-spicule. Internal structure radiate; radii composed of bundles of spicules, which extend from a nucleated centre towards the circumference through a compact areolar sarcode, and in a more or less gyrate course from the base to the summit. Colour grey or brown externally, bright yellow when fresh within or purple throughout, especially on the surface. Vents apical, or scattered over the surface singly or in groups. Pores in the interstices of the hirsute dermal reticulation. Excretory canal-system not well pronounced, probably owing to the compact and contractile nature of the areolar sarcode of the body. Texture tough, hard, and compact throughout, especially in the dermal layer. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of two forms, viz.:—1, large, acerate, more or less curved; 2, anchoring-spicule—that is, spicules composed of a long delicate shaft with three arms of equal length extended fork-like in some, and recurved anchor-like in others, like the "anchoring-spicule" of the foregoing families; arms sometimes unequal in length in the fork-like heads, one being much longer than the other two, which are equal. Sometimes the arms of the fork-like form are much expanded, and the shaft of the spicule enlarged altogether, so as to somewhat resemble the "zone-spicule" of the Geodina. Flesh-spicule of one kind only, viz. bihamate or C-shaped contort (*i. e.* spiral), for the most part minute and indistinctly microspined; or large and sparsely, but evidently, spined, especially towards the extremities: sometimes absent altogether. Forms already mentioned.

Family 4. Pachastrellida.

Group 17. **Pachastrellina.**

Incrusting, passing into crevices of the rock or other hollow cavities, massive, sessile, thick, flat, or semiglobular and sessile. Structure fibreless, confused—that is, with little or no apparent regularity of the spicules with which the areolar structure of the body is densely charged, and no nucleus. Surface plane, uniformly harsh asperous, with no distinct cortical layer of any kind, saving the thickened dermal sarcode. Colour light grey or dark grey, passing into soot-black, especially on the surface. Vents scattered singly or in groups on the surface. Pores in the smooth interstices of the dermal sarcode, situated between the projecting ends of the spicules. Branched excretory canal-system well developed. Texture asperous. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of three forms, viz.:—1, large triradiate, with the shaft or fourth arm aborted or obsolete, or triradiate, with the fourth arm produced, quadriradiate; arms smooth, conical, pointed simply, or furcated once or twice irregularly; 2, smaller, consisting of a three-armed shaft with the arms regularly furcate, and spreading almost horizontally or perpendicularly to the shaft; 3, long, simple, acerate, more or less curved. Flesh-spicules stelliform sinuous and spined, or bacillary and spined; or ellipsoidal, inflated in the centre, and smooth (skittle-like); or acerate and more or less inflated, curved, and microspined; or acerate, smooth, or simple "tricurvate;" or globostellate, with the rays rounded tuberculiform, the whole resembling the siliceous balls of the Geodina.

N.B. The once or twice irregularly furcated extremities of the larger triradiate spicule in *Pachastrella abyssi*, Sdt., leads to the more elaborate furcation &c. in the following group, viz. the Lithistina.

Group 18. **Lithistina.**

Massive, substony, excavated; dish-shaped, circular, with thick undulating wall, stipitate; or vasiform, with more or less thick undulating wall, which, in some species, may be so plicated meandrinately as to almost fill the centre, and thus produce the appearance of a double flower. Structure more or less confused, fibreless, composed of a dense mass of spicules imbedded in areolar sarcode; essentially spiculous, and growing, like all other sponges, in concentric layers. Surface even, smooth, or asperous, *not corticate.* Colour grey when fresh or wet, yellowish white or brown when dry. Vents pustular, uniformly scattered, singly or in little groups, on the inner side of the wall only. Branched excretory canal-system well defined, although small in calibre, corresponding in this respect with the compact structure of the sponge. Pores general, in the sarcodic interstices of the dermal layer. Spicules of two kinds for the most part, viz. skeleton- and flesh-spicules. Skeleton-spicule of three forms, viz.:—1. The surface-spicule, consisting of a horizontal head and vertical shaft, the latter directed inwards. Head consisting of three round smooth arms, spread out horizontally and symmetrically furcated, amidst the flesh-spicules of the surface; or with three flattened, irregularly bifurcated and sinuous arms; or with the same denticulated on the borders; or united together laterally, so as to form a disk more or less deeply fissured on the margin, or subcircular; or with the arms sinuously branched, and the branches more or less tubercled, the tubercles simply round or two- or three-spined. Shaft for the most part smooth, straight, round, and pointed, presenting, where it joins the head, a trifid division of the central canal, whose arms (being short, equal in length, and symmetrically disposed) form a very characteristic feature on the surface and in the interior, whereby the original direction of the spicule can be ascertained. 2. Body- or staple spicule of the mass, consisting of a horizontal head and vertical shaft, which thus seems to mark the concentric layers of growth; but otherwise it is so altered from the original surface-spicule that the shaft becomes marrow-bone-like in form, and the arms not only bifurcated and sinuous, but so intensely and irregularly branched and filigreed, and so intimately and intricately interlocked with each other and the branches of the inner end of the shaft of the next layer (which, to a certain extent, so simulates the head in this respect as to be almost undistinguishable from it), that, in the mass, the bodies of the shafts respectively can only be recognized by the comparatively open interval which they form between the lines of dense interlacement caused by the intermixing of their almost equally branched extremities—while, when the mass is broken up, the shaft can only be identified by the trifid central canal before mentioned, when this is visible. At the same time, this trifid canal often presents itself in such a position as to indicate that either the spicules of the mass become more or less confusedly mixed up together like those of *Pachastrella*, or that the shafts become so branched and altered as to be undistinguishable but for the presence of the trifid central canal. 3. Acerate spicule of the body, beam-like, scattered among the foregoing, long, smooth, curved, finely pointed or fusiform, and acuate. Flesh-spicules of various forms, sometimes two or more in the same species, viz. acerate smooth or microspined, cylindrical bent and more or less inflated towards the ends, microspined, or sinuous and blunt-spined tubercle-like.

Family 5. Potamospongida.

Group 19. **Spongillina.**

Sarcode colourless, greenish or purple. Skeleton composed of a reticulation of spiculo-fibre of two kinds, viz. vertical or large, and horizontal or small. Structure radiating, more or less plumose; interstices filled up by areolar sarcode, flaky when dry, charged with the spicules of the species and the ampullaceous sacs. Colour pale tawny yellow, greenish, or purple. Vents large, scattered irregularly. Branched excretory canal-system well pronounced. Pores spread generally over the surface, in the sarcode which tympanizes the interstices of the dermal reticulation. Texture friable, crushable, crumb-of-bread-like. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule acerate, curved, smooth, more or less finely pointed. Flesh-spicule of various forms, according to the species. Characterized by the presence of reproductive seed-like bodies, visible to the naked eye, and of a globular or ellipsoidal form (according to the species), with a hiliform depression opening into the interior, corresponding in colour with that of the species, only brighter or more intense; composed of a horny capsule surrounded by a columnar structure of horny cells, or by a layer of flesh-spicules arranged perpendicularly or tangentially (according with the species) to the surface; filled with germinating substance of the sponge, which, under growth, makes its exit through the hiliform opening. *Habitat.* Fresh water.

HEXACTINELLIDA.

For the characters of the Groups into which the Families of the Hexactinellida have been divided, see the illustrations respectively pp. 199 and 200; and for all known species, see 'Annals,' 1873, vol. xii. p. 349 &c.

Classification of the Spongida *into Orders, Families, and Groups (provisional).*

Class **SPONGIDA,** Huxley.

Orders.	Families.	Groups.
I. CARNOSA	1. Halisarcida.	
	2. Gumminida.	
II. CERATINA	1. Luffarida.	
	2. Aplysinida.	
	3. Pseuodceratida.	
III. PSAMMONEMATA	1. Bibulida	1. Euspongiosa.
		2. Paraspongiosa.
	2. Hircinida	3. Hirciniosa.
		4. Callhistia.
		5. Penicillata.
		6. Rigida.
		7. Subrigida.
		8. Foliata.
		9. Dactylifera.
		10. Fenestrata.
		11. Platyfibra.
		12. Peraxiata.
		13. Incrustata.
		14. Otahitica.
		15. Sarcocornea.
		16. Arenosa.

	3. Pseudohircinida	17. Pseudoarenosa. 18. Chalinohircinina. 19. Armatohircinina.
IV. RHAPHIDONEMATA	1. Chalinida	1. Digitata. 2. Palmata. 3. Reptata. 4. Spinifera.
	2. Cavochalinida	5. Tubulodigitata. 6. Aculeata. 7. Subaculeata. 8. Ciliata. 9. Bivalvata. 10. Complanata. 11. Plicata.
	3. Acervochalinida	12. Solida. 13. Clathrata. 14. Dictyalia.
	4. Pseudochalinida	15. Digitifera. 16. Fistulodigitata.
V. ECHINONEMATA	1. Ectyonida	1. Pluriformia. 2. Plumohalichondrina. 3. Microcionina. 4. Echinoclathrata. 5. Baculifera.
	2. Axinellida	6. Multiformia. 7. Durissima.

TABLE (*continued*).

Orders.	Families.	Groups.
VI. HOLORHAPHIDOTA	1. RENIERIDA	1. Amorphosa.
		2. Isodictyosa.
		3. Thalyosa.
		4. Crassa.
		5. Fibulifera.
		6. Halichondrina.
		7. Hyndmanina.
		8. Esperina.
		9. Hymedesmina.
	2. SUBERITIDA	10. Cavernosa.
		11. Compacta.
		12. Laxa.
		13. Donatina.
	3. PACHYTRAGIDA	14. Geodina.
		15. Stellettina.
		16. Tethyina.
	4. PACHASTRELLIDA	17. Pachastrellina.
		18. Lithistina.
	5. POTAMOSPONGIDA	19. Spongillina.
VII. HEXACTINELLIDA	1. VITREOHEXACTINELLIDA	1. Patulina.
		2. Tubulina.
		3. Scopulifera.
	2. SARCOHEXACTINELLIDA	4. Rosettifera.
		5. Birotulifera.
	3. SARCO-VITREOHEXACTINELLIDA.	
VIII. CALCAREA.		

Key to the foregoing Classification of the Spongida*.

Class **SPONGIDA**, Huxley.

Order I. CARNOSA.

Family 1. HALISARCIDA.

Halisarca Dujardinii, Johnston, British Sponges, 1842, p. 192; Ann. & Mag. Nat. Hist. 1873, vol. xii. p. 25.
H. lobularis, Schmidt, Spong. adriat. Meeres, 1862, p. 80; Ann. & Mag. Nat. Hist. 1874, vol. xiii. p. 433.

Family 2. GUMMINIDA.

Chondrilla nucula, Sdt. Spong. adriat. Meeres, p. 39.
Corticium candelabrum, Sdt. *ib.* p. 42.
C. australiensis, Carter, Ann. & Mag. Nat. Hist. 1873, vol. xii. p. 23, pl. i. fig. 12.
C. abyssi, Carter, *ib.* p. 18, pl. i. fig. 1.

Order II. CERATINA.

Family 1. LUFFARIDA.

One Group only.

Luffaria, Duchassaing de Fonbressin et G. Michelotti, 'Spong. de la Mer Caraïbe,' Harlem, 1864, 4to, p. 59; Natuurk. Verh. Holland. Maat. Wet. te Harlem, vol. xxi. 1864.
L. fistularis, D. et M. *op. cit.* p. 60,=*Spongia fistularis*, Esper, 1794, pls. xx. & xxi.,=*Verongia*, Bowerbank, 1866, Monograph of British Spongiadæ (Ray Soc. pub.), vol. ii. p. 15, vol. i. pl. xii. fig. 266; also 'Annals,' 1845, vol. xvi. p. 403, pl. xiii. fig. 7. See remarks on, 'Annals,' 1872, vol. x. p. 102.
L. ramosa, C. MS. See Part III. (A large species with *solid* branches.)
L. sessilis, C. MS. *Ib.* (A sessile species.)

Family 2. APLYSINIDA.

One Group only.

Aplysina aërophoba, Nardo ap. Sdt. *op. cit.* p. 25, Taf. iii. fig. 2.
A. carnosa, Sdt. *ib.* p. 26, Taf. iii. fig. 3.
A. corneostellata, C. Annals, 1872, vol. x. p. 105, pl. vii., ?=*Darwinella aurea*, Archiv f. mikroskop. Anat. 1865, p. 344, Taf. xxi.

Family 3. PSEUDOCERATIDA.

One Group only.

Ianthella, Gray, Proc. Zool. Soc. Lond. July 1869, p. 49,=*Spongia flabelliformis*, Esper, Taf. xiii. &c.

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* One or two species of each family and group respectively will be here inserted for illustration, where any have been described; but where none have been described, reference will be made to species which will be described in the Third Part of this communication.

Aplysina capensis, C. MS. Incrusted species. See Part III.
A. chalinoides, C. MS. Faced with proper spicules. *Ib.*

Order III. PSAMMONEMATA.

Family 1. Bibulida.

Group 1. Euspongiosa.

Spongia officinalis &c.

Group 2. Paraspongiosa.

S. officinalis, var., &c.

Family 2. Hircinida.

Group 3. Hirciniosa.

Hircinia typica, Nardo ap. Sdt. *op. cit.* p. 32. (A type specimen is in the British Museum.)
H. variabilis, Sdt. *ib.* p. 34. (*Ib.*)
H. panicea, Sdt. *ib.* p. 32, Taf. iii. fig. 11, =*Stematumenia*, Bk. Annals, 1845, vol. xvi. p. 407, pl. xiv. figs. 1 & 2, also good figures of the same in Mon. Brit. Spong. *op. cit.* pl. xii. fig. 256 and pl. xxviii. fig. 381. (Character based on a parasite, viz. *Spongiophaga communis*, 'Annals,' 1871, vol. viii. p. 330, =*Polytherses*, D. et M. *op. cit.* p. 67, pl. xii. f. 5, *P. campana**.)

Group 4. Callhistia.

Halispongia choanoides, Bk. Proc. Zool. Soc. 1872, pl. vi.
For other species see Part III.†

Group 5. Penicillata.

For species see Part III.

Group 6. Rigida.

For species see Part III.

Group 7. Subrigida.

For species see Part III.

Group 8. Foliata.

For species see Part III.

Group 9. Dactylifera.

For species see Part III.

Group 10. Fenestrata.

For species see Part III.

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* As many species of this group consist of nothing but the fibrous skeleton in which the alga (*Spongiophaga communis*) has replaced the sarcode, and many of the Hircinida are subject to the same change, it is questionable if they all belong to the group "Hirciniosa."

† The number of references to the third part of these "Notes" for illustration will show how much remains to be done in describing even the different kinds of Sponges already in our Museums.

Group 11. PLATYFIBRA.

Sarcotragus fœtidus, Sdt. *op. cit.* p. 36. (A type specimen is in the British Museum.)

For other species see Part III.

Group 12. PERAXIATA.

For species see Part III.

Group 13. INCRUSTATA.

For species see Part III.

Group 14. OTAHITICA.

Spongia othahetica, Solander and Ellis, 1786, 4to, pl. lix. figs. 1 & 2. (The original specimen is in the British Museum.)

Halispongia ventriculoides, Bk. Proc. Zool. Soc. 1874, pl. xlvii.

(The Ventriculites were Hexactinellids, and had the structure of *Myliusia Grayi*, Bk., according to Mr. W. J. Sollas, Quart. Journ. Geol. Soc. Feb. 1873, p. 65, fig. 2, and Schmidt, 1870, Spongienf. atlant. Gebiet. Taf. ii. fig. 16.)

H. Mantelli, Bk. Proc. Zool. Soc. 1874, pl. xlvii.

Spongionella Holdsworthii, Bk. *ib.* 1873, pl. v., = *Spongia papyracea*, Esper, 1797, Taf. 65.

For other species, which are very numerous and varied, see Part III.

Group 15. SARCOCORNEA.

? *Cacospongia cavernosa*, Sdt. Sp. adriat. Meeres, p. 28. (A type specimen is in the British Museum.)

Group 16. ARENOSA.

Dysidea fragilis, Johnston, *op. cit.* p. 187, = *Spongelia*, Sdt. Spongienf. atlant. Gebiet. 1870, p. 77.

Spongelia incrustans, Sdt. 1862, Spong. adriat. Meeres, p. 29, Taf. iii. fig. 7.

Family 3. PSEUDOHIRCINIDA.

Group. 17. PSEUDOARENOSA.

For species see Part III.

Group 18. CHALINOHIRCININA.

For species see Part III.

Group 19. ARMATOHIRCININA.

For species see Part III.

Order IV. RHAPHIDONEMATA.

Family 1. CHALINIDA.

Group 1. DIGITATA.

Halichondria oculata, Johnst. *op. cit.* p. 94, pl. iii., = *Chalina oculata*, Bk. Mon. Brit. Spong. *cit.*, = *Spongia polychotoma*, Esper, 1794, Taf. xxxvi.

Group 2. Palmata.

Halichondria palmata, Johnst. *op. cit.* p. 92, pl. ii.

Group 3. Reptata.

Halichondria simulans, Johnst. *ib.* p. 109, pl. viii.

Group 4. Spinifera.

For species see Part III.

Family 2. Cavochalinida.

Group 5. Tubulodigitata.

For species see Part III.

Group 6. Aculeata.

Tuba, Duchassaing de Fonb. et Michelotti, *op. cit.* 1864, p. 44, = *Siphonochalina,* Sdt. 1868, Spong. Küste v. Algier, p. 7.
Tuba sororia, D. et M. *op. cit.* pl. viii. fig. 1.
T. digitalis, D. et M. *ib.* fig. 2.
T. armigera, D. et M. *ib.* fig. 3.
(These are good illustrations. Fig. 2 appears to have been affected by a parasitic polype, to which these sponges are very liable.)
?*Spongia cancellata,* Esper, 1794, Taf. vi.
?*S. muricata,* Esper, *ib.* Taf. vii.
?*S. aculeata,* Linn., and *S. villosa,* Pallas, Esper, *ib.* Taf. vii. *a.*

Group 7. Subaculeata.

Tuba, D. et M. *op. cit.* p. 44.
?*T. tortolensis* and *T. longissima,* D. et M. *ib.* pl. ix. figs. 2 & 3.

Group 8. Ciliata.

Tuba, D. et M. *op. cit.* p. 44.
T. plicifera, D. et M. *ib.* pl. x. fig. 2.
Spongia compressa, Esper, Taf. lv.
For other species see Part III.

Group 9. Bivalvata.

?*Spongia agaricina,* Esper, Taf. lix.
For other species see Part III.

Group 10. Complanata.

For species see Part III.

Group 11. Plicata.

For species see Part III.

Family 3. Acervochalinida.

Group 12. Solida.

For species see Part III.

Group 13. Clathrata.

For species see Part III.

Group 14. Dictyalia.

For species see Part III.

Family 4. Pseudochalinida.

Group 15. Digitifera.

For species see Part III.

Group 16. Fistulodigitata.

For species see Part III.

Order V. ECHINONEMATA.

Family 1. Ectyonida.

Group 1. Pluriformia.

Ectyon sparsus, Gray, Proc. Zool. Soc. 1867, p. 515; Annals, 1871, vol. vii. p. 270, pl. xvii. fig. 1 &c.
Chalinopsis clathrodes, Sdt. 1870, Spongienf. atlant. Gebiet. p. 60. (A type specimen is in the British Museum.)
Agelas dispar, D. et M. *op. cit.* p. 76, pl. xv. figs. 1 & 2.
Clathria oroides, Sdt. (like *Ectyon sparsus*), 1868, Spong. Küste v. Algier, p. 9. (A type specimen is in the British Museum.)
Echinonema typicum, C. MS. See Part III. ?=*Tenacia clathrata*, Sdt. 1870, *op. cit.* p. 56 (a type specimen is in the British Museum), ?=*Spongia cactiformis*, Lam. 1816, Anim. sans vertèbr. p. 370.
Clathria compressa, Sdt. 1862, *op. cit.* p. 58, Taf. vi. fig. 1.
Dictyocylindrus ramosus, Bk. 1864, *op. cit.* vol. ii. p. 103, vol. iii. (1874), pl. xvi.,=*Raspalia*, Sdt.
Spongia muricata, Esper, 1794, Taf. iii.,=*Trichentrion muricatum*, E. Ehlers (Prof. Zool. Erlangen), 1870, 'Esper'schen Spong. in der Zool. Samml. der k. Universität Erlangen.
Acarnus innominatus, Gray, Proc. Zool. Soc. 1867, p. 544; Annals, 1871, vol. vii. p. 273, pl. xvii. figs. 4 &c.
For other species see Part III.

Group 2. Plumohalichondrina.

Halichondria plumosa, Johnst. *op. cit.* p. 103, =*Hymeniacidon plumosa*, Bk. Mon. Brit. Spong. *cit.* vol. ii. p. 195.

Group 3. Microcionina.

Microciona atrosanguinea, Bk. *op. cit.* vol. ii. p. 138, vol. i. pl. xxxiv. fig. 369, =*Scopalina*, Sdt.
Halichondria maculans, Johnst. (Johnstonian Collection in the British Museum), =*Hymeraphia stellifera*, Bk. *op. cit.* vol. ii. p. 146, and vol. i. pl. xxxiv. fig. 370.

Group 4. Echinoclathrata.

Halichondria seriata, Johnst. *op. cit.* p. 125, pl. xiv. fig. 2, =*Chalina seriata*, Bk. *op. cit.* vol. i. p. 376, and vol. ii. pl. xvii. fig. 287.
For other species see Part III.

Group 5. Baculifera.

Caulospongia plicata, Kent, Proc. Zool. Soc. 1871.
C. verticillaris, Kent, *ib.*

Family 2. Axinellida.

Group 6. Multiformia.

Halichondria hispida, Johnst. *op. cit.* p. 4 (Johnstonian Collection, British Museum), =*Dictyocylindrus hispidus*, Bk. *op. cit.* vol. ii. p. 108, and vol. iii. pl. xvii.
Axinella cinnamomea, Sdt. *op. cit.* 1862, p. 61, Taf. vi. fig. 2.
Acanthella, Sdt. *ib.* p. 60, Taf. vi. fig. 7. *A. acuta*, Sdt.
Halichondria ventilabrum, Johnst. *op. cit.* p. 107, pl. vii., =*Phakellia ventilabrum*, Bk. *op. cit.* vol. iii. pl. xxii.
Hymeraphia vermiculata, Bk. *op. cit.* vol. ii. p. 141, and vol. iii. pl. xxvi. fig. 1. (There is an erect form of this species, which thus passes into *H. ventilabrum.*)

Group 7. Durissima.

For species see Part III.

Order VI. HOLORHAPHIDOTA.

Family 1. Renierida.

Group 1. Amorphosa.

Halichondria panicea, Johnst. *op. cit.* p. 114, pl. xxxi.,= *Halichondria panicea*, Johnst., Bowerbank, 1864, *op. cit.* vol. iii. (1874), pls. xxxix. & xl.

Group 2. Isodictyosa.

Isodictya rosea, Bk. *op. cit.* vol. ii. p. 282, vol. iii. pl. xlix. fig. 12.
I. varians, Bk. vol. ii. pl. xx. fig. 309, see for characteristic arrangement of the spicules of this group.

Group 3. Thalyosa.

Thalysias, D. et M. *op. cit.* p. 82.
T. subtriangularis, D. et M. *ib.* p. 85, pl. xvii. fig. 1.
Isodictya mirabilis, Bk. Proc. Zool. Soc. 1873, p. 319, pl. xxviii.
? *Spongia clavata*, Esper, 1794, Taf. xix.
Schmidtia clavata, Balsamo-Crivelli, 1863, Atti d. Soc. Ital. d. Sc. vol. v. tav. iv. fig. 11.

Group 4. Crassa.

? *Reniera calyx*, Sdt. 1862, *op. cit.* p. 76, Taf. vii. fig. 12. (A type specimen is in the British Museum.)
For other species see Part III.

Group 5. Fibulifera.

Reniera fibulata, Sdt. 1862, *op. cit.* p. 73, Taf. vii. fig. 9. (A worldwide species.)

Group 6. Halichondrina.

Halichondria incrustans, Johnst. *op. cit.* p. 122, pl. xii. fig. 3. See also Bowerbank, *op. cit.* vol. iii. pl. xliv. fig. 7, &c.

Group 7. Hyndmanina.

Halichondria Hyndmani, Bk. *op. cit.* vol. ii. p. 255, and vol. iii. pl. xlvi. figs. 7–15.

Group 8. Esperina.

Halichondria ægagropila, Johnst. *op. cit.* p. 119, pl. xi. fig. 1 (Johnstonian Collection, British Museum), =*Desmacidon ægagropila*, Bk. *op. cit.* vol. iii. pl. lxiii. figs. 8–4.
Hymeniacidon macilenta, Bk. *op. cit.* vol. iii. pl. xxxiii. figs. 7–13.
Esperia, Nardo ap. Schmidt, *op. cit.* 1862, p. 53 *et seq.*

Group 9. Hymedesmina.

Hymedesmia Johnstoni, Bk. *op. cit.* vol. i. p. 276, pl. xviii. fig. 293, =*Desmacidon Johnstoni*, Sdt. *op. cit.* 1870, p. 53, Taf. v. fig. 17.
? *Desmacidon titubans*, Sdt. *op. cit.* 1870, p. 55, Taf. v. fig. 18. (A type specimen is in the British Museum.)

Family 2. Suberitida.

Group 10. Cavernosa.

Cliona celata, Johnst. *op. cit.* p. 125, =*Raphyrus Griffithsii*, Bk. (the free form), *op. cit.* vol. ii. p. 354, ?=*Alcyonium tuberculosum*, Esper, Taf. xxiii.
Raphiophora patera, Gray, Proc. Zool. Soc. 1867, p. 524, ="Neptune's Cup,"=*Potérion*, Harting, 1870, Mém. sur le Genre, 4to, Utrecht, Natuurk. Verh. Provin. Utrecht Genootschap. v. Kunsten en Wetenschappen (excellent illustrations).

Group 11. Compacta.

Halichondria suberea, Johnst. *op. cit.* p. 141, fig. 14, and p. 139, pl. xii. figs. 5 & 6, =*Suberites domuncula*, Sdt.
H. ficus, Johnst. *ib.* p. 144, pl. xv. figs. 4 & 5.
Suberites, Nardo and Schmidt, *op. cit.* 1862, p. 65.

Group 12. Laxa.

Halichondria sanguinea, Johnst. *op. cit.* p. 133, pl. xiv. fig. 3, =*Hymeniacidon sanguinea*, Bk. *op. cit.* vol. iii. pl. xxx. figs. 5–8. (It is worthy of notice that Dr. Bowerbank found in a British specimen of this red sponge the characteristic flesh-spicule of the carmine *Vioa Johnstonii*, Sdt., Mon. Brit. Spong. vol. i. p. 239, pl. iii. fig. 72.)
Alcyonium purpureum, Lam. (This beautiful carmine-coloured sponge from Australia equals the following in the permanency and brilliancy of its colour, and also corresponds with it in the forms of its spicules.)
Vioa Johnstonii, Sdt. *op. cit.* 1870, p. 5, Taf. vi. fig. 18. (Observe that these spicules are quite different from those of the *Vioa Johnstonii* of 1862, *op. cit.* p. 78, Taf. vii. fig. 17. The carmine species (of which there is a type specimen in the British Museum) has, in addition to the flesh-spicules figured by Schmidt in 1870, a *pin-like*

skeleton-spicule; while those figured in 1862 are respectively stellates with an *acerate* skeleton-spicule. See Schmidt's explanation of this, *op. cit.* 1870, p. 5.)

Grayella cyathophora, C. Annals, 1869, vol. iv. p. 189, pl. vii.
Cliona corallinoides, Hancock, Annals, 1867, vol. xix. p. 238, pl. vii. fig. 3. Also 'Annals,' 1871, vol. viii. pl. ii. figs. 33–37.

Group 13. Donatina.

Donatia aurantium, Nardo, 1833, 'Isis,'=*Tethya lyncurium*, Lam. 1816; Annals, 1869, vol. iv. p. 6, pl. ii. fig. 1 &c.
Suberites appendiculatus, Balsamo-Crivelli, 1863, *op. cit.* vol. v. tav. vi. figs. 4 &c.
Polymastia, Bk. 1866, *op. cit.* vol. ii. p. 58, and vol. iii. pls. 10, 11, 12, & 72.
Thecophora semisuberites, Sdt. 1870, *op. cit.* Taf. vi. fig. 2.
Rinalda uberrima, Sdt. *ib.* fig. 3.
Radiella spinularia, Sdt. *ib.* Taf. iv. fig. 7.
Trachya pernucleata, C. Annals, 1870, vol. vi. p. 178, pl. xii. fig. 11 &c.
Axos Cliftonii, Gray, Proc. Zool. Soc. 1867, p. 546, =*Dictyocylindrus dentatus*, Bk. *ib.* 1873, p. 321, pl. xxix.
Xenospongia patelliformis, Gray, *ib.* 1858, p. 230, and 1867, p. 547.
Halicnemia patera, Bk. *op. cit.* vol. ii. p. 96, and vol. iii. pl. xv. figs. 31 & 32.
Placospongia melobesioides, Gray, Proc. Zool. Soc. 1867, pp. 128 & 549.

(*Axos Cliftonii*, independently of its form, *Xenospongia patelliformis*, independently of its crust of stellates, and *Placospongia melobesioides*, independently of its crust of *Geodia*-like siliceous balls, will, I think, ultimately have to come among the Suberitida; while the spicules of *Hymeraphia verticillata*, especially that form which is inflated in the centre, at present thus far find their analogue alone in *Halicnemia patera*.)

Family 3. Pachytragida.

Group 14. Geodina.

Geodia zetlandica, Johnst. *op. cit.* p. 195; also Bowerbank, *op. cit.* vol. ii. p. 45, and vol. iii. pl. vii.
Geodia arabica, C. Annals, 1869, vol. iv. p. 4, pl. i. figs. 9 &c.
Pachymatisma Johnstonii, Bk. *op. cit.* vol. ii. p. 51, and vol. iii. pl. viii. fig. 1; Annals, 1869, vol. iv. p. 8, pl. ii. figs. 7 &c.
Stelletta discophora, Sdt. *op. cit.* 1862, p. 47, pl. iv. f. 5.
S. euastrum, Sdt. 1868, Spong. Küste v. Algier, p. 20, Taf. iv. f. 4.

Group 15. Stellettina.

Stelletta Grubii, Sdt. *op. cit.* 1862, p. 46, pl. iv. fig. 2. (Found also on the rocks at Budleigh-Salterton, South Devon.)
S. aspera, C. Annals, 1871, vol. vii. p. 7, pl. iv. figs. 7 &c.
S. lactea, C. *ib.* p. 9, pl. iv. fig. 15 &c.

Group 16. Tethyina.

Tethya cranium, Johnst. *op. cit.* p. 83, pl. i. fig. 1 &c.
T. arabica, C. Annals, 1869, vol. iv. p. 3, pl. i. figs. 1 &c.
T. dactyloidea, C. *ib.* vol. iii. p. 15, fig. 1, and 1872, vol. ix. p. 82, pl. x. fig. 1 &c.
T. atropurpurea, C. *ib.* 1870, vol. vi. p. 176, pl. xiii. fig. 1 &c.
T. casula, C. *ib.* 1871, vol. viii. p. 99, pl. iv.
Tetilla polyura, Sdt. 1870, *op. cit.* p. 66, Taf. vi. fig. 8.

Family 4. PACHASTRELLIDA.

Group 17. PACHASTRELLINA.

Pachastrella abyssi, Sdt. 1870, *op. cit.* p. 64, Taf. vi. fig. 4.
Dercitus niger, C. Annals, 1871, vol. vii. p. 3, pl. iv. fig. 1 &c. = *Dercitus*, Gray, Proc. Zool. Soc. 1867, p. 542, = *Hymeniacidon Bucklandi*, Bk. *op. cit.* 1864, vol. ii. p. 226, = *Battersbya Bucklandi*, Bk. vol. iii. 1874, pl. xcii. fig. 8.

Group 18. LITHISTINA.

MacAndrewia azorica, Gray, Proc. Zool. Soc. 1859, p. 438, Rad. pl. xv.; *ib.* 1867, p. 507.
Corallistes, Sdt. 1870, *op. cit.* p. 22 &c. See Taf. iii. for illustrations.
For other species see 'Annals,' 1873, vol. xii. p. 437.

Family 5. POTAMOSPONGIDA.

Group 19. SPONGILLINA.

Spongilla, Lam. 1816, vol. ii. p. 98, = *Badiaga*, Buxbaum, in Spreng. Syst. Veg. iv. p. 374.
S. fluviatilis, Johnst. *op. cit.* p. 159, pls. xvii. & xviii.
For Bombay species see 'Annals,' 1849, vol. iv. p. 81, pls. 2, 4, and 5; and for species generally see "Monograph" by Bowerbank, Proc. Zool. Soc. 1863, pl. xxxviii.

Order VII. HEXACTINELLIDA.

Family 1. VITREOHEXACTINELLIDA.

Group 1. PATULINA.

Dactylocalyx pumiceus, Stutchbury, Proc. Zool. Soc. 1841, p. 86.

Group 2. TUBULINA.

Euplectella aspergillum, Owen, Trans. Zool. Soc. vol. iii. p. 203, pl. xiii.

Group 3. SCOPULIFERA.

Aphrocallistes Bocagei, Wright, Quart. Journ. Microscop. Soc. vol. x. N. S. p. 4, pl. i. 1870.

Family 2. SARCOHEXACTINELLIDA.

Group 4. ROSETTIFERA.

Crateromorpha Meyeri, Gray, Annals, 1872, vol. x. p. 112.
Rossella, C. *ib.* 1875, vol. xv. p. 113, pl. x., see for all known species.

Group 5. BIROTULIFERA.

Hyalonema Sieboldii, Gray, Proc. Zool. Soc. 1835, p. 65.
H. lusitanicum, Bocage, *ib.* 1864, p. 265, pl. xxiii.
H. cebuense, Higgin, Annals, 1875, vol. xv. p. 377, pl. xxi.
Holtenia Carpenteri, Wy. Thomson, 1869, Phil. Trans. p. 701, pls. lxvii.–lxxi.

Meyerina clavæformis, Gray, Annals, 1872, vol. x. p. 110.
Labaria hemisphærica, Gray, *ib.* 1873, vol. xi. p. 275; *ib.* Higgin, 1875, vol. xv. p. 385, pl. xxii. fig. 3.

Family 3. SARCOVITREOHEXACTINELLIDA.

One Group only.

Euplectella cucumer, Owen, Trans. Linn. Soc. 1857, vol. xxii. p. 117, pl. xxi. figs. 1–7*.

Order VIII. CALCAREA†.

[To be continued‡.]

XXIV.—*Descriptions of two new Species of* Marginellidæ *from the Cape-Verd Islands.* By EDGAR A. SMITH, F.Z.S., Zoological Department, British Museum.

THE two following species were obtained by the British Museum from Mr. P. Furse, of the Control Staff, who collected them whilst stationed at the Cape-Verd Islands. Both belong to that section of *Marginella* to which Hinds, in the Proc. Zool. Soc. 1844, gave the name *Volvarina*, and which contains a group of species having short small spires, narrow linear apertures, the columella furnished at the base with a few oblique folds, and the labrum exteriorly varicose.

1. *Marginella* (*Volvarina*) *verdensis*, sp. nov.

Testa elongata, cylindraceo-ovata, nitens, subpellucida, mediocriter tenuis, pallide flavescens (vel albescens), lineis transversis obliquis pluribus fuscis (interdum roseo-rufis) fasciata; anfractus 4; spira brevissima, marginibus convexis; apertura angusta, basi paululum dilatata, longitudinem totam testæ fere æquans; columella superne convexa, inferne plicis obliquis quatuor, suprema minima, proxima sequente paululum majore, tertia maxima perobliqua, ultima (quæ columellæ basim format) aliquanto minore tertiæque juncta, in-

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* For all the "known species" of Hexactinellida see 'Annals,' 1873, vol. xii. p. 357.

† For illustrations of the Calcarea see Häckel's Monograph, with Atlas, on the Calcispongia, 1872, 'Die Kalkschwämme.'

‡ The above "Key" is *now* supplied, as it may be some months before the third part of these "Notes," although considerably advanced, is ready for publication—seeing that I have first to describe the remainder of the sponges dredged up on board H.M.S. 'Porcupine,' the illustrations for which, both general and elementary, are completed.

structa; labrum medio leviter compressum, margine incurvatum, extra valde incrassatum, fasciarumque finibus bene notatum.
Long. $10\frac{1}{2}$ mill., diam. 5.

At first I was inclined to consider this species but a variety of *M. obscura*, Reeve, 'Conch. Icon.' f. 132; but on a more careful comparison with the type of that species, there appear sufficient differences whereby the two forms may be recognized. The figure above quoted gives a very fair idea of the form of the present species, except that it does not display the slight contraction of the labrum near its middle, and the apex is perhaps a trifle too acuminately elevated. The bands are thus disposed: just below the suture there is a very broad one, which is sharply defined above but not so beneath, but gradually blends into the ground-colour of the shell; a little below this there are two narrow lines close together, then a single one round about the middle of the whorl, then two more approximated, which terminate at the base of the labrum. *M. obscura* has five equidistant bands, as shown in Reeve's figure; and the plaits on the columella are not precisely the same as in *verdensis*; for the two basal ones are quite separate, whereas in the latter species they are joined at the base.

The interior of the aperture displays a similar coloration to the exterior of the shell, the bands being conspicuous. All the bands are rather more deeply coloured on the varix which borders the labrum.

2. *Marginella* (*Volvarina*) *mediocincta*, sp. nov.

Testa ovato-cylindracea, nitens, saturate rufo-fusca, circa medium fascia lata alba cincta, atque ad columellæ basim alba; anfractus 4, sutura alba sejuncti; spira perbrevis; apertura angusta, ad basim leviter dilatata, longitudinem testæ totæ fere æquans; columella superne convexiuscula, inferne plicis quatuor, duabus superioribus quam inferioribus minoribus, munita; labrum margine albo, extra late incrassatum, incrassatione linea alba limitata.
Long. $6\frac{1}{2}$ mill., diam. 3.

This pretty species is so well distinguished by its style of coloration that it cannot be confounded with any other. With the aperture towards the eye, the white zone is situated rather above the middle of the shell; but on the back of the whorl it is about central. The broad varix which margins the exterior of the labrum is bordered by a thin white line; and the edge of the lip is also white, and likewise the base of the columella and the plaits with which it is furnished. The same figure which I quoted with regard to the preceding species may be cited as a guide to form with reference to the present, which, however, is not so elongated.

XXV.—*Brief Observations on the Anatomy of* Comatula. By C. Semper*. *With an Addendum by* W. B. Carpenter, M.D., LL.D., F.R.S., &c.

Since the publication of Müller's celebrated treatise on the structure of *Pentacrinus caput-Medusæ* †, errors have been propagated by all the manuals of zoology (and so-called comparative anatomy), the refutation of which no one, to my knowledge, has hitherto attempted. To me, however, the erroneousness of some individual statements of that great man was already known while residing in the Philippine Islands; and from the commencement of my course as a teacher I have in my lectures endeavoured to spread truer views.

In the year 1868 I was intending to publish a short memoir on that which I had found, when, becoming acquainted in London with Dr. Carpenter, I was delighted to learn that that able observer had obtained exactly the same results on European as I on Philippine *Comatulæ*. In the expectation that the English investigator would soon publish his already prepared work on the Crinoidea, I deferred till now the communication of the results of my examination: but since, after five years waiting, there is imminent risk that from my lectures the results of Carpenter's and my own toilsome investigations may somehow find their way into publicity, I hold that the moment has arrived to break the silence I have hitherto kept.

My present concern is only to correct Müller's inaccurate representation of the sexual parts and what he calls the nervous system. He says (*l. c.* p. 57), "In the arms of *Pentacrinus* and *Comatula*, between the joints and the membranous covering of the groove (derived from the perisome), under the groove of the tentacle are situated two ‡ membranous canals, one above the other. *Between the two lies the nerve-cord* of the arm, specially enclosed in a membranous sheath; opposite each pinnule it forms a longish slight swelling from which the nerve-fibre departs into the pinnule." This description has been admitted into Gegenbaur's 'Grundzüge der vergleichenden Anatomie,' 2nd ed. p. 321 §, and Claus's 'Zoologie,'

* Translated from a separate impression, communicated by Dr. W. B. Carpenter.

† Abhandlungen der Berlin. Akad. 1841.

‡ This is only partially correct. According to Müller's own drawing (*l. c.* pl. iv. f. 12), *Alecto europæa* has only one canal in the arms; the lower one is absent. In the tropical *Comatulæ*, however, it is present, and also in the European, according to Edmund Perrier (Arch. d. Zool. Expérim. &c. tome ii. 1863, pp. 49, 57). To the work of the latter I shall return further on.

§ I take this opportunity to protest against the mode in which Gegen-

2nd ed. Müller further on (*l. c.* pp. 58, 59) describes the ovaries as lying in the pinnules completely isolated from each other, and compares this situation to that of the analogous organs in the proglottides of the Cestoda.

The cord discovered by Müller (*l. c.* pl. iv. fig. 11, pl. v. f. 16) between the two canals of the arm—which, moreover, is wanting in the drawing of a section of the arm of *Comatula europæa* (*l. c.* pl. iv. f. 12)—is indeed present; it is not, however, the nerve-system, but belongs to the parts of generation. This is proved by sections of the arm of a new *Comatula* from the Philippines, which I shall subsequently describe; the sections were made on arms carefully decalcified. The pinnules, as is well known, arise with a tolerably sharp curve towards the arm. At the period of sexual maturity the ovaries prolong themselves in the same direction into the soft portions of the arm before uniting with each other through the cord (Müller's nervous cord) which runs along the middle line. In transverse sections, therefore, made close behind the insertion of a pinnule, the prolongations of the ovaries which are situated in the hinder part of the arm, under the groove of the tentacle, must be met with, and, in a favourable case, also the cords connecting them with the central cord. Such sections are in fact obtained with tolerable facility. In the annexed woodcut (fig. 1), on the left the pinnule is not met with; but on the right it is, though only partially. In the proper body-parts of the arm, under the tentacle-canal *c.t* (from which the lateral vessels depart for the tentacle) a cord *r*, cut through somewhat obliquely, is seen in the middle line: this is Müller's nerve of the arm (see fig. 2). To the right of it is situated a portion of the right ovary, *ov*, with developed ova mostly on

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baur quotes from my Monograph of the *Holothuriæ* in his 'Lehrbuch;' his readers are not informed of the existence of such a work, but only that I published some observations on *Holothuria* in my 'Reisen im Archipel der Philippinen.' I myself can bear the disadvantage thence arising; but it is not so easy for others to do so, because they are led into error by *his* authority. Recently a Privatdocent at Graz has written a special memoir on the histology of the Holothuria, without the slightest suspicion that he could have found all his supposed novelties already in my book. Moreover I cannot suppress the conjecture that Gegenbaur himself has not carefully read my work; otherwise he would hardly have granted a place in his own to manifest errors. For it is not true that (as he says, p. 343 of the 2nd edition of his 'Grundzüge') "neither the structure nor the function of the Cuvierian organs are known." The former is better explained by me than almost any other organ by others; and the negative result of my investigation, that they were certainly not glands, is much more positive than Gegenbaur's absolutely arbitrary assumption that they are "probably excretory organs" (*l. c.* p. 329).

the outer periphery; but here its connexion with the central cord was not brought into view. On the contrary the peripheral layer of the central cord clearly passes into the mass of

Fig. 1.

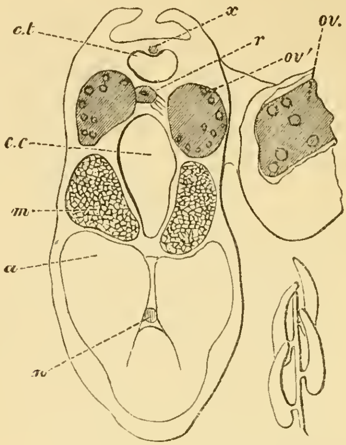

Fig. 2.

Fig. 1. Transverse section of a decalcified Arm: *a*, organic basis of the skeleton; *n*, cord occupying the canal of the calcareous segment, regarded by Müller as a vessel and by Carpenter as a nerve; *m*, muscles; *c.c*, inferior or cœliac canal; *r*, cord regarded by Müller as a nerve, by Carpenter and Semper as the rhachis of the generative system; *ov*, ovary; *c.t*, superior canal, the tentacular canal of Müller: *x*, fibrous cord of Perrier and Semper, corresponding in situation with the real tentacular canal of Carpenter.

the left ovary. The ova here, as well as in the pinnules, show a distinct germ-vesicle and spot. Müller has seen these connecting branches, as is shown in the representation of what he calls the nervous cord (*l. c.* pl. v. f. 16); he interprets them as lateral nerves for the pinnules. Judging from the figure, these branches appear to be very fine; so that, without making sections, Müller might the more readily fail to demonstrate the connexion with the ovaries, as no similar relation in any Echinoderm had given a hint of so peculiar an arrangement of the parts of generation. In what manner these central cords (probably comparable to the rhachis in the ovary of the Nematoda) are distributed in the disk I have not investigated; Müller, however, states, and Carpenter has confirmed it to me, that they are traceable far up the disk and there form a ring round the œsophagus.

The question now is, Where are we to look for the nervous system? In regard to this, unfortunately, my examination has conducted to no conclusion, because I have not yet had any opportunity to repeat it on living animals. It might even be possible that the cord (n) in the interior of the calcareous skeleton, which has hitherto always been regarded as a vessel, is a nervous cord; and if so, then the so-called heart situated in the calyx would certainly have to be looked upon as a ganglion. That it is not a vessel, is shown by the total absence of a lumen; its mass consists of very fine close-lying fibres, which Hoffmann also, in his recently published work, compares to nervous fibres. On the other hand, above the tentacle-canal there is a second fibrous cord, which was first discovered by Perrier (Archives de Zoologie Expérimentale, tome ii. 1873, p. 55, pl. iii. f. 8, m), and which I have also recognized in sections of the arm of *Comatula* which I have preserved for some years (see x, fig. 1). This cord also appears probably to belong to the nervous system. Yet in no case is proof furnished of the nervous nature of either the one or the other; the only thing fully established with respect to the first, is the absence of any ground for interpreting it as a vessel.

In conclusion, I wish to add a remark on the work of Perrier above referred to. He strenuously contends that one of the two canals described by Müller in *Pentacrinus*, and by Carpenter in *Comatula*, is not present, viz. that named by the latter "canalis cœliacus." But in this he to a certain extent contradicts himself. At pp. 48, 49, in directly contesting the presence of the lower canal of the arm, he says:—"for there (in adult individuals) the tentacular canal appears always to *rest directly* upon the *thin layer* of tissues which invests the skeleton, and in that layer *nothing resembling a canal* can be distinguished." In the same page, however, he says "it is upon the walls of the prolongations of the general cavity into the pinnules that the genital glands are developed;" further, p. 57, "the tentacular vessel is seen to rest directly upon the membrane that envelops the calcareous axis;" and, in the same page, "immediately above this covering" (of the calcareous axis) "is the general cavity." A more distinct contradiction cannot be imagined. It seems to me that Perrier has been misled by the German word *Gefäss*. He calls the tentacle-canal a canal, because he wishes to indicate thereby its belonging to a system of vessels distinctly cut off from the body-cavity; while he will not give that name to the canal-like prolongations of the body-cavity (which he yet himself describes, though not clearly) *, since the body-cavity and consequently also its prolongations are supposed to be separated from the vascular system. His attack on Müller and Carpenter therefore fails, since he finds again the same parts as they, and only arbitrarily changes the name and interpretation. Moreover he is positively behind them both: he denies the existence of the nervous system described by Müller (*l. c.* p. 83); yet it is present, though it was erroneously interpreted by its discoverer. The only really new information given by Perrier is concerning the fibrous band situated above the tentacle-canal (*l. c.* p. 55, pl. iii. f. 8, *m*), with which I am also acquainted, and which, as mentioned above, will probably prove, on closer histological examination of living animals, to be the nervous system that for the moment is yet to be sought.

Addendum by Dr. Carpenter.

The full justice which my friend Prof. Semper has obviously desired to do me, in speaking of my conclusions in regard to the structure of *Comatula*, as having been arrived at independently of, and contemporaneously with, his own, might seem to render it quite unnecessary for me to put forward any claim to a discovery which has, I think, many bearings of great interest, physiological as well as morphological. But he seems to have overlooked the fact that I had not only distinctly pointed out what I believe (in common with him) to be Prof. Müller's errors, but had indicated what I regard as the true Nervous System, in the First part of my "Researches on the Structure, Physiology, and Development of *Comatula rosacea*," communicated to the Royal Society in 1865, and published in the 'Philosophical Transactions' for 1866.

After describing (par. 19) the muscular apparatus of the arms, I say:—"It will be shown, in the Second part of this memoir, that the cord which traverses the length of the arms between the canal just mentioned and another canal which overlies it, and which was regarded by Prof. Müller as a nerve, really belongs to the reproductive apparatus. But it will also be shown that a regular system of branching fibres, proceeding from the solid cord (described by Prof. Müller as a vessel) that traverses the axial canal of each calcareous segment of the rays and arms, is traceable on the extremities of the muscular bundles; and reasons will be given for regarding these fibres as

* This follows indubitably from his remark (p. 49), "the general cavity of the body is continued beneath the tentacular canal."

probably having the functions of nerves, though not exhibiting their characteristic structure."

Again, in describing the dorsal cirrhi (par. 29), the axial canal of the arms (par. 45), and the circlet of basals in the Pentacrinoid larva (par. 76), I mentioned the connexion of these solid sarcodic cords with "the wall of a remarkable quinquelocular organ, contained within the centro-dorsal basin," which organ was "supposed by Prof. Müller, who first noticed its presence [though he did not recognize its subdivision], to be a heart," but which "I shall hereafter describe under the name of the 'centro-dorsal vesicle,' and which I shall show to be an expansion of the original crinoidal axis, hollowed out into a multiple ventricular cavity."

The chief difficulty which I felt in regarding this axis and its extensions into the arms as constituting a Nervous System, arose from the entire absence of any of the ordinary histological characters of nerves. I found that I could tear the axial cords (hardened in strong spirit) into fibrils of extreme minuteness, but that these fibrils showed a perfectly homogeneous composition. Still "the remarkable energy and rapidity of muscular action in *Comatula*, far surpassing that of every other known animal of its class" (par. 19), strongly impressed me with the belief that its muscles must be called into action by nerves proceeding from a common centre; and as these muscles are all *flexors*, while the *extension* of the arms is provided for by elastic ligaments, I arrived at the opinion that the want of histological differentiation in the nervous system might be related to the fact of its having only one kind of action to perform. To this conclusion I have given expression in the last edition of my 'Microscope and its Revelations,' p. 771.

Being at Oban in the summer of 1867, I made an experiment on the living *Comatula*, which seemed conclusive (not only to myself, but to the numerous Physiologists to whom I have mentioned it) as to the nervous character of the central quinquelocular organ and of the cords proceeding from it. Having turned out from the calyx the whole visceral mass (which, in the living animal, is so loosely held in by the soft perisome as often to be lost in the dredge), I had remaining the entire skeleton, its muscles and ligaments, and the supposed nervous system radiating from the central quinquelocular organ still contained in the cavity of the centro-dorsal plate. On irritating the central organ by a needle passed down through the aperture leading into this cavity from the base of the calyx, all the ten arms suddenly and consentaneously coiled up. On the withdrawal of the needle, the arms gradually straightened

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themselves again, and again coiled up as before when the irritation of the central organ was renewed.

The only additional proof derivable from experiment as to the nervous character of this apparatus, would be the production of a similar effect in a single arm by irritating the supposed nerve-cord in its course. But this, through the complete inclusion of the cord in the solid calcareous skeleton of the arm, would scarcely be possible.

As I distinctly remember mentioning this experiment to Prof. Semper when I had the pleasure of a visit from him in 1868, I am rather surprised at his saying that no experimental verification of the doctrine has been obtained. I was, on my part, very glad to learn from him that the histological character of the axial cords of *Comatula* closely corresponds with that of what he felt assured to be the Nervous System of the *Holothurida*, his admirable researches on which group ought to be known to every comparative anatomist.

Nothing but the engrossment of my spare time in the various inquiries that have arisen out of the Deep-Sea researches which I prosecuted in the vacations of 1868 and three following years, has prevented me from publishing long before this the Second part of my Memoir on *Comatula*, for which the essential materials (in the shape of some hundreds of preparations, and a series of most admirable drawings executed by Mr. George West and Mr. A. Hollick) have been in my possession ever since the appearance of the First. These drawings, made from very careful dissections, show that the ovaries (or testes) in the pinnules have exactly the same relation to the so-called nerve-cord of Müller, that the currants on a bunch have to their stalk. I was led to trace this connexion, in the first instance, by finding that the position of the ovary in the pinnule, between its two principal (afferent and efferent) canals, exactly corresponds with that of Müller's nerve-cord (*r* in Prof. Semper's figure) between the two canals *c.t* and *c.c* of the arm. They further show that in *Comatula rosacea* the canal *c.t*, spoken of by Müller as the tentacular canal, has no connexion with the tentacles, and exists equally in the oral pinnules which have no tentacles; whilst the real tentacular canal occupies the position *x* in Prof. Semper's figure*. This

* That there is here, in *Comatula rosacea*, a most distinct *canal*, from which the tubular tentacles originate, is a fact of which I am as certain as I am of any point in the anatomy of this animal. Whether the same may not be the case in Prof. Semper's Philippine *Comatula*, is a question which I would commend to his careful investigation. I have a strong belief that in a sufficiently thin section of a pinnule he would find his so-called "fibrous cord" to possess a lumen; though this may be obscured by the collapse of the canal, which is not cylindrical but flattened.

fact also I have indicated in Par. 15 of the First part of my Memoir.

I expect to be able to prove that the *Crinoidea* have scarcely any thing in common with Echinoderms generally as to plan of structure, and that their developmental history differs essentially from that which is now regarded as characteristic of that group. In fact, as Prof. Semper remarked to me, a Crinoid might almost be considered a more highly organized Polype. In its early state the digestive cavity has but a single orifice in the centre of the oral disk; and the animal then exhibits *an absolutely perfect radial symmetry*. The only departure from this symmetry in the adult Crinoid arises from the elongation of the digestive cavity into an intestine, the anal termination of which appears on the oral disk, bearing in *Comatula* an unsymmetrical plate, which belongs to the "perisomatic skeleton"*. The "radial skeleton," with its ligaments, muscles, and nerves, and the complicated vascular, respiratory, and generative systems contained in the arms, all have such an exact radial symmetry, that to affirm that Crinoids are modified Annelidans, merely because the "pro-embryo" which carries about the true Crinoid-germ has somewhat of an Annelid form, seems to me about as scientific as it would be to describe Man as a Radiate, because the villous chorion, which furnishes nutriment to the true Vertebrate embryo, is globular. If the type of the Nervous System goes for any thing, and this nervous system in *Comatula* is what I affirm it to be, its disposition, from its very first appearance, is as distinctly *radiate*, as the disposition of the nervous system in the Articulate and Vertebrate subkingdoms is *bilaterally* symmetrical.

Doubtless I shall be charged in this instance, as I have been in others, with an undue preference for older to newer ideas, and with an indisposition to avail myself of the light thrown by developmental history upon the affinities of animals. I only ask, however, a suspension of judgment until I shall have published the facts which have been in my possession for more than ten years past, and which I only want an interval of leisure concentrated upon the subject to present in a complete and systematized form.

* See par. 84 of the first part of my "Researches."

XXVI.—*Descriptions of new Genera and Species of New-Zealand Coleoptera.*—Part I. By Francis P. Pascoe, F.L.S. &c.

[Plate V.]

Captain F. W. Hutton, Director of the Museum at Otago, and author of several valuable papers on the geology and natural history of New Zealand, has had the kindness to remit to me from time to time collections of insects of nearly all orders from that country. To his friends also, especially Mr. Travers and Captain T. Broun, I am indebted for several interesting novelties. Some of these gentlemen's discoveries have been anticipated, as far as publication is concerned, by other collectors, and have been described by Messrs. H. and F. Bates, Dr. Sharp*, and Mr. Wollaston, more especially the former gentleman, and our knowledge of New-Zealand entomology has been greatly increased; but doubtless much still remains to be done, inasmuch as insects in those islands are very scarce individually, and the species seem restricted to more than usually limited areas.

It is perhaps premature to generalize upon our present materials; but, so far as we have gone, the following is a summary of what I think may be said:—(1) That the insect-fauna is most nearly allied to that of Australia, if we exclude such "microtypal" forms as are common more or less to all temperate countries. Such well-marked genera as *Distypsidera*, *Promecoderus*, *Calonota*, *Cilibe*, *Rhadinosomus*, *Psepholax*, *Mitrastethus*, *Didymocantha*, *Phlyctænodes*, and others are common to both and are not known elsewhere; while genera found in Australia have in New Zealand comparatively numerous others closely allied. On the other hand, however, there is a singular absence, or only an exceedingly limited number, of large and characteristic Australian genera, and even of whole families having numerous exponents in Australia—as, for example, the Buprestidæ, with over 300 representatives in Australia, but only with one, and that very doubtful, in New Zealand; the Scarabæidæ, with 11 New-Zealand species (no *Cetoniinæ*) has about 450 in Australia; the great group of Phytophaga, abundant almost everywhere, and some of

* I take this opportunity to mention that Dr. Sharp's genus *Lawsonia* (Ent. Monthly Mag. x. p. 30) is identical with *Exillis* (*antè*, ser. 3, v. p. 43). Two species are described from New Zealand, both distinct from the type *E. longicornis* from Borneo. Unfortunately Dr. Sharp has given the same specific name to one of his species. Lacordaire wrongly refers *Exillis* to his "Anthribides vrais;" it is nearer *Tropideres*, but, from its reniform eyes, it is perhaps best placed near *Proscoporhinus*, as Dr. Sharp has suggested.

them great pests to the agriculturist, with more than 200 Australian species, has only three or four in New Zealand, and those belonging to three microtypal genera. Of the entomology of the numerous islands north and north-east of New Zealand we know very little, except that it includes some isolated forms. (2) That out of about, in round numbers, 180 genera of Coleoptera, about 50 are peculiar to New Zealand, and about 50 are either almost cosmopolitan or also found in middle Europe [mostly British]; the remainder have representatives in Australia, the Malayan archipelago, Japan, Madagascar, North and South America, Africa, &c., but not in Europe. In the other orders of insects European forms are mostly represented. No one genus, I believe, is peculiar to New Zealand, except amongst the Lepidoptera*. From these considerations, I think that the New-Zealand fauna (for insects at least) cannot be regarded as belonging to the primary Australian region, but that it is a secondary or "satellite" region, having too many endemic forms and too many representatives (out of all proportion to the rest) of widely distributed genera, and yet subsidiary to a certain extent to the Australian, inasmuch as it approaches it in a very marked manner in possessing several peculiar forms, as we have already stated†.

Some caution must be exercised in regard to introduced species. New Zealand, it has been observed, seems to have a slight hold on its animal and plant life; and, conversely, introduced species seem to do well. In that category I believe I may place the Australian *Cyttalia griseipila* (*antè*, xi. p. 195), or at least a form so closely allied that I hesitate to place it as a distinct species; it is found very commonly on a plant called the "Spaniard," whatever that may be. An *Onthophagus*, apparently identical with the Australian *O. fulvo-*

* Mr. Butler, in the recently completed 'Zoology of the Voyage of H.M.S. Erebus and Terror' [Janson], enumerates 318 species of Lepidoptera. A few genera, for the present at least, may be assumed to be peculiar.

† Mr. Murray, in his paper "On the Geographical Relations of the chief Coleopterous Faunæ" (Journ. Linn. Soc. xi. pp. 1 *et seqq.*), seeks to establish three great "stirpes" to which all the Coleoptera in the world are referable, viz.—i. the Indo-African; ii. the Brazilian; and iii. the "microtypal." To the first of these, *inter alia*, belongs the New-Guinea group, and to the last Australia and New Zealand, including also the temperate regions of the globe as well as tropical Peru. While I agree with Mr. Murray in regarding the beetle-fauna of New Guinea as totally different in character from that of Australia, I look upon the latter as being peculiarly distinct and isolated. If we knew any thing of the entomology of the southern part of New Guinea and more of the district of Cape York, the gap which now exists might be somewhat lessened.

lineatus, Bl., and an *Aphodius*, like *A. pusillus*, have also been received; but there could have been no pabulum for such insects formerly. Captain Hutton has likewise sent from Wellington numerous specimens of our *Otiorhynchus sulcatus*. I suspect, among others, a *Catops*, a *Scymnus*, a *Ptinus*, some wood-borers, &c.

The following is a list of species described in this Part:—

Byrrhidæ.

Morychus coruscans.
Liochoria, n. g.
—— Huttoni.

Tenebrionidæ.

Phycosecis, n. g.
—— discoidea.
—— atomaria*.
Actizeta, n. g.
—— ammobioides.
—— albata.
Syrphetodes, n. g.
—— marginatus.

Cerambycidæ.

Stenopotes, n. g.
—— pallidus.
Xuthodes, n. g.
—— punctipennis.
Xyloteles costatus.

Curculionidæ.

Tysius, n. g.
—— amplipennis.
Inophlœus, n. g.
—— Traversii.
—— inuus.
—— villaris.
—— rhesus.
—— vitiosus.
Phrynixus, n. g.
—— terreus.
Cecyropa, n. g.
—— tychioides.

Coccinellidæ.

Cranophorus venustus.

Morychus coruscans.

M. ellipticus, valde convexus, nitidissime æneus, antennis pedibusque pallide ferrugineis; capite leviter subconfertim punctato; prothorace elytrisque coriaceis, subtilissime punctatis; scutello transversim triangulari, impunctato; corpore infra ferrugineo, leviter punctato; femoribus tibiisque sparse hirsutis. Long. 2 lin.

Hab. Wellington.

Of this species I have seen only one specimen. It is very like the European *M. auratus*; but, *inter alia*, it is narrower, more minutely punctured, and the scutellum is transverse.

Liochoria.

Antennæ subelongatæ, articulis sex ultimis, ultimo excepto, perfoliatis, clavam angustatam formantibus. *Labrum* magnum, distinctum. *Palpi* maxillares articulo ultimo ovali. *Tibiæ* anticæ extus excavatæ.

* In a note *Phycosecis algarum* and *P. litoralis*, from Australia.

I have only a single specimen of the species described below; but, so far as I have been able to examine it, it seems to differ from *Morychus* in the six-jointed, very narrow club of the antennæ. It is apparently perfectly free from any villosity; but under a strong lens very short, erect, hair-like bristles are seen to exist.

Liochoria Huttoni.

L. elliptica, convexa, nigra, nitida, antennis pedibusque piceis; capite prothoraceque confertim subtiliter, elytris subtilissime, punctatis; scutello æquilateraliter triangulari; corpore infra femoribusque subtiliter punctatis, sparse hirsutis; tibiis extus integris, intus ciliatis. Long. $3\frac{2}{3}$ lin.

Hab. Otago.

PHYCOSECIS.

Caput transversum, deflectum. *Antennæ* longiusculæ, 11-articulatæ, articulo basali ampliato, secundo subelongato, tertio breviore, duobus ultimis conjunctim globosis, intermediis transversis. *Oculi* prominuli, liberi. *Palpi* maxillares articulo ultimo ovato. *Prothorax* antice productus, lateribus ciliatus, basi rotundatus. *Elytra* modice convexa, subrotundata. *Tibiæ* anticæ subtrigonatæ, apice inermes, omnes extus denticulato-ciliatæ; *tarsi* lineares, antici liberi, articulo ultimo majusculo.

In the rounded base of the prothorax, in contact only with the elytra in its middle portion, this genus agrees with *Hyocis*; but the globose two-jointed club of the antennæ, the last joint being very small, differentiates it from all the other genera of its subfamily. The genus contains four species, two only inhabiting New Zealand; the other two, from Australia, are described in the note. One of the species, and probably all, like many others of the Phaleriinæ, is found on the sea-shore under algæ.

Phycosecis discoidea. Pl. V. fig. 6.

P. breviter ovata, nigra, elytris vel totis pallide ochraceis vel nigris, sæpissime in medio plus minusve nigris, squamulis minutis albis rare adspersa; fronte longitudinaliter sulcata; antennis fuscis; prothorace sparse punctato, antice leviter granulato; elytris sat rude seriatim punctatis, singulis in medio seriebus irregulariter dispositis; corpore infra fusco, sparse punctulato; pedibus subsetulosis, femoribus tarsisque dilute fuscis, tibiis ochraceis. Long. $1\frac{1}{4}$ lin.

Hab. Waikato.

A variable species in regard to the coloration of the elytra.

Phycosecis atomaria.

P. breviter ovata, nigra, squamulis albis sparse irrorata, antennis pedibusque piceis; fronte minus sulcata; prothorace pone medium latiore, punctis sparsis singulis squama repletis; elytris subrotundatis, haud seriatim punctatis, punctis singulis squamulam albam elongatam erectam gerentibus; corpore infra pedibusque sparse albo-setosulis. Long. $1\frac{1}{4}$ lin.

Hab. Great Barrier Island; Kaikarua.

The silvery white, small, erect scales dotting the elytra will, *inter alia*, readily distinguish this species from the preceding*.

ACTIZETA.

Caput transversum, antice rotundatum. *Antennæ* validiusculæ, 11-articulatæ, articulis duobus basalibus ampliatis, æqualibus, tertio minore, cæteris ad octavum valde transversis, gradatim incrassatis, tribus ultimis clavam oblongam formantibus. *Oculi* liberi. *Palpi* maxillares articulo ultimo breviter subcylindrico. *Prothorax* transversus, convexus, lateribus haud ciliatus, basi rotundatus, antice late emarginatus. *Elytra* breviter obovata, prothorace vix latiora. *Tibiæ* anticæ dilatatæ, extus profunde emarginatæ, lobo elongato terminatæ, angulo interiore spinis duabus instructo; *tarsi* lineares, antici liberi, intermedii et postici elongati.

There are two species of this genus: one, *A. ammobioides*,

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* *Phycosecis algarum.*

P. breviter ovata, supra pedibusque fulvo-testacea, squamulis minutissimis albidis dense tecta; capite castaneo vel subcastaneo; antennis pallide ferrugineis; prothorace subtransverso, marginibus lateralibus longe albo-ciliatis; elytris subrotundatis, punctis numerosis, singulis squama pallida repletis, sat confertim impressis; corpore infra pedibusque subtiliter sparse setosulis; tarsis articulo ultimo apice nigro. Long. $1\frac{2}{3}$ lin.

Hab. Melbourne.

Under a high power of the microscope the exceedingly minute scales are seen to radiate from a common base; the patches thus formed appear under an ordinary lens to look like simple scales closely imbricated.

Phycosecis litoralis.

P. ovata, fusca, supra squamulis minutissimis albis sat dense tecta; antennis, marginibus elytrorum pedibusque ochraceis, albo-setosulis, femoribus aliquando nigris; corpore infra dense albo-squamoso. Long. $1\frac{1}{3}$ lin.

Hab. King George's Sound.

In this species the punctures are filled with very minute scales, and probably in a fresh state the intervals between the punctures are also covered with scales; beneath the scales appear to be massed together in profusion.

the type, is like *Ammobius rufus* and is about the same size, apparently scaleless; but I suspect when perfectly fresh it is otherwise: the second species, *A. albata* is a pretty little insect clothed with close-set white scales having a somewhat varnished gloss, but generally marked with a few dark more or less indistinct spots. All the tibiæ are armed at the interior angle of the apex with two long spines.

Actizeta ammobioides.

A. ovalis, castaneo-fusca, subtilissime crebre punctulata; antennis ferrugineis, clava articulis bene determinatis; prothorace transverso, basi in medio canaliculata et bifoveata; elytris striato-punctatis, striis secundo tertioque subflexuosis, interstitiis parum convexis; corpore infra sparse punctato; pedibus colore dilutiore; tibiis setulosis. Long. $1\frac{1}{3}$–$1\frac{1}{2}$ lin.

Hab. Great Barrier Island.

Actizeta albata. Pl. V. fig. 5.

A. ovata, nigra, squamis albis, aliquando maculatim nigrescentibus, dense tecta; antennis brevioribus; clava articulis arcte contiguis; capite prothoraceque rarissime punctatis, hoc fortiter transverso, basi in medio impressa; elytris striatis, striis subflexuosis, interstitiis rarissime uniseriatim punctulatis; corpore infra pedibusque ferrugineis, squamis albis adspersis. Long. $1\frac{1}{2}$–$1\frac{2}{3}$ lin.

Hab. Waikato.

In most specimens there is a dark round blotch on the middle of each elytron, and vestiges of two or three smaller spots on the prothorax.

Syrphetodes.

Caput depressum; *clypeus* apice truncatus; *labrum* productum; *palpi* maxillares elongati, labiales brevissimi; *mentum* transversum; *oculi* rotundati. *Antennæ* tenues, articulis tribus ultimis clavam formantibus. *Prothorax* transversus, basi angustatus, apice profunde emarginatus. *Elytra* convexa, subcordata; *epipleuræ* latæ, integræ. *Pedes* tenuati; *tibiæ* cylindricæ, apice breviter bispinosæ. *Coxæ* posticæ subapproximatæ.

The head is slightly concave between the antennæ; the latter are nearly free at the base, owing to the small size of the antennary orbits; for the same reason the eyes preserve their rounded outline. The clypeus is rather narrowed anteriorly, and shows no trace of any line of separation from the front. The tarsi are filiform, and the claw-joint is nearly as long as the rest together, especially of the anterior pair. *Opatrum tuberculicostatum*, White, the type of a new genus, differs from *Syrphetodes* in the antennæ not being clavate, the eye partly divided by the antennary orbit, and by the non-approximation of the posterior coxæ; both genera agree with the "Phylacides" of Lacordaire in having the epipleuræ of the elytra entire behind. The exact habitat is unknown; my specimens I owe to the kindness of Major Parry.

Syrphetodes marginatus. Pl. V. fig. 10.

S. ovalis, fuscescens, squamis silaceis sat dense tectus; antennis articulo tertio quam secundo duplo longiore; clava tomentosa; prothorace inæquato, apice bifido, angulis anticis acute productis, lateribus explanatis; scutello valde transverso, fusco; elytris prothorace latioribus, punctis parvis in seriebus irregularibus impressis, dorso tuberculis plurimis instructis, marginibus explanatis, transversim sulcato-punctatis; pedibus albido variatim maculatis. Long. 5 lin.

Hab. —— ?

Stenopotes.

Caput elongatum, antice protensum, quadratum. *Oculi* reniformes, obliqui, grosse granulati. *Antennæ* corpore longiores, articulo basali elongato. *Prothorax* capite angustior, latitudine sesquilongior, lateribus inermis. *Elytra* elongata, subparallela, leviter costulata, epipleuris distinctis. *Pedes* tenuati; *femora* fusiformia; *tibiæ* rectæ. *Coxæ* anticæ subcontiguæ.

The strongly faceted eyes in this genus are an exceptional character in this and in a few others of the forty-eight "groupes" into which Lacordaire has divided his "Section B" of the Cerambycidæ. In other respects *Stenopotes* differs, in the form of the prothorax, in the presence of epipleuræ to the elytra, &c., from both *Rhagiomorpha* and *Tritocosmia*, the other two genera of the "groupe." These he differentiates by the one having a tuft of hairs on the third joint of the antennæ, which the other has not. At best this is a doubtful character; one objection to it is, that the tuft very often, apparently, belongs to the insect only in its earlier life*. *Rhagiomorpha* is at present confined to one species—*lepturoides*, Boisd. My *R. exilis*, from its prothorax slightly

* In the case of *Tritocosmia Digglesii* (Tr. Ent. Soc. ser. 2, v. p. 58), one of my specimens has the tuft reduced to a small patch at one point of the apex of the joint; this is what I alluded to in saying that the tuft was "deciduous," an expression which M. Lacordaire has taken to mean a denial of its existence. In the same note (Gen. viii. p. 408) he quotes me as giving "Nouvelle Bretagne" (from which island I have never seen an insect), instead of New South Wales, as the habitat of *T. rubea.* The antennæ of *T. paradoxa* are remarkable, but do not, in the absence of other characters, justify its generic separation as Lacordaire suggests.

protuberant but not spined at the side, will probably form the type of a new genus. *Stenoderus concolor*, M'Leay (King's Voyage, ii. 452), with which Lacordaire identifies *R. leptu-roides*, is a true *Stenoderus*.

Stenopotes pallidus. Pl. V. fig. 7.

S. elongatus, fulvescens, vix nitidus, capite prothoraceque saturatioribus, illo in medio canaliculato; rostro longitudine paulo latiore, planato-marginato; antennis leviter piloso-fimbriatis, articulo tertio quam sequentibus multo breviore; prothorace latitudine sesquilongiore, postice gradatim latiore, pone apicem parum incurvato, supra lineis duabus pilosis notato; scutello subrotundato; elytris prothorace quintuplo longioribus, supra planatis, singulis costulis duabus longitudinalibus instructis; infra pedibusque pube tenuissime indutis. Long. 7 lin.

Hab. Waikato.

XUTHODES.

Caput breve, inter oculos sulcatum. *Oculi* magni, supra distantes. *Antennæ* corpore longiores, tenuiter ciliatæ, articulo basali obconico, tertio fere æquali, quarto paulo breviore, quinto ad undecimum longioribus. *Prothorax* antice late truncatus, utrinque bituberculatus, tuberculo anteriore apicali, altero mediano, disco inæquali. *Elytra* oblonga, parallela. *Pedes* mediocres; *femora* fusiformia. *Prosternum* angustum, arcuatum.

In habit and colour the only representative of this genus is like the Chilian *Phymatioderus bizonatus*; but its characters ally it with *Grammicosum* and *Hesperophanes*, from both of which it differs in the prothorax and antennæ.

Xuthodes punctipennis. Pl. V. fig. 9.

X. capite prothoraceque fulvis, opacis; elytris nitide flavescentibus, nigro-punctatis, punctis apicem versus minutis, pone medium fascia angusta fusca ornatis; antennis, pedibus abdomineque luteis; prothorace impunctato, disco 5-tuberculato. Long. 7½ lin.

Hab. Pitt's Island.

Xyloteles costatus. Pl. V. fig. 8.

X. elongatus, fusco-metallicus, antennis pedibusque castaneis, subtilissime tomentosis; illis articulis basi plerumque pallidioribus; capite prothoraceque lævigatis, hoc in medio tenuiter corrugato; scutello semicirculari, griseo-pubescenti; elytris oblongo-obovatis, apicibus rotundatis, singulis fortiter quinquecostatis, costis duabus exterioribus basi conjunctis, interstitiis sparsim impresso-punctatis; corpore infra subtiliter punctulato; abdomine segmentis quatuor basalibus utrinque macula grisea pilosa notatis. Long. $7\frac{1}{2}$–9 lin.

Hab. Pitt's Island.

What, from its narrower abdomen, I take to be the male, has shorter elytra less drawn out at the apex than the female; the antennæ are about the same length—a little shorter than the body in both. This fine species, which at first sight might be taken to be generically distinct from *Xyloteles*, was, like the last, found by Mr. Travers in Pitt's Island, one of the Chatham group.

TYSIUS.

Caput elongatum; *rostrum* mediocre, subangulatum; *scrobes* subterminales, obliquæ, infra oculos currentes. *Scapus* tenuatus, gradatim incrassatus, ad marginem posticum oculi attingens; *funiculus* 7-articulatus, articulo basali elongato, ampliato, secundo breviter obconico, cæteris transversis; *clava* distincta, longe elliptica. *Oculi* subrotundati, grosse granulati, a prothorace distantes. *Prothorax* parvus, subcylindricus, antice paulo productus. *Scutellum* triangulare. *Elytra* ampliata, oblongo-cordata, humeris rotundatis. *Femora* antica et intermedia modice incrassata, illa mutica, postica valida, infra fortiter dentata; *tibiæ* subflexuosæ, apice inermes; *tarsi* mediocres, articulo tertio late bilobo. *Metasternum* modice elongatum. *Processus* intercoxalis latus, truncatus. *Abdomen* segmentis duobus basalibus ampliatis; *sutura* prima in medio arcuata.

The only species of this genus is ferruginous in colour, with deciduous greyish scales, but always more scattered at the sides, which, to the naked eye present the appearance of being marked with a large brownish patch. I obtained my original specimen from an old collection in the possession of Mr. Stevens; but I have since received it from Capt. Broun, who finds it plentifully at Tairoa, near Auckland.

Eugnomus, Schönh., with an undescribed New-Zealand insect for its type, is unknown to me, but is apparently differentiated from the present genus in several particulars, *i. e.* in the eyes, antennæ, prothorax, elytra, &c.

Tysius amplipennis. Pl. V. fig. 1.

T. ferrugineus, squamulis grisescentibus inæqualiter vestitus, supra setulis paucis adspersus; capite confertim punctato, super oculos tuberculis duobus munito; rostro capite parum longiore; prothorace longitudine latitudini fere æquali, pone apicem fortiter constricto; elytris basi prothorace duplo latioribus, pone basin oblique excavatis, striato-punctatis, interstitiis latis, vix convexis, tertio quintoque interrupte elevatis, quarto quintoque versus apicem callosis; corpore infra sparse punctato. Long. $1\frac{3}{4}$ lin.

Hab. Tairoa.

Inophlœus.

Rostrum modice elongatum, robustum, apicem versus gradatim incrassatum, supra tricarinatum, plaga triangulari munitum; *scrobes* terminales, arcuatæ, ad latera rostri cito desinentes. *Scapus* pone oculum superans; *funiculus* articulo basali elongato, cæteris obconicis vel pyriformibus; *clava* distincta. *Oculi* infra angulares, subfortiter granulati. *Prothorax* basi angustior, lobis ocularibus munitus. *Elytra* dorso planata vel subdepressa, apicem versus declivia. *Femora* in medio crassiora; *tibiæ* anticæ flexuosæ, intus haud dentatæ, reliquæ rectæ, posticæ corbellis subapertis; *tarsi* normales. *Abdomen* segmentis duobus basalibus ampliatis.

The Chilian genus *Cylindrorhinus* is not capable of being strictly defined as it stands at present; but taking Lacordaire's characters, the more determinate seems to be the close connexion of the club to the funicle; in the genus before us the club is well limited. If, however, we had been dealing with Chilian instead of New-Zealand insects I should have had little hesitation in placing, provisionally at least, the species described below with *Cylindrorhinus*, except that the latter is without any vestige of scales.

Inophlœus Traversii. Pl. V. fig. 4.

I. fuscus, obscure griseo-squamosus, rostro prothorace paulo breviore, carina intermedia sat acute elevata; antennis piceis; funiculi articulo secundo quam primo paulo breviore; clava elongato-elliptica, griseo-tomentosa; prothorace parum longiore quam latiore, supra inæquali, subtilissime punctato, lobis ocularibus prominulis; scutello minuto, vix conspicuo; elytris postice gradatim latioribus, supra valde planatis, inæqualiter striato-punctatis, punctis nonnullis areolatis, humeris obliquis, singulis elytris utrinque angulatis, postice dentato-productis, apicibus acutis, parte declivi in medio paulo producta; pedibus sparse squamosis; tibiis sat elongatis. Long. 5–6 lin.

Hab. Chatham Islands.

This species is remarkable for the perfectly flat disk of the elytra, the sides bent suddenly down forming a sharp angle with the disk. It is from Pitt's Island, one of the Chatham group, where it was found by Mr. Travers.

Inophlœus inuus.

I. nigrescens, subtiliter squamosus, squamulisque piliformibus albis adspersus; rostro prothorace vix breviore, carina intermedia basi magis elevata; antennis piceis; funiculi articulo secundo quam primo breviore; clava elongato-elliptica, tomentosa; prothorace paulo latiore quam longiore, punctis flexuosis leviter impresso; scutello parvo, distincto; elytris sat anguste obovatis, supra paulo convexis, seriatim fortiter punctatis, interstitiis alternis paulo elevatis, tertio a sutura postice dentato-producto, parte declivi in medio modice convexa, apicibus paulo elongatis; tibiis sat elongatis. Long. 7 lin.

Hab. Queenstown.

The punctures on the prothorax are so modified as to give the impression of a granulated surface rather than of punctuation. Nearly all the characters of this species are diagnostic.

Inophlœus villaris.

I. fuscus, griseo-squamosus; rostro prothorace multo breviore, apice sat subito deflecto; antennis brevioribus, funiculo articulis duobus basalibus æqualibus; prothorace fere in medio latiore, supra inæquali, vage foveatim impresso; scutello inviso; elytris pone humeros latioribus, supra subplanatis, striato-punctatis, postice minus angulatis, apicibus acuminatis, vix productis; corpore infra pedibusque squamis elongatis aspersis; tibiis minus elongatis. Long. $3\frac{1}{2}$ lin.

Hab. Christchurch.

Has a somewhat different outline from that of *I. Traversii*, but is perhaps more nearly allied to it than the preceding.

Inophlœus rhesus.

I. ovatus, fuscus, leviter griseo-squamosus, supra setulis adspersus; rostro prothorace breviore; antennis ferrugineis; funiculo articulis secundo, tertio, quarto subæqualibus, modice elongatis; clava minus elongata; prothorace rugoso, ante medium latiore; scutello parvo; elytris subcordatis, dorso ad suturam postice dentato-productis, versus apicem verticaliter declivibus, seriatim foveatis, singulis costis tribus munitis; tibiis minus elongatis. Long. $3\frac{1}{2}$ lin.

Hab. Lake Guyon.

Allied to the preceding; but, *inter alia*, there is a small but very distinct scutellum.

Inophlœus vitiosus.

I. subangustus, niger, nitidus, squamis concoloribus adspersus; rostro prothorace fere duplo breviore, apice squamositate grisea tecto, costis lateralibus obsoletis; antennis piceis; funiculi articulo secundo quam primo longiore; prothorace æquato, latitudine longiore, ante medium latiore; scutello minuto; elytris elongato-cordatis, basi depressis, postice singulis in mare acute productis, apicem versus ad suturam carinato-elevatis, supra striato-punctatis, punctis sat remotis, bene determinatis; tibiis posticis paulo flexuosis. Long. $3\frac{3}{4}$ lin.

Hab. Lake Guyon.

A somewhat aberrant species. A specimen, apparently the female, has the elytra less produced and the apex more rounded.

PHRYNIXUS.

Rostrum mediocre, arcuatum, basi angustius; *scrobes* medianæ, foveiformes. *Oculi* parvi, ovales, grosse granulati, a prothorace distantes. *Scapus* antennarum clavatus; *funiculus* 7-articulatus, articulis a secundo sensim crassioribus; *clava* distincta. *Prothorax* suboblongus, irregularis, lobis ocularibus obsoletis. *Scutellum* nullum. *Elytra* brevia, ovata, angulis anticis porrectis. *Pedes* breviusculi; *femora* in medio incrassata; *tibiæ* subflexuosæ, apice mucronatæ; *tarsi* articulis tribus basalibus transversis, penultimo integro, supra excavato, ultimo valido. *Abdomen* segmentis duobus basalibus connatis, ampliatis.

On the whole this genus may be considered as being most nearly allied to the European *Dichotrachelus*; but in four species of that genus, which I have examined, I do not find the penultimate tarsal joint entire, as stated by Lacordaire, but more or less bilobed. The foveiform scrobes and small eyes away from the prothorax are the most essential diagnostic characters of *Phrynixus*. My specimen is from an old collection, and was purchased from Mr. Stevens.

Phrynixus terreus. Pl. V. fig. 2.

P. ovatus, fuscus, supra squamositate dilutiore vestitus; rostro prothorace paulo breviore; funiculi articulo basali longiusculo, secundo breviore, quinque sequentibus transversis, ultimo crasso, obconico; clava brevi, obsolete articulata; prothorace supra sulcatim tuberculato; elytris irregularibus, seriatim punctatis, punctis approximatis, tuberculis plurimis conicis instructis; pedibus rude squamosis. Long. $2\frac{2}{3}$ lin.

Hab. ——?

CECYROPA.

Rostrum breve, validum; *scrobes* subterminales, postice dilatatæ, longe ante oculos desinentes; *scapus* elongatus, gradatim incrassatus, pone oculum superans; *funiculus* breviusculus, 7-articulatus, articulo basali crassiore, secundo breviore, cæteris transversis; *clava* distincta. *Oculi* ovati, grosse granulati, prothoraci contigui. *Prothorax* ampliatus, paulo convexus, utrinque rotundatus, basi truncatus; lobis ocularibus fere obsoletis, fimbriatis.

Scutellum invisum. *Elytra* cordiformia, prothorace latiora, humeris obliquis. *Femora* crassa; *tibiæ* versus apicem valde ampliatæ, posticæ corbellis cavernosis; *tarsi* articulis duobus basalibus triangularibus, secundo minore, tertio late bilobo; ultimo mediocre; *unguiculis* liberis; *coxæ* anticæ haud contiguæ. *Abdomen* segmentis duobus basalibus amplis, sutura prima arcuata.

It is not without hesitation that I place this genus with the *Rhyparosominæ*, the cavernous corbels of the posterior tibiæ being exceptional. It has, however, some analogy at least to *Dysostines* on account of its large prothorax and the non-contiguity of the anterior coxæ. At any rate there is no other place for it in "Section A" of the "Phanérognathes symmérides" of Lacordaire, to which the genus belongs. Of my two specimens one has a few patches of dark-coloured scales on the middle of the elytra; in the other the dark predominates, the white forming dispersed spots on the upper surface.

Cecyropa tychioides. Pl. V. fig. 3.

C. sat late ovalis, fusca, squamulis griseo-albidis adpressis, supra plus minusve fuscis interjectis, omnino dense tecta; rostro antennisque squamulosis, his ferrugineis setulis adspersis; prothorace ante medium latiore, utrinque valde rotundato, apice quam basi duplo angustiore; elytris seriatim punctatis, punctis approximatis, juxta apicem sat subito deflexis; pedibus parce setulosis. Long. $2\frac{3}{4}$ lin.

Hab. Pitt's Island; Wellington.

Cranophorus venustus.

C. elliptico-ovatus, modice convexus, villosus, niger, supra sat confertim punctulatus; prothorace utrinque late flavo-marginato; elytris singulis margine externo maculisque duabus magnis flavis. Long. $2\frac{1}{4}$ lin.

Hab. Waikato.

Cranophorus, Muls., is easily recognized by the prolongation of the anterior part of the prothorax completely covering the head (not emarginate as in the generality of the Coccinellidæ). Two species only from the Cape were known hitherto. I have but a single specimen of the species before me; but a minuter examination might show structural peculiarities requiring its generic separation from the Cape species, which have certainly a somewhat different aspect. Only four members of the family are known from New Zealand, viz. *Coccinella Tasmanii*, *C. concinna*, *Lais antipodum*, and the above; Capt. Broun has sent two or three species of *Scymnus*, not yet determined, and possibly introduced.

EXPLANATION OF PLATE V.

Fig. 1. *Tysius amplipennis*; 1 *a*, head.
Fig. 2. *Phrynixus terreus*; 2 *a*, head (the eye is much too small).
Fig. 3. *Cecyropa tychioides.*
Fig. 4. *Inophlœus Traversii.*
Fig. 5. *Actizeta albata.*
Fig. 6. *Phycosecis discoidea*; 6 *a*, antenna; 6 *b*, fore tibia and tarsus; 6 *c*, maxilla with its palpus; 6 *d*, mentum with the lower lip and its palpi.
Fig. 7. *Stenopotes pallidus.*
Fig. 8. *Xyloteles costatus.*
Fig. 9. *Xuthodes punctipennis.*
Fig. 10. *Syrphetodes marginatus.*
Fig. 11. Right fore tibia and tarsus of *Actizeta albata* (the artist has placed it in a position to represent the left). 11 *a*, antenna; but the basal joint has been unaccountably omitted.
Fig. 12. Head of *Cyttalia griseipila.*

XXVII.—*On a new Sponge of the Genus* Luffaria, *from Yucatan, in the Liverpool Free Museum.* By Thomas Higgin, of Huyton.

[Plate VI.]

A remarkably fine specimen of one of the trumpet-shaped sponges has recently been presented to the Liverpool Free Museum by Staff-Surgeon-Major Samuel Archer, stationed at Belize, in the name of Dr. Barry, Staff-Surgeon at Corosal, who obtained it from Ambergris Island, off the coast of Yucatan, Gulf of Honduras; and, thanks to the care and trouble taken by these gentlemen in preserving it and transmitting it to this country, it has arrived in an almost perfect state. From its great size and its resemblance to a speaking-trumpet, Mr. Archer has called it "Neptune's Trumpet."

It is an undescribed species of the group of sponges to which MM. Duchassaing de Fonbressin and Michelotti, in their memoir on the sponges of the Caribbean Sea, gave the generic name *Luffaria*, from the gourd *Luffa*, or "vegetable sponge" as it has been called, in common use in the West Indies and elsewhere*. This term (*Luffaria*) was accepted

* The fruit of this Cucurbitaceous plant, when denuded of its soft fleshy parts, is found to have a skeleton consisting of a thickly anastomosed mass of fibres made up of thin-walled cells, which quickly takes up water, and is therefore suitable for washing-purposes. It has lately been introduced into this country as an article of commerce, and is sold in the druggists' shops, cut open down the side and spread out flat, as a flesh-brush for use in the bath.

by Dr. Oscar Schmidt in 1870, in his work on the Atlantic sponges, as serving to represent a family proper to the Tropical seas—also by Mr. H. J. Carter in 1872, as recorded in his contribution to 'Ann. & Mag. Nat. Hist.' vol. x. p. 101—and has now been adopted by the latter in his "Notes introductory to the Study and Classification of the Spongida," published in the last two issues of this Journal.

The sponge about to be described is not figured or described by any of the old writers on the Class; and as no perfect specimen of it exists in the British Museum, Mr. Archer's sponge, which is so well grown and in such good condition, may advantageously be taken as typical of this particular species of *Luffaria*. The specimen consists of two tubes—a very long one, which has a flattish basal attachment, and a small one, which grows up from the base of the larger one, possibly from pullulation, most likely, however, from the development of an embryo which had settled at the base of the larger one; but for present purposes each may be regarded as a zoological individual.

Luffaria Archeri, n. sp. (Pl. VI.)

The form of this sponge is that of a tube which gradually increases in width as it increases in length up to its free end, which is somewhat constricted; while at its small or fixed end there is a strong flange-like growth, which forms the basal attachment: hence its general shape is that of a speaking-trumpet, and suggestive of the long horn used in Switzerland to awaken the mountain-echoes, with which tourists are familiar. The inside of the tube presents a slightly circularly ridged appearance, but is smooth; the outside is deeply furrowed transversely throughout its entire length with sinuosities, which have a depth of $\frac{3}{8}$ to $\frac{1}{2}$ an inch, and a width of $\frac{1}{4}$ to $\frac{3}{8}$ of an inch. The wall of the tube is of uniform thickness nearly throughout its whole length—that is, from the base to within half an inch or an inch of the free end, when it diminishes up to the rim of the aperture, which has a smooth, well-defined, and rather sharp edge; the wall generally measures, from the inside of the tube to the tops of the sinuous ridges on the outside, from $\frac{1}{2}$ to $\frac{5}{8}$ of an inch, or occasionally $\frac{3}{4}$ of an inch, and is composed of a close network of rather rigid, clear amber-coloured fibre, which seldom exceeds 1-100th of an inch in diameter. The fibre has the opaque, white, granular pith-like core peculiar to the family; but in this species the granules do not form a lining or crust on the inside of an axial cavity, neither are they closely compacted into a dense column filling up the axis of the fibre; but the first deposit of hardening sarcode or horny material has penetrated amongst the granules instead of forming a decided wall around them, and thus the fibre is not tubular, as in most of the Luffarida, but solid; and this feature is characteristic. The diameter of the granular core is uniformly (excepting, of course, at the joints or angles of the meshes) about 1-1600th of an inch, and the thickness of the horny material around it is in the young growth also about 1-1600th of an inch, thus making the diameter of the young fibre 3-1600ths of an inch; while that of the oldest fibre measures about 16-1600ths or 1-100th of an inch. The horny skeleton-network does not present any radial lines, but is a reticulation of meshes of nearly uniform figure and character, and is apparently increased by the addition of one polyhedral mesh after another, through the extension of new fibre chiefly projected from the angles of the already formed meshes, which branchlets soon bifurcate, extend, and unite to form new meshes. The round-edged ridges on the outside of the tube are simply extended growths of the ordinary network, which is produced more in one place than another; and they seem to occur much like a succession of rings, though the circle is seldom complete, and often an appearance is assumed similar to that of the surface of the *Meandrina* coral. The rim of the aperture consists of fine, young, reticulated fibre imbedded in very dark-coloured sarcode (nearly black, indeed); and the extension of the tube both in length and thickness appears to be produced by the addition of similar ring-like structure growing apically, endogenously and exogenously. The dermal reticulation supports a strong glazed cuticle of a dark brown colour, through which may now be seen protruding the plain and bifurcated ends of the young fibre. This dermal covering is pierced at irregular intervals with pores, which measure from 1-50th to 1-25th of an inch in diameter, considerable spaces occurring in it in which no pores can be detected; but although the pores are thus found scattered and isolated over some parts of the surface, they are elsewhere found in groups of several together both in the furrows and on the ridges. They lead directly into the "subdermal cavities," which are large and roomy, and which, besides communicating with the areolar structure behind them by means of the usual sphinctral openings in their sarcodic walls, sometimes communicate with each other in a similar way, thus accounting for the paucity of pores in some parts of the dermal layer. The areolar structure of the interior is a series of roomy chambers, which extend from the subdermal cavities across the walls of the tube, and which communicate with each other by means of circular openings in the sarcode which tympanizes the interstices of the horny network; these openings are sometimes small, measuring 1-200th of an inch across or even less, and sometimes are as large as 1-50th of an inch; but whether large or small, the margin of each is a more or less thickened ring, and they are no doubt sphinctral. The sarcode of this areolar structure is not dark-coloured like that of the dermis, but is almost colourless, and is dotted over with rounded granular bodies, which may be regarded, according to the observations of Mr. H. J. Carter, as the pigment-cells, which, when exposed to the light (as they are in the dermal sarcode), become deeply coloured, and in that condition give the sarcode of the surface its characteristically dark brown or black appearance. It is probably for the same reason that the sarcodic surface-layer of the *inside* of the tube is not so dark as that of the outside; but another reason is that it is not so strong. The position of the vents is a good deal obliterated by this tender dermal sarcode having cracked in drying; they may, however, be fairly traced, occurring in circular lines on the inner surface of the tube, and rather larger than the pore-openings. Thus, as in all tubular sponges, the vents open into the so-called "cloacal cavity," which is but the great excretory canal of the whole sponge emptying itself at the aperture.

Size. The large individual or tube measures 3 feet 9 inches in length, with a diameter of 2 inches at the small or fixed end, where it rises from the flange-like base; and one of 5 by 4 inches at the other extremity just before it terminates, not being absolutely round at this part. The small individual or tube is 1 foot 7 inches long, its smallest diameter being 1 inch, and its largest $2\frac{1}{2}$ inches. The proportions of the two tubes are therefore similar. But Mr. Archer has subsequently met with another specimen, which is said to be nearly five feet six inches long.

Obs. The large tube has in the living state doubtless been quite round at its free end, like the small tube; but it has been placed on its side to dry, in which position the walls, having been heavy with water, have not had sufficient strength to retain the original shape of the tube, but have, by depending, somewhat fallen together; and consequently, drying in this state, it is not quite round at the free end.

The only sponge hitherto figured with which this species might be confounded is that which was described, with illustrations, by Esper in the volume of 'Pflanzenthiere' published in 1794, page 222, tab. xx., xxi., xxi. A, as the *Spongia fistularis* of Linnæus, and which appears to be also *Spongia tubæformis* of Lamarck; but neither the plates nor the letterpress represent or describe our species, which differs in outward form and appearance as well as in the details of its fibre and its reticulation. The formula of *Spongia fistularis*, in the twelfth edition of the 'Systema Naturæ,' more properly applies to one of the tubular Chalinas than to any of the Luffarida; and the observations of all the old writers on the subject render it almost certain that they included both the tubular Chalinas and tubular Luffarida under the specific name "*fistularis*," the different examples of each then known being taken to be varieties of the same species.

In the sulcate sinuosities of the surface are many examples of both siliceous-spiculed and calcareous-spiculed sponges of humble and diminutive growth, also the stems or branches of Tubuliporidæ and the empty tube-cases of minute Serpulidæ, and many small patches of calcareous deposits; and frequently the dermal covering is seen to be sprinkled over with particles of white sand and other débris, adhering firmly to it, or imbedded in the exposed fibrous network.

Mr. Carter has kindly sent me a tracing of his "rough sketch" of a specimen of the genus *Luffaria* from the East Mediterranean, obtained fresh, and preserved in spirit, by Admiral Spratt, who presented it to the British Museum (No. 73. 4. 6. 9); to which Mr. Carter has obligingly added the following remarks:—"It is tubular, about 6 inches long and about $\frac{3}{4}$ of an inch in diameter, also bears a somewhat smaller specimen by its side. Thus the foregoing statement upon Schmidt's authority, viz. that the 'family is proper to the Tropical seas,' requires modification; for it is also to be found in the Mediterranean sea. Moreover from this fresh specimen we learn that the aperture is circumscribed by a wide duplicature of dermal sarcode, which in a ring-like form surrounds the opening, and evidently performs the sphinctral diaphragmatic office common to vents generally."

EXPLANATION OF PLATE VI.

The figure is after an excellent photograph by Robinson and Thompson, and gives the general character and appearance of the sponge faithfully; but it is rather too broad in the lower half, and therefore does not look quite so graceful as the specimen itself.

XXVIII.—*Description of a new Species of Pigeon from the Karen Hills.* By Arthur, Viscount Walden, P.Z.S., F.R.S.

Ducula griseicapilla, n. sp.

Chin and throat pure white; remainder of lower surface pale grey, the breast being tinged with lilac; back of neck vinous; interscapulary region brown with a vinous tinge; wing-coverts brown, like the back, but not so strongly tinted with vinous; quills dark brown, almost black; uropygium and upper tail-coverts dark ash; rectrices above dark brown, with a broad grey terminal band; lower surface of rectrices pale grey; under tail-coverts pale cream-colour; forehead, crown, nape, cheeks, and ear-coverts pure French grey.

Wing 9·5 inches, tail 8·5, bill from forehead 1, tarsus 1, middle toe 1·75.

"Iris (♀) greyish white; orbits grey-brown; bill reddish plum-colour, pale at tip" (*Wardlaw Ramsay*).

Described from examples obtained by Lieutenant Wardlaw Ramsay on the Karen hills, at from 4000 to 4200 feet. A representative form of *D. insignis* and *D. badia*.

XXIX.—*Descriptions of some Leporine Mammals from Central Asia.* By Dr. Albert Günther, F.R.S.

The British Museum has recently received several small collections of Central-Asiatic Mammalia, which consisted chiefly of species previously known, but imperfectly represented in the National Collection. Among the specimens of hares (*Lepus* and *Lagomys*), for the majority of which we are indebted to Capt. J. Biddulph, there were several species apparently hitherto undescribed; and on these and a few others I beg to offer the following remarks.

Lepus tibetanus (Waterhouse).

Two specimens, obtained by Captain Biddulph in June in the Nobra valley, agree very well with the type of this species, being only a little smaller in size, while a fourth specimen, collected many years ago by Captain Strachey in Ladak, equals the latter in this respect. Also in this species the hairs are straight, and not curled as in *Lepus pallipes*.

Lepus oïostolus of Hodgson, which I know only from the drawing in his collection and from a very young example presented by him to the Museum, has evidently curly hairs on the back; and therefore I doubt whether it is correctly referred to the synonymy of *Lepus tibetanus.*

Lepus pamirensis.

Distinguished by its unusually dense and rather short and stiff fur, which reminds one of that of the wild sheep of the same region: this peculiarity of the fur, however, is limited to the back; on the haunches and on the sides it is as soft as in other species. *Also the front part of the ears is covered with an extraordinarily dense and comparatively long and stiff fur.* Back brownish, darkest in the middle; haunches light grey; back of the neck and foremost part of the chest rufous. A whitish streak above the eye. Front part of the ear brown, like the back; apex of the ear blackish below; both margins of the ear-opening white, but the white fringe of the lower margin is accompanied on the inside of the ear by a dark brown band. Legs white, fore part of the front legs and outer part of the hind legs slightly tinged with yellow-rufous.

	inches.
Length from tip of nose to root of tail	15
Length from nose to occiput	$3\frac{1}{2}$
Length of ear	4
Length of tarsus, including the nails......	$4\frac{3}{4}$

A single specimen, stated to be a young male, was obtained on the Pamir in the month of May.

Lepus yarkandensis.

Differs from *L. tibetanus* in lacking the black colour near the apex and margins of the ears, from *L. pallipes* in being without grey on the haunches, and from both in being of smaller size, and especially in the legs being more slender.

Fur long, dense, silky, without any tendency to curl. Back of a pale ochre-colour, some of the hairs being black-tipped. The colour of the back passes on the sides gradually into the pure white of the lower parts, the hairs of the abdomen being remarkably long. Chest with a faint reddish tinge, the hairs of this region being of a light slate-colour at the base. Upper part of the head, anterior margin of the ears, and side of the head coloured like the back. A whitish band round the upper part of the orbit, continued for some distance in the direction towards the base of the ear; a more or less conspicuous whitish band ascends from the throat towards the ear. Front part of the ears covered with a moderately dense fur; hind margin of the ear with a dense fringe of buff-coloured hairs. Tail white, brownish grey above; fore legs of a delicate buff colour like the back of the neck; hind legs of a still lighter colour, nearly white.

	inches.
Length from tip of nose to root of tail	16
Length from nose to occiput	4
Length of ear	$4\frac{1}{2}$
Length of tarsus, including the nails	4

The two specimens in the British Museum were obtained by Captain Biddulph in November and January, in the neighbourhood of Yarkand; both are nearly of the same size.

Lagomys nepalensis (Hodgson).

M. Alphonse Milne-Edwards, in his remarks on the species of this genus in 'Recherch. Mammif.,' observes that the definition of the species hitherto described is somewhat vague, and that their number would probably have to be reduced, the majority being founded on slight modifications of colour. As far as I can judge from the specimens of the Asiatic species in the British Museum, I believe that they are easily distinguishable, and that the coloration is pretty constant in the species of the same range. With regard to the species described by him as *Lagomys tibetanus*, I admit that there is considerable difficulty in separating it from *L. nepalensis*, of which we possess specimens almost identical with *L. tibetanus* in size and colour.

Lagomys Curzoniæ (Hodgson).

General hue of a pale sandy brownish grey, many of the hairs on the back having blackish tips; upper part of the head and cheeks coloured like the back; a whitish crossband on each side of the throat behind the ear; these bands are not confluent, but separated from each other along the middle of the neck by a stripe of the same dark colour as the back. The colour of the back gradually passes into the whitish of the lower parts, which is slightly washed with rufous. Chin black; feet whitish. A subcutaneous glandular patch below the ear is indicated by hairs which are of a rusty colour at the base. Soles of the feet covered with rather long hairs, below which the pads of the toes are hidden. Ears of moderate size, sparsely covered with hairs. The fur resembles, as regards denseness and structure, that of *Lagomys rufescens.*

	inches.
Total length	8
Length of ear	$\frac{3}{4}$
Length of tarsus, including nails	$1\frac{1}{4}$

The above diagnosis is taken from two skins presented by Mr. Hodgson as *Lagomys Curzoniæ* in the year 1858. The specimens were obtained in the Sikkim Himalayas.

Lagomys ladacensis.

I propose this name for the Ladak species fully described by Stoliczka and Anderson under the name of *L. Curzoniæ* (Hodgson). Mr. Blanford (Journ. As. Soc. Beng. 1872, p. 35) has already expressed his very just doubts respecting the propriety of identifying the Ladak species with that described by Hodgson. To the descriptions published I have only to add that the glandular patch on each side of the throat, below the ear, which is so very distinct in *L. rufescens*, is very indistinctly indicated by the colour and structure of the hairs in the present species; and that the hairs on the lower side of the feet, although dense, are not long enough to hide the black pads of the toes.

The specimens before me are from Chagra, 14000 feet above the sea.

Lagomys macrotis.

Fur very soft and long, especially on the hind part of the back. General hue of the upper parts pale buff-yellow, whitish on the sides and underneath; a small white patch behind the ear; feet pure white; chin white; the hairs of the moustaches white, but some of them black. Apparently no glandular patch below the ear. Ears very large, well covered with hairs. Soles of the feet covered with short hairs, leaving the pads of the toes quite bare.

	inches.
Total length	8
Length of ear	$1\frac{1}{8}$
Length of tarsus, including nails	$1\frac{3}{8}$

Of this long-eared species I have seen two specimens: one of them, which is in a very bad condition, has been in the British Museum since 1844, without indication of its habitat; for the other we are indebted to Captain Biddulph, who gives Doba as the locality.

XXX.—*Description of a new Species of* Taphozous *from Labuan.* By G. E. Dobson, M.A., M.B., F.L.S., &c.

Taphozous affinis, n. sp.

Ears shorter than the head, inner margin of the ear-conch not papillate; tragus rather short, almost quite circular above, outer surface concave. Lower lip with a deep narrow groove in the centre of its upper surface. Male with a deep gular sac as large as in *T. saccolaimus*; female with a rudimentary sac, the margins of the sac alone developed.

No radio-metacarpal pouch. Wings from the ankles.

Fur above black, the bases of the hairs white; beneath wholly pure silky white, as in *Vesperugo Temminckii*. The integument of the back is white; the antebrachial and interfemoral membranes, and that portion of the wing-membrane between the humerus and the leg, black; the wing-membrane between the forearm and third finger is white, while that portion between the third and first fingers is black, mottled with white along the third finger; beneath, the wing-membrane is pure white from the sides of the body outwards as far as the third finger, beyond which it is coloured as the corresponding part above.

Measurements of an adult female, the largest of four specimens preserved in alcohol:—length, head and body 3·4 inches; tail 1·1; head 1·15; ear 0·9; tragus 0·25; forearm 2·9; thumb 0·5; second finger—metacarpal 2·8, first phalange 1·2, second phalange 1·2; fourth finger 2·5; tibia 1·0; foot and claws 0·6.

Hab. Labuan. The four specimens referred to above were taken from a hole in a tree in the old forest, Labuan. Type in the collection of the British Museum.

This species resembles *T. saccolaimus* very closely in general structure and size, but may be distinguished by the margins of the gular pouch in the female being alone developed, whereas in *T. saccolaimus* the female has a distinct gular pouch, though smaller than in the male. The colour of the fur is also very different; but this character is too variable in Chiroptera to depend upon alone as a specific difference.

MISCELLANEOUS.

Descriptions of two new Species of Heterocerous Lepidoptera of the Family Arctiidæ. By A. G. Butler, F.L.S. &c.

Phægoptera, Herrich-Schäffer.

Phægoptera rhodosoma, n. sp.

In form most like *P. thalassina*; primaries pale brown, transversely streaked all over with dark greyish brown; secondaries with disco-apical area, from costa to near anal angle, dark brown, semihyaline internally, discoidal cell whitish subhyaline, interno-anal area broadly rose-red; top of head, centre of collar, and of prothorax creamy ochreous, remainder of thorax sepia-brown; abdomen rose-red, posterior segments transversely banded with black; antennæ dark brown: wings below sepia-brown, primaries showing the darker transverse streaks indistinctly; secondaries with rosy area as above; head black; thorax dark brown, coxæ rose-red, remainder of the legs dark brown; venter brown, paler at base.

Expanse of wings 2 inches 9 lines.

Hab. Ecuador (*Buckley*). Type, B.M.

Section *Lophocampa*, Felder.

Phægoptera fumosa, n. sp.

Nearly allied to *P. flavopunctata* of Walker, same general pattern, but the ground-colour of the wings semitransparent smoky brown; primaries—veins blackish, a marginal series of yellow or white triangular spots terminating the nervures; a zigzag disco-submarginal brown chain-like streak (the links of the chain, where visible, yellowish or white); a curved postmedian series of triangular dusky-edged yellowish or white spots; a subcostal streak near the end of the cell, sometimes inclosing a pale spot; an angulated blackish streak across the centre of the cell, inclosing pale spots; base blackish, spotted with orange; secondaries paler than primaries: head and thorax dark brown, spotted with orange, collar margined with orange; abdomen dark brown, with basal tufts, sides, and anal segments orange: wings below much paler than above; body whity-brown, dotted with orange at the sides.

Expanse of wings 2 inches 6–7 lines.

Hab. Brazil (*Becker*). Type, B.M.

Before leaving this group I may as well record a synonym which I have discovered during my rearrangement of the family.

Halesidota albidator and *H. vitripennis* of Walker are identical; they more nearly approach the group which I regard as *Phægoptera* than *Halesidota* proper; but, as a matter of fact, *H. cinerea*, *degenera*, and *albidator* will form a new genus, differing considerably in the neuration of the secondaries.

Lacerta muralis cærulea: *a Contribution to the Darwinian Theory.* By Dr. Theodor Eimer.

On the south-east coast of the Isle of Capri four large rocks may be remarked with a very picturesque aspect, three of which are entirely separated from the land, while the fourth is only joined to it by a small low and narrow isthmus, which threatens also to disappear under the action of the waves. The outermost of these islets is in the form of a truncated pyramid with four sides, 115 metres high, and terminated above by a small plateau containing about 50 square metres. Its sides are nearly vertical, and, in consequence, nearly inaccessible. There are only three inhabitants of Capri who venture to climb it, for the purpose of gathering the eggs of sea-gulls.

In the spring of the year 1872 M. Eimer applied to these men in order to procure specimens of the animals which live on this little islet, to ascertain whether the conditions of isolation had not exercised some influence on them.

His prevision was verified, for his collectors brought him a lizard forming a very remarkable variety of the common species (*Lacerta muralis*) of the Isle of Capri. This variety is even so distinct from the type that in the eyes of many zoologists it might be regarded as a species.

M. Eimer has made a complete study of this form, which exists only on the rock in question, and to which he has given the name of *Lacerta muralis cærulea*; and he compares it with the different varieties of *L. muralis* which are met with in Capri, in the Kingdom of Naples, at Genoa, and in Germany.

It is by its colouring that the variety *cærulea* is distinguished in the most striking manner. The colour of the dorsal parts is sometimes of a uniform more or less deep blue, sometimes blue with black markings. The belly, the throat, the lower jaw, and the lower surface of the tail and limbs are of a magnificent deep sky-blue. This colouring presents certain modifications depending on the season, the temperature, sex, &c. Thus at certain periods of the year emerald-green eye-spots make their appearance.

The colour does not result from a deposit of blue pigment, but it is due to the existence of a thick coat of black cells of connective tissue which are placed under a likewise thick coat of colourless epidermis. This arrangement, as is well known, produces the impression of blue. By direct light under the microscope a fragment of skin appears black; by reflected light it is seen to be blue. In the green lizards there is, between the black layer and the colourless layer, a layer of yellow pigment of a fatty nature, which assists in producing the impression of green. In *L. muralis cærulea* this yellow coating is absent or is nearly so.

A constant peculiarity of the *L. muralis* of Germany is the depressed form of the head. This character is not found in the variety *cærulea*, of which the head forms rather a quadrangular pyramid with nearly equal sides.

The new variety differs less from Italian individuals than from those of Germany; but it is distinguished from them nevertheless.

M. Eimer has proved a tendency to the appearance in the variety *cærulea* of characters of the squamation, which manifest themselves in the region where the dorsal granules abut against the ventral plates. Another difference, which is not, however, quite constant, shows itself in the number of femoral pores, which vary from 21 to 25, while in the typical *L. muralis* we rarely count more than 20.

Lastly a very curious peculiarity of the individuals of this variety is their want of fear of man, which is above all interesting if one compares it with the extreme shyness of their cousins in Capri.

When kept in captivity the representatives of the two varieties show affinity towards those of the same form as themselves and hostile dispositions towards those of the other form.

It appears from these physical and moral characters that the form discovered by M. Eimer would be distinct enough to merit, in the eyes of certain zoologists, the title of a species, while on the other hand its affinities and its habits clearly show from what root it has sprung. It furnishes a striking example of what has been called an "incipient species."—*Bibl. Univ.* April 15, 1875, *Arch. des Sci.* p. 346.

New Tertiary Pleurotomaria.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—I greatly regret that, in sending you a notice lately of a new Tertiary *Pleurotomaria*, I lost sight of the fact that Goldfuss and Deshayes had also each found a species of the same age many years ago. Your most obedient Servant,

Frederick M'Coy.

Melbourne,
June 12, 1875.

Note on the Larva of a Longicorn Beetle (Clytus quadripunctatus, *Fabr.*). By Charles O. Waterhouse.

The larva of this insect was brought to me about two years ago. It had been found feeding upon ebony, and appeared nearly full-grown, measuring two thirds of an inch in length. Understanding that this larva would also eat sycamore, I bored a small hole in a piece of an old stand made of that wood and placed the larva in it, on October 7th, 1873. The perfect insect, a female, emerged from the wood on the 14th of August, 1875. The length of time that this example remained in the larval state may have been increased by the great dryness of the wood in which I placed it, the stand having been in use in the British Museum thirty years ago. As I have not met with any description of this larva, I subjoin the following note, made at the time the larva was received:—

"Mandibles black; clypeus transverse, rounded in front, pitchy; labrum white, rounded in front, narrowed towards the base; basal joint of maxillary palpi twice as broad as long, second joint nearly globular, apical joint very small and acuminate; antennæ very short, with only three visible joints, the basal one elongate slightly narrower at the base, second joint a little longer than broad, third joint nearly as long as the preceding, but small and acuminate; the first and third joints are white, the second is pitchy. Large thoracic segment twice as broad as long, very slightly narrowed in front, all the angles rounded, very pale yellow; disk with a large opaque white patch which is narrower and rounded in front, its posterior border nearly reaching the hind margin of the segment; the second and third segments very short, slightly narrower than the large anterior segment; the segments which follow become gradually longer, narrower, and more convex; the eighth segment is the narrowest; the ninth is scarcely broader; the tenth is narrow at the base, widened behind, with a slight callosity on the disk; the eleventh segment is very short and as wide as the sixth; the twelfth is triangular, rounded at the apex. The general colour of the body is dirty white."

Note on Cossypha pyrrhopygia, *Hartlaub.* By R. Bowdler Sharpe, F.Z.S. &c.

During a recent rearrangement of the species of African Robin-Chats in the British Museum, I was surprised to find that a specimen of *Cossypha pyrrhopygia* in the collection was not a *Cossypha* but a *Cittocincla*, with graduated tail. On examining the history of the species, we find that it was first described by Dr. Hartlaub in his 'System der Ornithologie West-Afrika's' (p. 78), from the collection of the Comte de Riocour, with the doubtful habitat of West Africa. The specimen was shown to Dr. Hartlaub in Paris by M. Jules Verreaux; and about the same time another example was sold by the Maison Verreaux to the British Museum, with the locality "West Africa." I have, however, no doubt that neither of these specimens ever really came from West Africa; for the species is *Cittocincla luzoniensis* (Kittl.) from the Philippines. About the years 1855 and 1856 the localities of the specimens sold by the Maison Verreaux seem to have been most untrustworthy; for the British Museum was then victimized with the *Micrastur castanilius* of "New Granada," which is nothing more than *Astur macroscelides* of Western Africa (*cf.* Gurney, Ibis, 1875, p. 363). Nothing can be more annoying than to have apparently trustworthy species foisted upon science, and to find that, after having been incorporated in many standard works, they have to be expelled after a lapse of years from the fauna where they have found a place. I take the present opportunity of correcting an error into which I was unfortunately beguiled last year in a very similar way to that in which Dr. Hartlaub was led to describe *C. pyrrhopygia* as West-African. I described a bird as a new genus from Jamaica under the name of *Phœnicomanes iora* (P. Z. S. 1874, p. 427, pl. liv.), which now turns out to be *Iora lafresnayi*, of Malacca. The specimen in question was sold to the Museum as from the identical collection in which a new *Todus* was contained; and I am convinced that the vendor acted in perfect good faith, as he was the first to point out to me, on his receiving a second specimen direct from Malacca, that there was probably some error in the Jamaican habitat of the previous example.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

No. 94. OCTOBER 1875.

XXXI.—*Notes and Descriptions of some new and rare British Spiders.* By the Rev. O. P. Cambridge, M.A., C.M.Z.S.

[Plate VIII.]

In his very able work on European Spiders, published in 1869–70, Dr. T. Thorell notices, as a remarkable fact, that the number of known spiders of Great Britain and Ireland no more than very nearly equalled those of Sweden and Norway—304 species in the former and 308 in the latter countries; and he suggests that the British Islands ought, from their more southerly position and warmer climate, to possess a richer spider-fauna than the peninsula of Sweden and Norway. Dr. Thorell, as a subsequent note attests, was only acquainted at that time with Mr. Blackwall's work on the Spiders of Great Britain and Ireland—being then unaware that since the publication of that work in 1864 numerous new species had been recorded, in various natural-history journals, as indigenous (chiefly) to England.

At the present time the number of known British spiders (including those here described as new) amounts to 474; while every new district searched, and even some long- and well-worked localities, still reveal species not before known to be British. Not only are Devonshire and Cornwall almost an untried district, but very few spiders have yet been authenticated in Ireland, whose comparatively mild and humid climate is probably favourable to the existence of many spiders not met with in England and Scotland. Of the few spiders yet published as Irish no more than eight are peculiar to Ireland; and some even of those are obscure and perhaps doubtful species. Thus no general work can at present, without a serious misnomer, be entitled either "British Spiders" or "Spiders of Great Britain and Ireland." Our knowledge of *Scotch* spiders is rapidly advancing, thanks to the fine collections kindly sent to me by Mr. James Hardy and Mr. J. H. W. H. Traill; will not some resident entomologists in *Ireland* pay some attention to spiders during their collecting-expeditions? The trouble of collecting and bottling spiders is very slight compared with that of the preservation and setting-out of the Insecta; and a few bottlefuls collected, even indiscriminately, at different times of the year and in different localities, would soon make us acquainted, at least, with the commoner species. A published list of these might then possibly stir up some one to collect and investigate Irish spiders more thoroughly and systematically.

I need scarcely add that it will give me great pleasure to receive and determine any spiders sent to me from Ireland.

Genus Atypus, Latr.

Atypus piceus, Sulzer. Pl. VIII. fig. 2.

Atypus Sulzeri, Blackw. Spid. Great Brit. & Ireland, p. 14, pl. 1. fig. 1; Cambr. System. List of Brit. Spid., Linn. Trans. xxx. p. 320.

A. affinis, Cambr. System. List of Brit. Spid., Linn. Trans. xxx. p. 320.

A. anachoreta, Auss. Beit. zur Kenntn. der Arachn.-Fam. der Territelariæ, Thor., Verhandl. k.-k. zool.-bot. Gesellsch. in Wien, 1871, Band xxi. p. 133.

The determination of the European species of the genus *Atypus* seems to be a matter of considerable uncertainty, and the subject must be said to be as yet somewhat confused. Upon a close comparison made by Dr. Thorell in 1873 of the type specimen of Mr. Blackwall's figure and description of the male of his *A. Sulzeri*, sent to him by myself, with the type specimen of *A. anachoreta*, Auss. (the latter lent to him by Dr. L. Koch), Dr. Thorell decided that *A. Sulzeri*, Bl., ♂, and *A. anachoreta*, Auss., are identical, and (on other grounds) that both are identical with *A. affinis*, Eichw.

A female sent to Dr. Thorell, taken by myself in Portland, was decided to be identical with *A. piceus*, Sulz., and the same as the female of Mr. Blackwall's *A. Sulzeri*.

In accordance with the above determination I included two species in my systematic list (*l. c. supra*), viz. *A. piceus*, Sulz., = *A. Sulzeri*, Bl., ♀, and *A. affinis*, Eichw., = *A. Sulzeri*, Bl., ♂.

Dr. Thorell published the results of his examination and comparison of my specimens with those of Dr. Koch and others in his 'Remarks on Synonyms of European Spiders,' Upsala, April 1873. Subsequently to this, as well as to the publication of my systematic list, a paper, written also in 1873, by M. Eugène Simon, came into my hands. In this paper the determination made as to the British species of *Atypus* is widely different from that come to by Dr. Thorell—M. Simon resolving Mr. Blackwall's *A. Sulzeri* into a species characterized by himself under the name of *A. Blackwalli*, remarkable for the strong excavation or impression on the inner side near the base of each of the falces.

Possessing the male of an *Atypus* given me by the late Mr. R. Beck and quite distinct from the type of *A. Sulzeri*, Bl., and having lately received some female examples of an *Atypus* sent to me from the Isle of Wight by Mr. J. H. Pearson (and which seemed to me at first distinct from either of the two former), as well as typical examples, both male and female, of *A. piceus*, Sulz. (Sim.), from M. Simon himself, captured at Troyes, France, I wished to obtain the opinion of the latter arachnologist upon the British species in my possession—the more especially as on a close comparison I could discover no distinction between the type (♂) of *A. Sulzeri*, Bl., and *A. piceus*, Sulz. (Sim.). M. Simon now decides the two latter to be identical, and the females received from the Isle of Wight to be of the same species; while the Portland female (considered by Dr. Thorell to be *A. piceus*, Sulzer), is decided to be quite distinct by M. Simon, and probably the female of the male received from Mr. R. Beck.

From the differential characters of *A. piceus*, Auss. (Thor.), and *A. anachoreta*, Auss., mentioned (*l. c. supra*) by Dr. Thorell, the former of these two spiders seems to be very closely allied to the example received from Mr. R. Beck; and it is possible that the two may eventually, on comparison, be proved to be identical; in the absence, however, of a rigid comparison of typical examples I do not venture now to decide this point—preferring rather to describe the example in my possession as a distinct species, at the same time differentiating it from my type of *A. Sulzeri*, Bl. (see *post*, p. 242), and leaving it to a future opportunity to determine its synonymic position.

It is possible that *A. piceus*, Thor. & Auss., rather than *A. piceus*, Sim., may be the true *Aranea picea* of Sulzer—in which case *Atypus piceus*, Sim., and *A. Sulzeri*, Bl., will probably become synonyms of *A. anachoreta*, Auss., or *A. affinis*, Eichw.; the full materials, however, for this determination are not yet before me, and I therefore hesitate to speak confidently on the point.

At present I conclude as certainly synonymic *A. Sulzeri*, Bl., *A. piceus*, Sim., and *A. anachoreta*, Auss. Chiefly on M. Simon's authority I conclude these to be *A. piceus*, Sulz. There will then remain *A. piceus*, Thor., and my English example, found by Mr. Beck, and which I have (*post*, p. 242) described under the name of *A. Beckii*, to be determined, as to their identity or the contrary, at some future time, when a comparison of typical examples may be had.

Of *A. piceus*, Sim. (*A. Sulzeri*, Bl.), the only males yet recorded as British are the one figured and described by Mr. Blackwall in 'Spid. of Great Brit. and Irel.' and one other, found by myself in the same locality where the first was obtained; females appear to be frequent in one locality near Ventnor in the Isle of Wight. Mr. Pearson has kindly sent me from thence some of the tubular nests as well as the spiders themselves; among the nests is one with a short sac-like enlargement or branch near the upper end, opening into the main tube. This enlargement seems to bear some analogy to the branches in the tubes of some species of *Nemesia* (described and figured by the late Mr. J. T. Moggridge in his interesting book on Trapdoor Spiders); it is, however, perhaps only an accidental occurrence. At my suggestion Mr. Pearson most kindly dug out several nests with great care, noting their form and length and any other point that appeared likely to be of interest or importance. It is from this source that the following details have been obtained.

The nests are generally found in those parts of the Down where the grass is longer than usual and not so matted about the roots. A favourite position is the side of an overhanging or projecting bit of turf, bare of vegetation but covered by the overhanging grass. The exterior portion of the tube is not, usually, more than from an inch to an inch and a half in length, the subterranean part being much longer, about two thirds or three fourths of the whole. The protruding portion is in general partially inflated, sometimes erect, sometimes prostrate, the part nearest the ground being then secured to the earth by the small fibres of the roots of neighbouring grasses. With regard to the aperture, many nests have the envelope of very slight and fragile texture at the summit, so that it is often torn and rent; but in the more perfect specimens no trace of an opening has hitherto been discovered. A nest perfect and apparently imperforate from top to bottom, and containing the spider inside it, was buried in a large box of earth; subsequently the tube was observed with a wide open mouth, appearing as if the spider had forced its way through the substance of the nest. Shortly after, the spider was observed to be engaged about the mouth as though making a new top to the nest; and on the following morning the extremity of the tube was again closed and presented the same appearance as at first, being only smaller. There appears to be considerable variation in the shape of the nests: the middle portion is narrow and very much wrinkled and folded; the dilatation that succeeds is generally somewhat pear-shaped, with the small end downwards; the bottom of the tube is extremely fragile (the most fragile part of the whole nest), being a mere web, which sometimes fits tightly round the spider, enveloping it like the covering of a ball. A very common form of nest is that of a stocking with bends corresponding to the knee and heel, at which last the dilatation occurs. A spider in captivity took possession of an empty nest lying on the earth, and, making a hole in the side of the nest next to the ground, began to form a new tube connected with the old one. [In this way, possibly, the branched nest mentioned above was formed.] One day a spider was observed in the act of making a new nest: it first spun a cylindrical web, attaching it to the stems of grasses; it then began to excavate the earth (apparently with the sharp claws of its falces), turned completely round, placed the earth against the sides of the web, patting it all over with its feet and smoothing it with its abdomen, and then repeating the operation. The nests dug out varied in their total length from $5\frac{1}{4}$ to $9\frac{1}{2}$ inches.

The exuviæ of the spiders after moulting are commonly found in the nests; and in some instances the remains of beetles and other hard-shelled insects were found.

Atypus Blackwalli.

Atypus Blackwalli, Sim. Ann. Soc. Ent. Fr. 1873, tom. iii. p. 110, pl. 4, figs. 6–9. (Exclude reference to plate, *l. c.*, as well as synonymic reference to *A. Sulzeri*, Bl.)

M. Simon (*l. c.*) places *A. Sulzeri*, Bl., among the synonyms of a new species to which he gives the name (suggested by A. Ausserer, *l. c.* p. 133) of *A. Blackwalli*.

This synonymic determination is undoubtedly a mistake, and is implied to be so by M. Simon himself in his recent determination of the identity of the type (♂) of *A. Sulzeri*, Bl., with that of *A. piceus*, Sim.

Among other examples of *Atypus* lately submitted by myself to M. Simon were two immature examples which appeared to me to have had the falces crushed or shrunken in near their base on the inner sides. M. Simon, however, determines them without any doubt to be examples of *A. Blackwalli*, in which this peculiar form of the falces is a leading characteristic. One of these examples was found by myself in the Island of Portland; the other was received from the Isle of Wight, where it was found by Mr. Pearson and kindly sent to me among females of *A. piceus*, Sim.

Atypus Beckii, sp. n. Pl. VIII. fig. 1.

Adult male, length $4\frac{3}{4}$ lines.

This spider is nearly allied to *A. piceus* (Sulzer); it appears, however, to be larger and rather broader in proportion, and it differs in the form of the cephalothorax and falces, as well as in the structure of the palpal organs and size and relative position of the eyes.

The whole of the fore part, including the legs and palpi, are of a rich deep red-brown colour; the abdomen is black, with the characteristic coriaceous patch on the fore part of the upperside of a large size and dark reddish brown colour; the hinder slope of the caput is rather abrupt and rounded in its profile-line: the central part of the ocular area is prominent, and, looked at in profile, full and rounded in front (much more so than in *A. piceus*); looked at from above its fore extremity is of a blunt angular form and projects a little beyond the margin of the clypeus, while in *A. piceus* the fore extremity is round and does not reach to the clypeal margin, and its colour is black; the thorax is flattened and the normal indentations strong.

The *eyes* are in the usual position, the central pair occupying the upper part of the large central ocular tubercular prominence; these two eyes are smaller than those of the corresponding pair in *A. piceus*, and the interval between them exceeds an eye's diameter by nearly or quite one half, while in *A. piceus* the interval no more than equals a diameter, certainly does not exceed it. The lateral groups are also further from the central pair in the present spider than in *A. piceus*, forming, when looked at from above, a transverse oblong area of far greater extent than in this latter species.

The *falces*, though of the same general character as in *A. piceus*, are rather longer and stronger, though perhaps not quite so prominent at their base on the upperside.

The *palpi*, although very similar in general character and appearance to those of *A. piceus*, show a strong and decided difference on a comparison of the palpal organs; this distinction will be best seen by comparing the figures given (Pl. VIII.) of these parts in the two species.

The *maxillæ*, *labium*, and *sternum* present no marked difference from those of *A. piceus*, nor does the abdomen: the spinners also (6 in number) are similar; the terminal joints, however, of those of the superior pair had been accidentally broken off before the example came into my possession.

A single adult male was sent to me some years ago by the late Mr. Richard Beck, of Cornhill, London, by whom it was found in the neighbourhood of Hastings. I have hesitated to describe this species until I had been able to compare it with continental examples of *A. piceus*, as well as to obtain the opinion of M. Eugène Simon upon its specific identity.

M. Simon has kindly sent me lately examples of *A. piceus*, and characterizes the present as a very distinct species from all known to him on the continent of Europe.

An adult female, agreeing with the male above described in the form of the ocular prominence, was found by myself, in the autumn of 1855, in the Island of Portland, and is no doubt of the same species.

Genus Micaria, C. Koch.

Micaria scintillans.

Drassus scintillans, Cambr. Trans. Linn. Soc. xxvii. p. 412, pl. 54. no. 12, A.

By an unaccountable oversight this spider was unfortunately omitted from my "Systematic List of British Spiders," Linn. Trans. 1874, vol. xxx. p. 321.

In a recent visit to the Isle of Portland I found both sexes, adult and in considerable abundance, running in bright sunshine on the grassy slopes towards the sea near Pennsylvania Castle. A large blackish ant was abundant on the same slopes, and it was exceedingly difficult at first to distinguish the spiders. The hue of the two in the bright sunshine was remarkably similar, and their respective movements ridiculously alike.

The only way in which I could, with any certainty, capture the spiders (owing to the general swiftness of their movements, and the rapidity with which they glided down among the stems and roots of the herbage) was by suddenly and quickly popping an empty inverted glass tube of good size over them; and as they invariably rushed up the tube, it was easy to transfer them thence to the spirit-bottle.

Genus Drassus, Walck.

Drassus criminalis, sp. n. Pl. VIII. fig. 3.

Adult female, length very nearly $3\frac{1}{4}$ lines.

The whole of the fore part of this spider is of a bright yellow-brown colour, that of the falces and labium being, however, rather deeper than the rest, and the cephalothorax bordered with a fine blackish line, the abdomen being of a uniform dull mouse-coloured black.

The *cephalothorax* is of ordinary form, the thoracic junction, however, being (in profile) a little higher than the occipital region; the normal grooves and indentations are not strongly marked, but are plainly indicated by dusky lines converging to the thoracic junction; the surface is thinly clothed with hairs, some of which are rather long, particularly those on the central longitudinal line and on the clypeus, where they are, in fact, bristles; the height of this latter part exceeds the diameter of the fore lateral eyes.

The *eyes* are of tolerable size and placed in the usual two transverse rows; the hinder row is longest and rather the most curved, the convexity of the curves of both being directed backwards: the eyes of the hind central pair are of a somewhat subtriangular shape and are almost, but not quite, contiguous to each other, and the interval between each and the hind lateral eye on its side is about equal to the diameter of the latter; those of each lateral pair are obliquely placed, the interval between them being nearly equal to the diameter of the hinder eye; those of the fore central pair (which are the smallest of the eight) are separated by an interval slightly exceeding an eye's diameter, and each is divided from the fore lateral on its side by a very slight interval, not more than one third of that which separates the fore centrals from each other.

The *legs* are strong, but not very long; their relative length appears to be 4, 1, 2, 3, though there is but little difference, if any, between those of the fourth and first pairs; they are furnished with hairs, bristles, and spines, the latter chiefly on the tibiæ and metatarsi of those of the third and fourth pairs; each tarsus terminates with two curved pectinated claws, beneath which is a small scopula of papilliform hairs, and beneath the tarsi are some other hairs of the same kind.

The *palpi* are strong, moderately long, and furnished with hairs, bristles, and spines; the cubital and radial joints are equal in length, the digital being nearly equal to both together, and terminating with a small, black, curved claw.

The *falces* are moderately long, strong, a little projecting and prominent at their base in front; their fore surface is furnished with strongish prominent bristles, and on their outer sides and towards the extremities they are slightly rugulose; the fang is short and strong, and on the hinder edge of the groove in which it lies when at rest are a few short strongish teeth.

The *maxillæ*, *labium*, and *sternum* are of the normal form and furnished with hairs and bristles.

The *abdomen* is oval, moderately convex above, and projects fairly over the base of the cephalothorax; it is of a dull mouse-coloured blackish hue, and clothed thinly with hairs: along the middle of the upperside the six pale, elongate, linear spots frequently seen on the abdomen of species of this genus are indistinctly visible: the spinners are short, and of a brownish yellow colour, those of the inferior pair being much the longest and strongest; the genital aperture is large and of a simple but characteristic form.

A single adult example was found by myself under a stone on Bloxworth Heath in May 1874.

Drassus delinquens, sp. n. Pl. VIII. fig. 4.

Adult female, length $2\frac{2}{3}$ lines.

The cephalothorax of this very distinct species is of a yellow-brown colour, tinged with dull orange, and clothed sparingly with hairs; the legs and palpi are rather paler, and the falces, maxillæ, labium, and sternum darker, the labium being the darkest. The form of the cephalothorax is of the ordinary type; the normal grooves and indentations are not strong, though well defined by fine blackish and rather irregular lines which converge towards the thoracic junction; the height of the clypeus rather exceeds the diameter of one of the fore central eyes.

The *eyes* are of tolerable size, and placed in two transverse, and nearly parallel, curved rows, the convexity of the curve being directed backwards and the hinder row being the longest; those of the hind central pair are oval in form, obliquely opposed to each other, and almost contiguous; each is separated from the hind lateral on its side by an interval equal to its own longest diameter; those of each lateral pair are separated by an interval slightly less than the diameter of the hinder eye, which is smaller than the fore one; those of the fore central pair (the smallest of the eight) are about an eye's diameter distant from each other, and each is very nearly contiguous to the fore lateral eye on its side.

The *legs* are tolerably strong, but not very long; and their relative length appears to be 4, 1, 2, 3; they are furnished with hairs and a very few spines; each tarsus ends with two curved pectinated claws, and beneath the tarsi are some papilliform hairs.

The *falces* are long, strong, prominent at their base in front, and project (though not very strongly) forwards; their front surface is furnished with longish bristly hairs.

The *maxillæ* and *labium* are of normal form.

The *sternum* is heart-shaped and glossy.

The *abdomen* is rather large, of an oval form, slightly truncated before, and not very thickly clothed with hairs; its colour is dull yellow-brown, darker along the middle of the upperside, where a very distinct pattern is shown, consisting of a strongish, wedge-shaped, dark brown, central, longitudinal marking on the fore part, followed to the spinners by a series of confluent angular bars or chevrons of a similar colour; the vertices of the angles are directed forwards; but the bars do not extend to the sides. The wedge-shaped brown marking has a paler indistinct line along the middle, and two or three irregular pale markings on either side of its hinder half. The spinners are of moderate size; those of the inferior pair are longer and stronger than those of the superior. The form of the genital aperture (which is rather large) is characteristic; its inner margins appear to be corneous and of a bright red-brown colour.

An example of this species, which is certainly new to Britain, and also, I believe, undescribed, was found by myself under a stone on Bloxworth Heath in May 1874.

Genus Lethia, Menge.

Lethia subniger.

Drassus subniger, Cambr. Trans. Linn. Soc. xxviii. p. 439, pl. 33. fig. 3.

A recent close examination of this litttle spider has convinced me that it belongs to the genus *Lethia*; doubts concerning its generic affinities have been expressed *l. c. supra.*

Genus Erigone (*Neriene*, Bl.).

Erigone Clarkii.

Erigone Clarkii, Cambr. Linn. Trans. xxvii. p. 441, pl. 56. no. 30.

An adult male of this spider (being only the third example of the species yet on record) was found by my son, Robert Jocelyn, on iron railings enclosing the lawn at Bloxworth Rectory, on the 24th of March, 1875.

Erigone Douglasi, sp. n. Pl. VIII. fig. 5.

Adult female, length $1\frac{1}{3}$ line.

The *cephalothorax*, *falces*, and *maxillæ* of this spider are yellow, the occiput, as well as the spaces between the normal grooves and furrows, being suffused with dusky black, and the thoracic margin black.

The form of the cephalothorax is of the ordinary type; the lateral constrictions at the caput are slight, and the whole profile outline forms a tolerably even curve from the clypeus to the end of the hinder slope.

The *eyes* are rather small, but in the usual position, forming a rather narrow, transverse oval figure, and are seated on strong, slightly tuberculate, black spots; those of the hinder row appear to be of the same size, and are separated from each other by equal intervals of an eye's diameter; those of the fore central pair are the smallest of the eight, dark-coloured, contiguous to each other, and each is separated by a diameter's interval from the fore lateral on its side. Each of the hind central eyes is separated from the fore central eye nearest to it by an interval rather greater than the diameter of the former; those of each lateral pair are contiguous to each other and placed obliquely. The height of the clypeus slightly exceeds half that of the facial space; it is rather strongly impressed immediately below the eyes, but projects at its lower margin.

The *legs* are long and tolerably strong; their relative length is 1, 4, 2, 3; they are of a pale yellow colour, and are furnished with hairs, bristles, and a very few long slender spines.

The *palpi* are similar in colour and armature to the legs.

The *falces* are strong and tolerably long, a little inclined backwards, and armed with a few minute teeth on their inner edges towards the extremity.

The *sternum* is small, of the usual heart-shape, and strongly suffused with greenish black.

The *abdomen* is oval, strongly convex above, and its profile line is abruptly curved at the hinder part; its upper part and sides are of a dull greenish black colour, the central longitudinal line being darkest; two thirds of its upperside (towards the hinder part) are marked with a series of tolerably distinct pale yellowish oblique spots or patches in pairs, the first pair being the largest and of an oval shape, the next less in size but more elongated, the rest being simply transverse angular bars or chevrons; the under part is dull pale yellowish, with a broad central, longitudinal, black band enclosing the spinners and reaching to the genital aperture; it is bordered by a whitish line, and its shape is that of an elongated lyre.

The genital aperture is furnished with a strong, somewhat tumid, but simply formed, epigyne (represented by fig. 5, *d*, Plate VIII.); the abdomen is thinly clothed with hair, and projects pretty strongly over the base of the cephalothorax.

A single example of this interesting spider was received from Mr. Douglas, by whom it was found in the spring of 1875 near Castle Douglas, Kirkcudbrightshire, Scotland. It differs from nearly all other known British species of this genus in having a series of large, well-defined, pale markings on the upperside of the abdomen, and a broad, central, longitudinal band on a pale yellowish ground on the underside.

I feel great pleasure in connecting this spider with the name of its discoverer, who appears to be entering upon the study of Scottish spiders with considerable care and zeal.

Erigone (*Neriene*) *nigriceps*, sp. n. Pl. VIII. fig. 6.

Adult female, length $1\frac{1}{3}$ line.

The *cephalothorax* of this spider is of ordinary form; the hinder slope rather long and gradual; the upper marginal line, seen in profile, level, there being only the slightest possible depression near the occiput; its colour is orange-yellow, the caput being strongly suffused with black; and there are a few fine bristly hairs along its central line, and within the ocular area; the normal furrows and indentations are visible, but not strongly marked; and the height of the clypeus (which is a little prominent) equals half that of the facial space.

The *eyes* are in the usual position on black tuberculate spots, the foremost row (looked at from the front) being much the shortest and straight. Those of the hind central pair are distinctly nearer to each other than each is to the hind lateral eye on its side, being separated from each other by less than an eye's diameter, and from the hind laterals by at least a diameter, if not a little more; those of each lateral pair are placed obliquely and are contiguous to each other; the fore laterals are largest of the eight, and each is separated from the fore central eye on its side by a very slight, though distinct, interval, those of the fore central pair being almost, but not quite, contiguous to each other.

The *legs* are moderately long, rather strong, particularly the femoral joints, their relative length being apparently 4, 1, 2, 3; they are of an orange-yellow colour, but not so dark as the cephalothorax: the metatarsi and tarsi are rather paler than the rest; their armature consists of hairs and a few slender prominent spine-like bristles on the femoral and tibial joints.

The *palpi* are similar in colour and armature to the legs.

The *falces* are rather long, not particularly strong, slightly divergent and nearly vertical; they are armed on their inner margin, near the extremities, with four or five sharp teeth.

The *maxillæ* are strong, rather long, but of normal form and character; they are furnished with a few bristles, and are of a dusky orange-yellow colour.

The *labium* is of normal form, and suffused strongly with black.

The *sternum* is of the usual heart-shape, considerably convex, and of a glossy bright orange-yellow colour, furnished with a few prominent bristles.

The *abdomen* is of an elongate oval form, not particularly convex above, nor projecting greatly over the base of the cephalothorax; its colour is dull black tinged with olive; and it is clothed thinly with hairs; the genital aperture is of characteristic form, but the epigyne connected with it is not very prominent.

A single example of this pretty and distinct species was found by myself among heather in May 1875, on Bloxworth Heath; the contrast of its dark caput and bright orange thorax and legs makes it, as a British one, rather a striking-looking spider, and I know of no described species of which it might possibly be the hitherto unknown female.

Erigone subitanea, sp. n. Pl. VIII. fig. 7.

Adult male, length $\frac{1}{23}$ inch.

This minute species is nearly allied to *E. præcox*, Cambr.; the latter, however, may be distinguished without difficulty by the greater curvature of the hinder row of eyes, the central eyes of this row being distinctly nearer to each other than each is to the hind lateral on its side; the ocular area is thus broader than in *E. subitanea*, and the clypeus is less in height, being less than half that of the facial space, while in *E. subitanea* it is as nearly as possible equal to half. In this latter species the occiput (looked at in profile) is also a little more gibbous; and the apophysis at the fore extremity of the radial joint of the palpus, although, if any thing, larger than the very similar one in *E. præcox*, is yet much less easily seen, being in close contact with the digital joint, so that when looked at in profile even its extreme point is scarcely visible beyond the surface of the digital joint, while in *E. præcox* it is prominent and very perceptible.

The *cephalothorax* is of ordinary general form and of a brightish yellow-brown colour; the normal grooves and indentations are distinctly, but not strongly, marked; and from close behind each hind lateral eye a tapering, slightly curved, indentation runs in a longitudinal direction backwards towards the hinder part of the occiput, which is a little gibbous on its upper part; the hinder slope of the cephalothorax is slightly hollow and rather abrupt; and there are two or three short prominent hairs on the central longitudinal line near the thoracic junction.

The *eyes* are in the ordinary position; those of the hinder row are equidistant from each other, the intervals separating them being equal to rather less than the diameter of one of the central pair; those of each lateral pair are seated obliquely on a tubercle; those of the fore central pair are the smallest of the eight, dark and indistinct, but appear to be very nearly, if not quite, contiguous to each other, and each is very near to the fore lateral eye on its side, certainly separated by not more than half a diameter; the interval between each of the hind central eyes and the fore central opposite to it exceeds very little, if at all, the diameter of one of the former.

The *legs* are tolerably long, slender, of a pale orange-yellow colour, furnished with hairs and very slender erect bristles; their relative length appeared to be 4, 1, 2, 3.

The *palpi* are short, slender, and similar in colour to the legs; the radial joint is rather longer and stronger than the cubital, and has at its fore extremity on the upperside a small, slender, slightly tapering production, which adheres closely to the digital joint, and is not very easily made out without careful examination; the digital joint is small, and the palpal organs simple, presenting under an ordinary lens no very remarkable spines or processes.

The *falces* are rather short, but tolerably strong, nearly vertical, similar to the cephalothorax in colour, and armed with a few very minute teeth on their inner margin near the extremity.

The *maxillæ* are similar to the falces in colour, but of normal form.

The *labium* is also of normal form, but rather darker in colour than the maxillæ.

The *sternum* is large, heart-shaped, and very convex, its colour being of a darker shade than that of the cephalothorax.

The *abdomen* is tolerably convex above, and projects over the whole of the hinder slope of the cephalothorax; it is of a dull blackish hue tinged with olive-green and (in spirit of wine) mottled and marked with pale spots and lines, the surface being thinly clothed with short fine hairs.

A single adult male of this, the smallest spider except one (*E. diceros*, Cambr.) that has yet come before me, was found by myself among decayed wood at Bloxworth Rectory in May 1874. Its near affinity to *E. præcox*, Cambr., has been mentioned above. It is allied also very closely to *E. alexandrina*, Cambr., a small spider found in a marsh near Alexandria, Egypt. This latter, however, is a larger species, and differs from the present in the relative position of the eyes, the rather greater gibbosity of the occipital region, as well as slightly in the form of the palpi and structure of the palpal organs.

Genus Linyphia, Fabr.

Linyphia expuncta.

Linyphia lepida, Cambr. Linn. Soc. Journ. xi. p. 539, pl. xv. fig. 7.

In conferring the specific name of *lepida* on this spider, it escaped my memory at the moment that Mr. Blackwall had previously (Ann. & Mag. Nat. Hist., Dec. 1866) given it to a spider of the same genus found in the south-east region of Equatorial Africa. I therefore now give the name *expuncta* to the pretty little Scotch *Linyphia* received from Mr. J. W. H. Traill, and at first described, *l. c.*, under the name of *lepida.*

Linyphia aëria, sp. n. Pl. VIII. fig. 8.

Adult male, length rather less than 1 line.

The *cephalothorax* of this small spider is of the ordinary oval form when looked at from above; but when seen in profile the thoracic portion is slightly higher than the caput, the occipital region of which is a little gibbous, and the ocular area sloping downwards. The colour of the cephalothorax is yellow-brown, the margins and normal converging grooves and indentations suffused with dusky brown; and along the central longitudinal line are a few fine bristles of different lengths directed forwards. The clypeus is impressed below the eyes, prominent at its margin, and its height is less than half that of the facial space.

The *eyes* are of tolerable size, and, relatively, do not differ much; they are placed in the ordinary position on black tuberculate spots in two curved rows, forming a transverse oval figure; those of the hinder row, which is the longest and most curved, are equidistant from each other, the interval being less than an eye's diameter; and each of those of the hind central pair is a diameter's distance from the fore central eye nearest to it; those of each lateral pair are placed a little obliquely and are contiguous to each other; those of the fore central pair, the smallest of the eight, are contiguous to each other, and each is very near, but not quite contiguous, to the fore lateral eye on its side.

The *legs* are rather long and slender, of a pale dull yellowish colour, and furnished with hairs and a few longish slender spines; the latter consist of one on each of the genual joints and three on each of the tibiæ.

The *palpi* are short, slender, and of the same colour as the legs; the cubital joint is very short, and furnished on its fore side with a fine tapering bristle; the radial joint is about the same length as the cubital, but stronger; it is a little more produced in front than behind, and has no distinct prominence or apophysis, being furnished, however, with some not very conspicuous bristly hairs; the digital joint is of moderate size; and the palpal organs are rather complex, composed of various spines and corneous processes pretty closely compacted, and no one of which is of a very marked character.

The *falces*, which are similar to the legs in colour, are of moderate length and strength, nearly perpendicular, and a little divergent at their extremity.

The *maxillæ* are of normal form, a little inclined towards the labium, and similar in colour to the cephalothorax.

The *labium* and *sternum* present no distinctive feature; and their colour is a dark blackish brown.

The *abdomen* is considerably convex above, and projects a good deal over the base of the cephalothorax; it is of a dull blackish colour, clothed, but not very thickly, with longish hairs.

The *female* is rather larger than the male, but resembles it in general structure and colour; the epigyne connected with the sexual aperture is of moderate size, a little prominent and directed forwards.

This spider, which is nearly allied to *L. parvula* (Westr.), may be distinguished by its smaller size, shorter legs, and a rather different relative position of the eyes of the front row—those of the fore central pair in *L. parvula* being smaller, and each further removed from the fore lateral on its side, being an eye's diameter distant from it; the thoracic junction is also less elevated in *L. parvula*; and the palpal organs have, at their fore extremity, a distinct coiled filiform black spine, which is entirely wanting in *L. aëria*.

Adult examples of both sexes were found running on iron railings at Bloxworth, Dorsetshire, in the autumn of 1873.

Genus Xysticus, C. Koch.

Xysticus viaticus.

Xysticus viaticus, C. Koch, Die Arachn. xii. p. 70, pl. 412. fig. 1003.
X. Kochii, Thorell, Europ. Spid. p. 185, and Syn. Europ. Spid. p. 241.
Thomisus viaticus, Cambr. Linn. Trans. xxviii. p. 528.

Adults of both sexes were found rather frequently among short herbage and on bare spots in different parts of the Island of Portland at the beginning of June 1875. Although I had previously met with this spider, it had been hitherto mixed up with *Xysticus cristatus*; it was not, therefore, until the occasion above referred to that I detected the species at the time of capture, and am consequently able to fix a locality for it with any certainty.

Genus Lycosa, Latr. (*Lycosa*, Blackw. ad partem).

Lycosa arenicola, sp. n. Pl. VIII. fig. 9.

Adult male, length 3 lines; adult female, $3\frac{1}{2}$ lines.

This spider is nearly allied to *L. fluviatilis*, Bl. (*L. arenaria*, Koch), both in size and general appearance, but may be distinguished by the absence of dilatation behind the eyes in the central pale band on the cephalothorax, as well as by the legs being apparently always free from dark annulations; none at least were visible on the legs of thirty-five examples of both sexes; the characteristic corneous process, springing from the middle of the palpal organs, is also of rather a different form, a little longer, and of a rugulose appearance; the whole of the palpal organs are of a darker as well as rougher and coarser character.

The *cephalothorax* is of a deep black-brown colour, with three longitudinal narrow yellowish bands; each lateral one is removed from the margin by at least its own width, and divided transversely, by sometimes no more than dark lines, into three elongate patches of different sizes; sometimes, however, the dividing lines form more extended dark patches; the central band is narrow, and extends from nearly about halfway down the hinder slope to sometimes the middle of the ocular area, where it fines off into a mere line clothed with pale greyish yellow hairs; both the upper and lower edges of the lateral bands are jagged; the central band is thus broadest at the thoracic junction, and fines off thence to a point both before and behind.

The *legs* are long; their relative length 4, 1, 2, 3; they are of a dull yellowish colour; the tarsi of those of the first pair are black, as well as also generally the tips of those of the fourth pair, and in some cases of all the rest also: the femora of all the legs are more or less clouded or suffused with black; and frequently their uppersides have two elongate-oval unsuffused patches, giving them a somewhat striped look; they are clothed with hairs and long spines.

The *palpi* are of a deep brown colour, approaching to black; the radial joint is much stronger but no longer than the cubital; it is, together with the digital joint, of a jet-black colour, thickly clothed with black hairs; this latter joint is large, broad at the base, and pointed at its fore extremity; the basal bulb of the palpal organs is large and prominent; the oblique process just in front of it is long, strong, and curved a little in towards the digital hollow near its extremity; it is nearly or quite black, and tapers a little to its obtuse extremity, its surface being rather roughened or rugulose.

The *falces* are yellowish, more or less marked with longitudinal stripes or patches of deep blackish brown.

The *maxillæ* and *labium* are also of a yellowish colour, with their bases generally suffused with brown.

Sternum deep black-brown.

The *abdomen* is dark brown, clothed thickly with hairs varying in hue from grey and yellowish grey to black: in many examples it is difficult to trace the usual pattern; but in some it is tolerably distinct, especially in immature examples and those only lately come to maturity: the pattern is like that of *L. fluviatilis*, Bl.; the characteristic elongate marking on the fore half of the upperside is blunt-pointed behind and obtusely angular on each side near the middle, forming an almost elongate-oval stripe, edged indistinctly with black, its own colour being dull brownish yellow, often clothed with pale greyish hairs on either side; following this marking to the spinners is a row of irregular and generally indistinct blackish spots, between which is a series of angular rusty yellowish hairs, or short, oval, oblique, opposed patches, which diminish in size as they approach the hinder extremity of the abdomen.

The above description fairly applies to both sexes; but in some females the pattern is much better marked than in others or than in most examples of the male sex; in such females the angular bars, or opposed oblique patches, have each of them a distinct black spot, which thus appear in a longitudinal series in four or five pairs, each pair placed transversely; the sides of the abdomen have also a mottled appearance, apparently from numerous small tufts of pale hairs. The legs in most of the females are of a darker hue than those of the male; and in one or two examples (out of thirty-five) there was a very faint trace of annulation.

The examples from which this description has been drawn were found close to the railway station in the Island of Portland (at the beginning of June 1875), on the edge of the Chesil Beach, among pebbles and brickbats and other débris; they did not appear to be running in sunshine of their own accord, but were very active when disturbed, and easily escaped among the loose pebbles of the beach. I have also two examples (male and female), exactly similar in all respects to those found in Portland, from a similar habitat near Brighton, and also another pair received from Bourg d'Oisans in Normandy.

Although this spider is so nearly allied to *L. fluviatilis*, Bl., that if the two forms should be found inhabiting the same localities it will be scarcely possible to uphold their specific distinctness, yet the absence of annulation on the legs, the simple and constantly attenuated form of the central yellow thoracic stripe, with the slight difference in the form of the palpal organs, are sufficient to mark its specific distinctness from *L. fluviatilis*, in which the legs of the female are *always* annulated, generally very distinctly, and traces of annulation are commonly visible in the male, though some few males certainly have no annulation at all. Now and then also a male of *L. fluviatilis* will be found with no dilatation on the central yellow stripe behind the eyes; but out of many females I have not seen one in which this dilatation is not apparent and generally strongly marked; it is usually also visible, though less strong, in the males. *L. fluviatilis* is often wholly covered with grey hairs, giving it a uniform hoary appearance; this is slightly so, in some cases, in regard to the present species also.

Lycosa agricola, Thor.

Lycosa arenaria, C. Koch, Die Arachn. xv. p. 36, tab. 514. figs. 1441–42.
L. fluviatilis, Blackw. Spid. Gr. Brit. p. 31, pl. ii. fig. 13.
L. agricola, Thor. Rec. Crit. Aran. p. 61; *id.* Syn. Europ. Spid. p. 278.

Dr. Thorell, in his 'Synonyms of European Spiders,' page 280, thinks that probably Mr. Blackwall had before him, in his description of *L. fluviatilis*, examples also of *L. agrestis*, Westr. I do not think so myself: I have examined many examples of both sexes of *L. fluviatilis* sent me by Mr. Blackwall from North Wales; and there is certainly no example of *L. agrestis* among them. Dr. Thorell also appears to have some doubt as to the specific distinctness of *L. agricola* from *L. agrestis*; but the short oblique process of the palpal organs of

L. agrestis, compared with the much longer process in those of *L. fluviatilis*, appears to me quite sufficient to determine their specific distinctness. Examples of *L. decipiens*, L. Koch, sent me by Dr. L. Koch from Germany, agree very exactly with the description of *L. agrestis*, Westr., given by Dr. Thorell, *l. c.*, who also considers these last two species to be identical (*l. c.* p. 282). Examples of *L. arenaria* sent me by Dr. L. Koch I am unable to distinguish from *L. fluviatilis*; but an example of *L. agricola*, Thor., sent me by Dr. Thorell from Sweden, is, I am inclined to think, an example of *L. agrestis* sent by mistake, inasmuch as the oblique process of the palpal organs is not much more than half the length of that of *L. fluviatilis* and *L. arenaria*, being also broader and slightly obliquely truncated at its extremity.

There are now several European species of this group so nearly allied as to be very difficult of determination (see the description of *L. arenicola*, sp. n., *antè*, p. 253). To determine them satisfactorily a considerable series of both sexes of each form from all the localities in which they are found is necessary. Comparative examinations of closely allied species can never lead to a thoroughly satisfactory conclusion when made upon one or two examples only of some one or more of the forms.

Lycosa annulata. Pl. VIII. fig. 10.

Lycosa annulata, Thorell, Syn. Europ. Spid. p. 299.

For several years past I have been aware of there being several British species of *Lycosa* included among my specimens of *L. saccata*, Bl. (*L. amentata*, Clerck) ; but until lately I have had no opportunity of determining them. Among these spiders one of the most striking and distinct is the present, *L. annulata*, Thor. ; it is much smaller than *L. amentata*; the patterns on the cephalothorax and abdomen are very like those of that species ; the legs are of a clearer and generally paler yellow colour, but distinctly annulated with dark brown, the annulations extending sometimes to the metatarsi ; the palpi, however, independently of all other distinctions, will serve to distinguish it from *L. amentata* at once : the humeral joint is deep brown ; the cubital yellow, slightly marked with brown near its base, and clothed with white hairs at its fore extremity ; the radial joint is dark brown and, as well as the digital joint, thickly clothed with black hairs, offering a strong contrast to the white cubital joint: the palpal organs are remarkable for the absence of the curved spine characteristic of *L. amentata* and the strong oblique process found in *L. fluviatilis* and others ; in their place there is merely a small tubercular process of an oval form.

Examples of this spider were found some years ago at Portland, and more recently at Bloxworth; three adult males were also received in May last from Ventnor, where they were found by Mr. J. H. Pearson, to whom I am indebted for their addition to my collection. The female has not yet been found in England; but I have received that sex also among many examples of the male from the late Mr. J. T. Moggridge, by whom they were found at Nice and Mentone; both sexes were also sent me by C. Collingwood, M.D., by whom they were found at Montreux, Switzerland. The female does not differ in colour and markings from the male; the genital aperture is, like that of nearly all other known spiders, characteristic in the details of its form and size.

In his description of *L. annulata*, Dr. Thorell does not remark upon the pale cubital joint and its white hairs with their necessarily strong contrast to the dense clothing of black hairs on the radial and digital joints. There is no doubt, however, of the identity of the present with his species, inasmuch as he has kindly sent me examples of his *L. annulata*, which in no way differ from those I possess from France, England, or Switzerland.

Lycosa riparia. Pl. VIII. fig. 11.

Lycosa riparia, C. Koch, Die Arachn. xv. p. 29, tab. 512. figs. 1435–36.

Two adult males of this spider were found by myself near Brighton in June 1871. In its general appearance it may easily be mistaken (as I myself mistook it at the time) for *L. amentata*, Clerck; though it is, in reality, more nearly allied to *L. pullata*, Clerck (*L. obscura*, Bl.). It may easily be distinguished from *L. amentata*, Clk., by the long, oblique, tapering, rather obtusely pointed spine in connexion with the palpal organs, to the surface of which latter this spine also adheres more closely in the present than in that species; the digital joint is also longer and much narrower in proportion.

From *L. pullata* it may be distinguished as well by its greater size as by the length and strength of this spine, and also by *the very distinctly annulated legs.* In the two specimens under consideration the legs are entirely annulated, except the tarsi, which are of a brownish yellow hue; *the palpi are black*, which is also another strongly distinctive character.

The central, yellow, thoracic band is, in the two examples noted, obsolete at the occiput; but in a female spider found at the same time and place, and which I believe to be of this species, the central band runs to the eyes, where it dilates as in *L. amentata* and *L. fluviatilis*; as, however, this example was not quite adult, it cannot be considered certain that it is specifically identical with the two males. In *L. pullata* the legs of the female are generally, though not often very distinctly, annulated, while those of the male have rarely any trace of annulation; the general hue of *L. pullata* is also much more of a yellow-brown, while *Lycosa riparia* is nearly black. This spider has not before been recorded as British.

Lycosa prativaga. Pl. VIII. fig. 12.

Lycosa prativaga, L. Koch, Die Arachnidenfauna Galiziens, p. 43.

Very nearly resembling in its general appearance and pattern *L. amentata*, but smaller, *L. prativaga* has passed for a variety of that species in my collection for some years past, having been also returned to me at the time of capture by Mr. Blackwall as small examples of his *L. saccata*. It is, however, more nearly allied to *L. pullata* and *L. riparia*; its legs are very distinctly annulated; and the oblique palpal-organ spine, while very like that of *L. pullata*, has another fine one almost beneath and nearly concealed by it; this additional spine is also present in *L. pullata*, but it is in that species much stronger and more visible.

From *L. amentata*, Clk. (*L. saccata*, Bl.), the much smaller size of the digital joints of the palpi will easily distinguish it.

The female resembles the male in colours and markings; and the genital aperture is characteristically different in form from that of both *L. pullata* and *L. amentata*.

Examples of both sexes have been found at Bloxworth and other localities in Dorsetshire; but hitherto it has not been recorded as British under its proper designation.

Genus Attus, Sim.

Attus arcuatus.

Araneus arcuatus, Clerck.
Salticus grossipes, Cambr. Trans. Linn. Soc. xxviii. p. 434; id. ibid. p. 527.

A comparison of the examples recorded, *l. c. supra*, with typical specimens of *A. arcuatus* received both from Dr. Thorell and Dr. Koch prove them to be identical. The female has not yet been found in Britain.

Attus fasciatus.

Salticus fasciatus, Hahn, Die Arachn. i. p. 54, pl. xiv. fig. 41; Cambr. Trans. Linn. Soc. xxviii. p. 434.

This spider was found by myself, in some abundance, in June last, among grass and herbage on the eastern side of the Chesil

Beach, Portland. A few examples of both sexes were adult; but the majority were immature females. Up to this time the only recorded British example has been a mutilated female found by Mr. W. Farren and sent to me by him from the New Forest, Hampshire.

Genus SALTICUS, Simon (Latr. ad part.).

Salticus formicarius.

Attus formicarius et *A. formicoïdes*, Walck. Ins. Apt. i. pp. 470, 471.
Salticus formicarius, Cambr. Linn. Trans. xxviii. p. 435.

In addition to the only record of this spider (hitherto) authenticated as British (Linn. Trans. *l. c.*), I have pleasure in now recording another example of the adult male found by the late J. C. Dale, Esq., at the Salterns, near Lymington, Hants, in August 1865. This example was shown to me lately by Mr. C. W. Dale, of Glanville's Wooton.

List of the Spiders noted and described.

EXPLANATION OF PLATE VIII.

Fig. 1. *Atypus Beckii*, sp. n., ♂: *a*, profile; *b*, spider (without legs), of natural size; *c*, right palpus, outer side, underneath, in front; *d*, natural length of spider, including falces; *e*, ocular eminence, from above and behind.

Fig. 2. *Atypus piceus*, Sulz., ♂: *a*, right palpus, outer side underneath, rather in front; *b*, ocular eminence, from above and behind;

c, ditto, from a French specimen received from Monsieur Eugène Simon.

Fig. 3. *Drassus criminalis*, sp. n., ♀ : *a*, spider, without legs, enlarged; *b*, ditto, in profile; *c*, eyes, from the front; *d*, genital aperture; *e*, natural length of spider.

Fig. 4. *Drassus delinquens*, sp. n.: *a*, spider (without legs), enlarged; *b*, profile; *c*, eyes, from the front; *d*, genital aperture; *e*, natural length of spider.

Fig. 5. *Erigone Douglasi*, sp. n.: *a*, profile of spider (without legs), enlarged; *b*, spider, from above, without legs; *c*, eyes and falces, from the front; *d*, genital aperture.

Fig. 6. *Erigone nigriceps*, sp. n.: *a*, spider, in profile (without legs) enlarged; *b*, eyes and falces, from the front; *c*, genital aperture; *d*, natural length of spider.

Fig. 7. *Erigone subitanea*, sp. n.: *a*, spider in profile (with legs truncated) enlarged; *b*, eyes and falces, from the front; *c*, left palpus, inner side in front; *d*, left palpus, in front, rather on outer side; *e*, natural length of spider.

Fig. 8. *Linyphia aëria*, sp. n.: *a*, spider, in profile (without legs), enlarged; *b*, eyes, from the front; *c*, abdomen, in profile; *d*, right palpus, outer side (inverted); *e*, natural length of spider.

Fig. 9. *Lycosa arenicola*, sp. n.: *a*, digital joint of ♂, showing structure of palpal organs; *a–x*, characteristic oblique process of ditto; *b*, genital aperture of ♀.

Fig. 10. *Lycosa annulata*, Thorell: *a*, digital joint of ♂, showing palpal organs; *a–x*, characteristic obtuse tuberculiform process of ditto; *b*, genital aperture of ♀.

Fig. 11. *Lycosa riparia*, C. Koch: digital joint of ♂, showing palpal organs; *x*, characteristic oblique spine; *y*, slender adjacent spine.

Fig. 12. *Lycosa prativaga*, L. Koch: *a*, digital joint of ♂, showing palpal organs; *a–x*, characteristic oblique spine; *a–y*, slender spine adjacent; *b*, genital aperture of ♀ (from a German example received from Dr. Ludwig Koch).

XXXII.—*Descriptions of new Species of* Vespertilionidæ. By G. E. Dobson, M.A., M.B., F.L.S., &c.

Genus Vespertilio.

Vespertilio, Keys. & Blas. Wiegm. Archiv, 1839, p. 304.

a. *Feet moderate; wings to the base of the toes.* (Subg. Vespertilio.)

Vespertilio africanus, n. subsp.

Ears shorter than the head; laid forwards the tips do not reach to the end of the muzzle; tragus acutely pointed. Glands on the side of the muzzle forming a conspicuous rounded elevation on either side between the eye and nostril.

Fur above dark at the base, with greyish extremities;

beneath, the basal half of the hairs is dark, the terminal half white.

Length (of an adult male preserved in alcohol)—head and body 2·5 inches, tail 2·3, head 0·9, ear 0·85, tragus 0·4 × 0·1, forearm 2·2, thumb 0·45, second finger 3·7, fourth finger 3, tibia 1·05, foot and claws 0·45.

Hab. Gaboon, W. Africa.

This species belongs to the same section of *Vespertilio* as *V. murinus* of Europe, which it very closely resembles in general form, in size, and even in the colour of the fur. It is, however, at once distinguished by the much shorter ears, acutely pointed tragus, and great development of the glands of the muzzle. The wing-membrane also does not extend so far outwards along the foot as in *V. murinus*, and the inner side of the ear-conch is less hairy.

Though thus readily distinguished from *V. murinus* of Europe, I am induced, on account of its very close general affinities to that species, to consider it a subspecies only.

Type in the collection of the British Museum.

b. *Feet very large; wings to the ankles or tarsus.* (Subg. Leuconoë.)

Vespertilio megalopus, n. sp.

Very similar to *V. Daubentonii*; but the ears are longer, much narrower and more acute, and, laid forwards, the tips pass beyond the end of the nose at least one tenth of an inch; the inner margin, instead of forming a regular arc from the base to the tip, is flattened along the upper third, and the narrow extremity of the ear is sharply rounded off. The tragus is also longer and narrower, and the upper third of the inner margin is slightly concave; but the extremity is not directed inwards.

The wing-membrane does not extend so far down on the tarsus as in *V. Daubentonii*; and the second upper premolar is slightly drawn inwards. In other respects, in general form and in the colour and distribution of the fur, this species closely resembles *V. Daubentonii*, of which it may be considered the African representative.

Length (of a male specimen preserved in alcohol)—head and body 1·65 inch, tail 1·6, head 0·6, ear 0·55, tragus 0·3, forearm 1·45, thumb 0·35, second finger 2·3, fourth finger 1·9, tibia 0·6, foot and claws 0·4.

Hab. Gaboon. Type in the collection of the British Museum.

Genus Vesperugo.

Vesperugo, Keys. & Blas. Wiegm. Archiv, 1839, p. 312.

Vesperugo (*Vesperus*) *platyrhinus*, n. sp.

Muzzle broad and obtuse; glandular prominences large, smoothly rounded; nostrils opening near the margin of the upper lip, on a level with the rounded extremity of the muzzle, not emarginate between. The front of the muzzle is evenly bevelled off from the summit of the glandular elevations to the margin of the upper lip; and the nasal apertures are narrow, appearing as small oblique slits in the front of the muzzle. Ears and tragus as in *V. Kuhlii*.

Wings from the base of the toes; postcalcaneal lobe small, but distinct; last caudal vertebra half free.

Fur above dark brown, paler towards the tip; beneath similar, the extremities of a lighter colour than on the upper surface.

Upper inner incisors long, faintly bifid at the extremities; outer incisors very short, scarcely equalling the cingulum of the inner ones; lower incisors crowded, trifid; no minute upper premolar; the single upper premolar very close to the canine.

Length (of an adult male)—head and body 1·8 inch, tail 1·4, head 0·7, ear 0·55, tragus 0·25, forearm 1·35, second finger 2·15, fourth finger 1·65, tibia 0·45, foot 0·25.

Hab. Unknown. Type in the collection of the British Museum.

This very peculiar species of *Vesperugo* resembles *V. Kuhlii* in size and in general form; but the absence of the first minute upper premolar and the shape of the muzzle at once distinguish it. The shape of the muzzle is so peculiar as to lead me to suspect it may be an individual peculiarity. As the specimen from which the description is taken is well preserved in alcohol, this flattening of the front of the muzzle and extremities of the nostrils is not due to imperfect preservation.

XXXIII.—*Descriptions of new Species of* Geckotidæ *in the British-Museum Collection.* By A. W. E. O'Shaughnessy, Assistant in the Departments of Natural History.

Phyllodactylus tuberculosus,

described by Wiegmann (Acta Ac. Nat. Curios. xvii. p. 241, pl. 18. fig. 2) from California, to which we must add as a synonym the *Phyllodactylus Xanti* described by Cope

(Pr. Ac. Nat. Sc. Phil. 1863, p. 102), also from California, has "small ventral scales, which, although hexagonal, affect a circular form." They are in more than 25 longitudinal series; and if counted longitudinally from the vent to the throat, where they gradually merge into the smaller gular scales, the number is about sixty. The large campanuliform mental is followed by two large postmentals, and these by a series of much smaller roundish plates, set transversely, two or three of them being behind each postmental, but not going up laterally between the postmental and the second infralabial.

This species has now been obtained from Guatemala and Salvador.

Phyllodactylus ventralis, sp. n.

Differs from the above in the ventral scales, which are much larger and regularly oval; there are not more than fifteen or sixteen longitudinal series of them; and counted longitudinally, to where they give place to the minute gular scales, they number about forty-five. The mental shield is longer, narrower, and more pointed posteriorly, its point being enclosed by two postmentals; and behind these a space reaching to about the middle of the chin exhibits rounded or polygonal scales, much larger than the minute gular scales of *P. tuberculosus* and those which follow in this species reaching as far as the chest. Immediately behind the postmentals the anterior rounded or polygonal scales constitute a distinct larger transverse series composed of four, the outermost on each side going up between the postmental and the second infralabial, occupying an interstice which is almost granular in *P. tuberculosus*. Head also much narrower, more pointed, and less flattened than in that species. The dorsal tubercles are in fifteen longitudinal series. The tail has rings of tuberculous scales at intervals, and a broadened inferior central series of scales. Ear-opening narrow, oblique.

Ground-colour yellowish brown. A narrow distinct stripe of dark brown from the nasal plate, through the eye, to the side of the body; the back variegated with dark brown.

Hab. Jamaica. One specimen, 4 inches in length.

Tarentola ephippiata, sp. n.

Head broad, depressed; muzzle rounded, covered with moderate-sized convex scales, somewhat larger in front than on the hinder portions of the head. Back minutely granular, with flat oval tubercles, disposed in fourteen regular longitudinal series; ventral surface covered with small uniform, roundish or hexagonal scales; gular region with minute scales, becoming larger again laterally. Supralabials ten, the last two minute; infralabials eight. Mental a long wedge-shaped plate reaching backward as far as the third infralabial. Three postmentals on each side beneath the first, second, and third infralabials, diminishing in size. A row of secondary sublabials intervenes anteriorly between the second and third postmentals and the infralabials, leaving the larger first postmental in contact with the first infralabial. Three or four minute roundish scales at the point of the mental. Ear-opening very narrow, oblique. Pupil narrow, vertical. Tail with rings of tuberculous scales at intervals, and flat, squarish, tessellated scales on the lower surface.

Ground-colour pale brown. A long reddish brown stripe from the nose on each side of the head to the back, some way behind the shoulders, where it is enlarged and, joining that of the opposite side, forms a saddle-shaped patch. A small isolated brown spot, pointed anteriorly, forked posteriorly, on the occiput, and some transverse brown patches on the hinder portion of the back.

Two specimens from West Africa. Length 4¼ inches.

Hemidactylus echinus, sp. n.

A species, the type of which comes from West Africa, presenting the peculiarity of a series of prickles or short spines along the side of the body.

Upper parts minutely granular, with numerous small convex tubercles scattered irregularly, becoming fewer or failing altogether on the head, where the general very fine granulation becomes scarcely coarser on the muzzle. Eyelid with small tubercular scales. Chin and chest minutely granular; scales of belly very minute, close-set, almost granular; several crescentic series of larger preanal scales enclosing a curved series of eight pores. No femoral pores. The lowermost tubercles on the side of the body are developed into a regular series of pointed projections or prickles, extending between the fore and the hind limb; though minute, they present a strong resemblance to the spines of a sea-urchin. Rostral broad, divided; supralabials twelve; infralabials eight, with a line of narrow secondary sublabials beneath them. Mental triangular, with a small scale at its point and a pair of small postmentals on each side. Tail quadrangular, the ridges with projecting spinous tubercles. Ear-opening very small. Pupil vertical.

Colour brown, paler on the lower parts, with a diamond-shaped dark spot on the centre of the nape, some lighter mottlings, rather indistinct, on the back, and a clear yellow spot on the hind part of the thigh, close to the root of the tail, which is banded alternately with dark and pale brown.

One specimen from the Gaboon, $4\frac{3}{4}$ inches long.

Goniodactylus caudiscutatus, Günth.,

does not offer the peculiarity mentioned by M. Bocourt, in 'Miss. sc. Mex.' p. 48, as characteristic of the *G. fuscus* of Hallowell, viz. that the mental plate is followed by a single large postmental in place of the row of small plates found in *G. albogularis.* The specimen bearing this name referred to by him is no doubt a different species; as there are specimens in the British Museum from Panama with a large single postmental; and these being different from Dr. Günther's species, I have named them, in accordance with M. Bocourt's differentiation, *G. fuscus.*

Goniodactylus Braconnieri, sp. n.

This form is referred to by Duméril, in 'Arch. du Mus.' viii. p. 473, as a variety of *G. albogularis.* It is distinguished from it by the conspicuous coloration of the gular region; and the British Museum has as yet received it only from the South-American continent, whereas *G. albogularis* appears to be a West-Indian species.

The whole of the chin is of a light colour, separated abruptly from the dark hue of the chest, which envelops the sides of the body, extending more or less on the belly. A straight white stripe, bordered with greyish, forked behind the mental, and dividing into two branches, extends the length of the chin to the chest. Another lateral stripe on each side curves upwards from before the chest towards the eye; and two blue spots on the supralabials beneath the eye correspond severally with the curved stripe and the lateral branch of the median gular stripe. There is also a vertical humeral band. The upper surface of the body is variegated like *G. albogularis*, being either (1) marbled with dark and light brown or (2) very finely punctulated.

Several specimens have been obtained from Barranquila, New Granada, and one, which agrees completely with them, bears the locality of Chili.

Goniodactylus sulcatus, sp. n.

Head narrow, sharply descending from the supraorbital region to the extremity of the snout. Supralabials six; infralabials five. Mental large, truncated behind, followed by two, small, hexagonal postmentals, and these by one or two rows of similar scales forming a postmental patch. Gular region covered by uniform convex granules equal to those on the muzzle, larger than the finer granules of the top and sides of the head. Ear-opening small. The whole upper surface of the body granular; ventral surface from front of chest to anus with moderate-sized hexagonal scales, which also protect the anterior faces of the limbs and the entire lower surface of the hind limb. Tail tetragonal, with one deep median superior and two deep lateral furrows the whole of its length; finely granular above, with a central series of broad and lateral series of smaller scales beneath.

Colour (in spirit) dusky brown, very finely punctulated over the back with darker. A vertical humeral stripe and several indistinct dark roundish spots on the sides of the body. The upper surface of the tail is regularly barred with broad brown and pale patches.

The type of this species was received from Cuba; its length is 3 inches.

XXXIV.—*Notice of the Occurrence of another Gigantic Cephalopod* (Architeuthis) *on the Coast of Newfoundland, in December* 1874. By A. E. Verrill*.

In an article published in the 'American Journal of Science' for February and March 1875†, I gave a summary of our information concerning twelve specimens of gigantic cephalopods that have been obtained in American waters during a few years past, together with a brief notice of the various specimens that have been described by European writers‡.

I am now able to add some important information concerning an additional specimen which was cast ashore last winter at Grand Bank, Fortune Bay, Newfoundland. As in the

* From the 'American Journal of Science' for September 1875.

† Vol. ix. pp. 123, 177, plates ii.–v. See also the 'American Naturalist,' vol. ix. pp. 21, 78, January and February 1875.

‡ In the 'Journal de Zoologie," vol. iv. no. 2, p. 88, 1875, M. Paul Gervais has also given a summary of the gigantic cephalopods previously known, and has mentioned an additional species (*Architeuthis Mouchezi*, Vélain), of which portions were brought to Paris by M. Vélain, from the Island of Saint Paul, where it was cast ashore. He also quotes the brief notice of the animal by M. Vélain (in Comptes Rendus, t. lxxx. p. 1002, Séance du 19 Avril 1875). It is stated that this example belongs to the same group with *Ommastrephes*; and if so, it will probably prove to be generically distinct from both of the Newfoundland species. M. Gervais does not refer, in any way, to the several American specimens described by the writer and others.

case of several of the previous specimens, I am deeply indebted to the Rev. M. Harvey for information concerning this one, and also for the jaws and one of the large suckers of the tentacular arms, these being the only parts preserved. Although this specimen went ashore in December, Mr. Harvey did not hear of the event until March, owing to the unusual interruption of travel by the severity of the winter. He informs me that Mr. George Simms, Magistrate of Grand Bank, has stated, in a letter to him, that he examined the creature a few hours after it went ashore, but not before it had been mutilated by the removal of the tail by the fishermen, who finally cut it up as food for their numerous dogs; and that the long tentacular arms were 26 feet long and 16 inches in circumference (probably meaning at their broad terminal portion); the short arms were "one third as long as the long ones, and about the same in circumference;" the back of the head or neck was 36 inches in circumference (evidently meaning the head behind the bases of the arms); the length of the body "from the junction to the tail" was 10 feet (apparently meaning from the anterior edge of the mantle to the origin of the caudal fins). He thinks the tail, which had been removed, was about one third as long as the body; but this is probably overestimated, judging from the Logie-Bay specimen (no. 5 of my former papers), in which it was about one fifth; but it may have been cut off above its proper base. Allowing one fifth also for the length of the head, the total length would be about 40 feet, the head and body together being about 14. The large sucker in my possession is one inch in diameter across the denticulated rim, and in form and structure agrees closely with those previously described and figured by me from the tentacular arms of nos. 4 and 5 (vol. ix. plate iv. figs. 11, 12, 13).

The jaws are still attached together, in their natural position, by the cartilages*. They agree very closely in form with the large jaws of *Architeuthis princeps*, V. (no. 10), figured on plate v. vol. ix., but they are about one tenth smaller. The upper jaw measures 111 millims. in height (front to back), 88 millims. from tip of beak to front edge of palatine laminæ, 20 millims. from tip of beak to the base of the notch. The lower jaw measures 96 millims. in total length, 80 millims. from tip of beak to front edge of laminæ, 19 millims. from tip to base of notch.

From the close agreement of these jaws with those of

* These will be figured in an article on the gigantic Cephalopods, now in preparation for the 'Transactions of the Connecticut Academy of Sciences.'

A. princeps, there can be very little doubt that they belong to that species; and if so, the measurements given will be of great importance as affording additional knowledge of the approximate form and proportions of this, the largest known species.

Note.—In 'The Zoologist,' London, 2nd ser. no. 118, p. 4526, July 1875, there is an article entitled, "Notice of a gigantic Cephalopod (*Dinoteuthis proboscideus*), which was stranded at Dingle, in Kerry, two hundred years ago. By A. G. More, F.L.S." The article is chiefly a reprint of the rude popular accounts written at the time of the capture; and upon these alone Mr. More attempts to found a new genus and species. The one character which he relies upon as of generic value is the power of projecting the beak in the form of a proboscis. But he apparently does not know that this is habitually done by the various common species of *Ommastrephes*, *Loligo*, &c., and perhaps by all ten-armed cephalopods. There is no reason to suppose, from the published accounts, that this specimen differed in any way from the *Architeuthis monachus*. It was described as 19 feet in total length; the long arms having been mutilated, the part remaining was 11 feet long, and as thick as a man's arm; the short arms varied from 6 to 8 feet in length, and were as thick as a man's leg, and had two rows of large serrated suckers; the proboscis (buccal mass with beak) was the "size of a man's fist;" the beak was "like an eagle's, but broader." The whole animal was said to have been as large as a large horse. The measurements given indicate a specimen smaller than several of the American examples, and but little, if any, larger than our no. 5, from Logie Bay.

In the August number of the 'Annals and Magazine of Natural History,' vol. xvi. p. 123, the same writer has briefly described the beak and portions of the tentacles and arms of another specimen, taken off Boffin Island, on the west coast of Ireland, last April. The tentacular arms are said to have been 30 feet long; the expanded portion 2 feet 9 inches; the large central suckers nearly 1 inch in diameter, those of the outer rows ·5 of an inch; one short arm is said to have been 8 feet long, and 15 inches in circumference at the base, when fresh.

Mr. More believes this to be distinct from the Newfoundland species, and refers it to *A. dux*; but his description agrees closely with the corresponding parts of *A. monachus* (no. 5), described by me. He appears to be ignorant of my articles on the subject, published in the 'American Journal of Science.'

XXXV.—*On a new Genus and some new Species of Graptolites from the Skiddaw Slates.* By H. Alleyne Nicholson, M.D., D.Sc., F.R.S.E., Professor of Natural History in the University of St. Andrews.

[Plate VII.]

In the following communication I wish to draw attention to some remarkable Graptolites collected by Mr. W. K. Dover from the Skiddaw Slates, and placed by him in my hands for examination. One of these is the type of a new and very singular genus; another is a large and fine new species of the genus *Thamnograptus*; and the third is a new species of *Didymograptus*.

Genus Azygograptus, Nich. & Lapw.*

Polypary simple, unilateral, consisting of a single monoprionidian stipe, which is developed from the central portion of the sicula on one side. Cellules slightly overlapping.

This genus completely fills up the great break between the unilateral and bilateral siculate Graptolites, and seems to be intermediate in its characters between the true *Monograptidæ* and the family of the *Nemagraptidæ*. It agrees with the former in the fact that the polypary consists of a single unicellular stipe—but differs altogether in its mode of development, the celluliferous stipe springing directly from one side of the sicula about its centre. In this important character the genus agrees with no other known Graptolites than *Nemagraptus*, Emmons, and *Cœnograptus*, Hall, both of these, however, including bilaterally developed forms. The cellules of *Azygograptus* are essentially of the type of *Monograptus Nilssoni*, Barr., and thus link the genus indifferently to either the *Monograptidæ* or the *Nemagraptidæ*.

Subjoined is a description of the only known species of the genus.

1. *Azygograptus Lapworthi*, Nich. Pl. VII. figs. 2–2*c*.

Polypary simple, of a single slender monoprionidian stipe, which takes origin from the centre of one side of a strongly marked pointed "sicula." The length of the sicula is about

* I have associated Mr. Lapworth with myself in the description of this new genus, partly because its name was suggested by him, and partly because it would not have been possible for me to satisfactorily determine its position and affinities had it not been for his valuable and elaborate researches on the development and classification of the Graptolites ("An Improved Classification of the Rhabdophora," Geol. Mag. vol. x. 1873).

half a line; and its shape is the normal triangular one. As there is good evidence amongst the *Diplograptidæ* that the broader end of the sicula forms the proximal extremity of the polypary, I have figured the present form in a corresponding position (figs. 2 *a*, 2 *b*). The stipe is narrow, apparently from one inch to two inches in length, and about one thirtieth of an inch in width opposite to the cell-mouths. The cellules are long and narrow, resembling those of *Monograptus Nilssoni* in shape, remote (about twenty in the space of an inch), slightly overlapping, the cell-mouths being nearly at right angles to the axis.

Owing to the remarkable appearance presented by the sicula standing nearly at right angles to the celluliferous stipe, there is not any difficulty in recognizing all fragments of this species in which the base is preserved. Owing also to the marked manner in which the stipe originates from the centre of the sicula, there is no difficulty in determining that we have not to deal with a *Didymograptus* broken off at the sicula.

I have named the species in honour of my friend Mr. Charles Lapworth, whose researches have of late years so materially increased our knowledge of the structure of the *Graptolitidæ*. The specimens from which the above description is taken were kindly placed in my hands for examination by Mr. W. K. Dover, who has long been an enthusiastic collector in the Skiddaw Slates. They include the remains of a great number of well-preserved individuals, none of which exhibits any branching, though the stipes are often so thickly crowded together as to render this point very difficult of observation.

Locality and Formation.—Hodgson-How Quarry, near Portinscale, Lower Skiddaw Slates. Apparently by no means of rare occurrence.

Genus Thamnograptus, Hall.

Polypary composed of a central rachis or stem, giving off slender alternating branchlets. Cellules unknown. A dorsal "axis" (?) entering into the branchlets as well as the main stem.

Much has yet to be learnt before we can speak positively as to the nature and affinities of *Thamnograptus*, though I think there can be little doubt as to its belonging to one great group with the true Graptolites. There is a possibility that the branchlets are greatly elongated cellules; but it is more probable that the branchlets carried the cellules in a single row on one face, though at present the published evidence on this subject is insufficient to establish this view.

2. *Thamnograptus Doveri*, Nich. Pl. VII. fig. 1.

Polypary composed of a central undulating stem, about one twelfth of an inch in width, giving off alternately placed branchlets on the two sides. The branchlets are straight, about one twenty-fourth of an inch in width, and placed at intervals of from one quarter to half an inch apart (measuring on the same side of the rachis). The terminations of the branchlets are not shown; but the longest ones preserved are about an inch and a quarter in length, and show no sign of an ending. No "solid axis" can be made out; but portions of the branchlets show very distinct transverse markings, which have every appearance of being the mouths of cellules.

Thamnograptus Doveri is readily distinguished from *T. typus*, Hall, and *T. Anna*, Hall, by its much larger dimensions and the remoteness and great length of the branchlets. The only specimen known is a very well-preserved fragment about two and a quarter inches in length, and exhibiting portions of five branchlets on the one side and of six upon the other.

I have named the species in honour of Mr. W. K. Dover, by whom it was discovered.

Locality and Formation.—Randal Crag, Skiddaw. Lower Skiddaw Slates.

3. *Didymograptus gibberulus*, Nich. Pl. VII. figs. 3–3 *b*.

Polypary bilateral, composed of two broad monoprionidian stipes, which bend backwards from the sicula in gentle curves at an angle of from 335° to 340°. The branches attain their greatest width at their junction with one another and the sicula, where they have a breadth of a line or more. The two central cellules are vertical in position; and from the vertical line thus formed the cellules become more and more obliquely divergent till they come to form an angle of about 45° with the back of the stipe. The cellules are about forty in the space of one inch; and their mouths, in well-preserved examples, are furnished with very prominent mucronate tips.

Didymograptus gibberulus belongs to the "reflexed" group of the *Didymograpti*, and is very similar in general appearance to the fossil described and figured by Mr. Salter under the name of *D. caduceus*. The *original* specimen on which this species was founded (Quart. Journ. Geol. Soc. vol. ix. p. 87), however, is beyond doubt an example of *Tetragraptus bryonoides*, Hall, or *T. Bigsbyi*, Hall, in which two of the normal four stipes are concealed from view by the matrix.

D. caduceus cannot, therefore, be retained, though I have little doubt that one of the forms subsequently figured by Mr. Salter from the Skiddaw States under this name (Quart. Journ. Geol. Soc. vol. xix. fig. 13 *a*) is identical with the species now under consideration.

That *Didymograptus gibberulus* is quite distinct from those specimens which consist of two of the stipes of *T. bryonoides* separated by the matrix from the other two, is at once seen by a comparison of the cellules near the sicula in the two cases. In *T. bryonoides* (as in all the *Didymograpti* except the present species) the primary cellules are comparatively small, the cellules not attaining their full development, or the stipes their full width, till we have receded to some distance from the sicula. There is thus a more or less extensive space opposite the sicula, which is formed by the union of the bases of the first pair of cellules and is narrower than the rest of the polypary (Pl. VII. fig. 5). On the other hand, in *D. gibberulus* the primary cellules are the most fully developed, and the stipes are consequently broader in the neighbourhood of the sicula than anywhere else (Pl. VII. figs. 3, 3 *a*).

There is also the very striking and unique peculiarity in *D. gibberulus* that the two primary cellules do not diverge at an angle from the top of the sicula, as is usual amongst the *Didymograpti*, but are placed vertically, parallel with the long axis of the sicula, and thus serve to divide the frond into two halves (Pl. VII. fig. 3 *a*).

None of the specimens that I have seen exhibits the terminations of the branches satisfactorily, the stipes in the largest of them being about nine lines long. The sicula is generally a broad blunt process, of a triangular shape, and about half a line in length; but it has occasionally a delicate thread-like extension which raises its length to two lines (Pl. VII. fig. 3 *b*).

In accordance with what we now know to be the true position of the sicula and its relation to the development of the celluliferous stipes, I have figured the specimens of this species in what would, prior to Mr. Lapworth's researches on this point, have been regarded as the reverse of their natural situation—namely, with the broader end of the sicula pointing downwards.

Locality and Formation.—Randal Crag and White Houses, Skiddaw, Lower Skiddaw Slates. Collected by Mr. W. K. Dover.

EXPLANATION OF PLATE VII.

Fig. 1. *Thamnograptus Doveri*, Nich., of the natural size.

Fig. 2. A slab with numerous individuals of *Azygograptus Lapworthi*, Nich., of the natural size. 2 *a.* A large individual of the same, magnified two diameters. 2 *b.* Small portion of the base of the same, enlarged still further. 2 *c.* A few cellules of the same, greatly enlarged.

Fig. 3. *Didymograptus gibberulus*, Nich., of the natural size. 3 *a.* Base of another specimen of the same, greatly enlarged. 3 *b.* Base of another example of the same, with a spiniform extension of the sicula, greatly enlarged.

Fig. 4. A specimen of *Tetragraptus bryonoides*, Hall, in which only two of the four normal stipes are preserved. The two missing stipes, not being in the same plane, are shown in outline.

Fig. 5. Base of two of the stipes of *Tetragraptus bryonoides*, introduced for comparison with the base of *Didymograptus gibberulus*, greatly enlarged.

XXXVI.—*On the Structure of* Amphicentrum granulosum, *Huxley*. By Ramsay H. Traquair, M.D., F.G.S., Keeper of the Natural-History Collections in the Edinburgh Museum of Science and Art.

[Plate IX.]

Since *Amphicentrum granulosum*, Huxley, was first described by Professor Young of Glasgow*, a second species, *A. striatum*, has been recognized from the Northumberland coal-field by Messrs. Hancock and Atthey†. Regarding the structural peculiarities, however, of this most singular genus of Carboniferous fishes, there has been nothing further published than what is contained in Dr. Young's well-known paper "On the affinities of *Platysomus* and allied genera."

In a subject beset with such difficulties as the osteology of fossil fishes, where the remains are, for the most part, either crushed or fragmentary, it is natural that the advent of fresh material should not only add to our knowledge but also reveal errors in the descriptions of previous writers. And with regard to *Amphicentrum granulosum*, the careful study of a beautiful series of specimens from the North-Staffordshire coal-field, recently lent me by my friend Mr. Ward, of Longton, has led me to results which, in some important points, differ

* Quart. Journ. Geol. Soc. vol. xxii. (1866), p. 306 *et seq.*

† Ann. & Mag. Nat. Hist. ser. 4, 1872, vol. ix. p. 255.

materially from those recorded by Dr. Young. To detail briefly those results is the object of the present communication.

Cranium proper.—I am quite unable to find any trace of the large median "*supraoccipital*" with its "crest," which Dr. Young has figured* and described as interpolated between the parietals, as in ordinary Teleostei. On the contrary, there is no doubt that in *Amphicentrum*, as in Ganoid fishes generally (*Lepidosteus*, *Polypterus*, *Amia*, *Lepidotus*, &c. &c.) and in some Teleostei (*Macrodon*, *Erythrinus*), the *parietals* (*p*, Pl. IX. fig. 1) were in contact with each other along the middle line. On comparing Dr. Young's restored figure with the skull represented in fig. 1, Pl. IX., it is pretty evident that he has designated the upper part of the supraclavicular element of the shoulder-girdle as "parietal," while the real parietal is included in his "frontal;" a broken line across the posterior part of the latter shows, at the same time, that the line of separation between the two bones did not altogether escape his notice. On the outer side of each parietal is a large *squamosal* (*sq*); and in advance of it there is a more elongated *frontal* (*f*). The latter does not, however, take any part in the formation of the orbital margin, being separated from it by two other plates (*p.f* & *a.f*), the *posterior* and *anterior frontals*, which form respectively the posterior-superior and anterior-superior margins of the orbit. The region of the skull between the prefrontals and the premaxillaries is in all the specimens very obscure, though there is evidence in this situation of a pair of square-shaped plates representing *nasals*; but I have not been able to discover any median ethmoid. Nor are the nasal apertures apparent, though probably they occur between each nasal bone and the large anterior suborbital (to be subsequently alluded to). Regarding the condition of the base and side walls of the cranium nothing more can be made out, beyond the presence of a strong parasphenoidal bar, which in some specimens is evident enough.

Jaws and palato-quadrate apparatus.—The *præmaxillæ* (*p.mx*) are generally plain enough, and are, as Dr. Young has described them, a pair of remarkable, prominent, sharp-edged edentulous bones, forming a beak-like projection at the front of the snout. Posteriorly each præmaxilla articulates with the maxilla of its own side.

As regards the *maxilla*, Dr. Young has described it as an oblong tooth-bearing plate, which "bulges below into an

* *Op. cit.* p. 304, woodcut, fig. 1.

abruptly projecting labial mass, whose oral margin forms a ridge separated by a shallow groove from an inner ridge. Seen from below, this groove terminates sharply behind by the approximation of the outer and inner ridges, but is closed in front by the præmaxilla. On the outer ridge the dental tubercles are few; on the inner, which is more prominent, they are more numerous,—less so, however, than on the *mandible*, which is the converse of the maxilla, in that the ridges approximate in front, the tubercles ceasing before their coalescence, while the groove is open posteriorly; the outer ridge is also the more prominent"*.

Now, few things are more clearly shown in the specimens before me than that the maxilla is, on the contrary, a thin plate, whose oral margin is *quite edentulous*, like that of the præmaxilla. It forms a somewhat triangular or, rather, trapezoidal plate (*mx*, Pl. IX. figs. 1 & 2), whose upper margin slopes gently downwards and forwards, the posterior more rapidly downwards and backwards; the anterior margin, very short and a little bevelled off, is in contact with the præmaxilla, which slightly overlaps it; finally, the oral margin, the longest, forms a simple and rather sharp edge, along which not the slightest trace of teeth or of dental tubercles can be seen. The external surface of the maxilla is beautifully ornamented with wavy ridges and wrinkles, which, save quite in front and near the upper margin, where they are more irregularly disposed, assume a general direction perpendicular to the oral edge of the bone, stopping short, however, just before reaching it, so as to leave here a very narrow smooth border. Both in form and in external sculpture this bone bears a great resemblance to the maxilla of *Eurynotus*, excepting, of course, that the obtuse rounded teeth with which the latter is garnished are here totally absent.

It is therefore clear that the bone reckoned as "maxilla" by Dr. Young, and of which the original specimen from Mr. Ward's collection, represented in his figure†, is now before me, cannot be that bone; and the question next arises as to what it is.

The twenty-six specimens of detached bones bearing tooth-tubercles, submitted to me by Mr. Ward, easily fall into two distinct sets. In the one, which includes the type specimen of the so-called maxilla (Pl. IX. figs. 5 & 6), the surface exhibiting granulations is more flat, the dental tubercles less prominent, and, indeed, quite obsolete on one of the two marginal ridges; while in the other (figs. 9 & 10), the dentigerous

* *Op. cit.* p. 306. † *Op. cit.* pl. xx. fig. 2.

margin of which bears an exact resemblance to that figured by Dr. Young as appertaining to the mandible, the surface of the bone is more convex and marked with a stronger granulation, the tooth-tubercles are more prominent and nearly equally developed on both the ridges, which are also more divergent.

Bones of both these descriptions occur *in situ*. In several specimens I have, by careful working-out, been able to prove beyond a doubt that the reputed *maxilla* is in reality a part of the *lower jaw*—an *internal dentary* or *splenial* mandibular element; while the *palatal* nature of the bones of the second category was evident from the very first.

The internal dentary bone (*sp*) is represented detached in Pl. IX. figs. 5, 6, 7, and 8, and *in situ*, seen from the inner aspect, in figs. 3 & 4. It is a somewhat oblong-shaped bone, rather pointed in front, though more truncated posteriorly. The inferior margin is thin; the upper one shows for the anterior two thirds of its length two ridges, separated by a shallow groove and coalescing posteriorly. The *outer* of the two ridges is the more prominent; nearly straight at its commencement, its contour soon assumes a gentle upward convexity, this part of the ridge displaying also several small sharpish dental tubercles, which are more strongly developed in some individuals than in others. The inner ridge is less prominent, and, proceeding in a straighter direction, gets lower down on the margin as it passes forwards; the dental tubercles are quite obsolete. The *inner* or *oral surface* of the plate presents below the level of the smaller ridge an oblong patch of enamelled granulations, roughening the lower part of the wall of the cavity of the mouth—a condition also not without a parallel among recent Ganoids, a portion of the oral aspect of the compound splenial bone of *Amia* being also granulated. On working out a specimen from the outer side (fig. 7), or making a transverse section of it, it becomes clear that the plate is longitudinally sharply folded on itself along the line of the tooth-bearing ridge, the outer aspect of the reflected portion showing, especially towards its lower edge, which articulates with the dentary bone proper, a number of minute tubercles, some of the more anteriorly placed of which considerably resemble in some cases the tubercle-teeth of the marginal ridge itself. Just behind the middle of the bone the externally reflected portion passes nearly horizontally outwards, showing a rather thick edge, and is then obliquely cut off posteriorly (fig. 8).

The proper *dentary* portion of the lower jaw belies its name, in being, like the maxilla, quite edentulous, its upper margin forming a thin sharp edge, separated by a considerable groove from the prominent tooth-bearing ridge of the element last described. In the small mandible figured by Dr. Young*, of which the original is now before me, this edge is broken away save quite in front; but it is well shown, seen from the inner aspect, in the head represented in Pl. IX. fig. 2. At the symphysis the anterior extremity of this element is sharp, prominent, and excavated above, and in this manner comes to look somewhat like the counterpart of the premaxillary beak opposed to it. The external surface is smooth and ganoid, being prettily sculptured with short ridges, furrows, and tubercles.

Other distinct mandibular pieces were certainly present; of these the only one seen with any distinctness is the *angular*, a narrow plate at the angle of the jaw, much resembling the corresponding element in the Palæoniscidæ.

The palatal tooth-bearing plate (*pa*, Pl. IX. figs. 9 and 10 detached, and figs. 3 & 4 *in situ*) differs, as might be expected, considerably in form from the mandibular. What may be designated the *body* of the bone presents a gently convex oral surface, bearing a large patch of tolerably prominent shining tubercles, some round, some oval, by which the roof of the mouth was roughened and armed†. The superior internal margin is thin; the external inferior one is convexly curved, and presents two prominent dentigerous ridges, separated by a groove, and coalescing posteriorly. The external of the two ridges is the more prominent; but the dental tubercles are developed nearly equally on both, being strongest in front and fading away posteriorly into mere undulations; considerable individual differences are also here observable in the number and degree of prominence of these dental eminences. Behind the union of the two dentigerous ridges, this palatopterygoid sends down a short blunt process (x, fig. 9), which seems, most probably along with subjacent cartilage, to have taken a part in the articulation of the mandible, there being no distinct quadrate. Above this articular process the posterior part of the bone projects upwards in a slightly expanded wing or lamina (y), which, bending also a little outwards, comes into contact with the hyomandibular (*hm*, fig. 3) by its thin hinder margin. The outer surface is concave; the lower margin, external to

* *Op. cit.* pl. xx. fig. 3.

† These tubercles are probably the same with those referred to by Dr. Young at p. 309 of his paper, and represented in fig. 7, pl. xx. of his illustrations. Their number is not, however, limited to three rows, nor is their arrangement always linear.

the outer tooth-bearing ridge, is slightly folded outwards, so as to form a ledge along which the maxilla was no doubt articulated; about the posterior fourth of the margin this ledge is suddenly cut off obliquely, probably to allow the passage of the masticatory muscles to the lower jaw.

The bone just described thus forms a powerful palato-pterygoid plate, extending from the hyomandibular and the articulation of the lower jaw to the front of the head, and, as shown by radiating lines seen on impressions of its outer aspect, was ossified from a centre placed below and behind, close to the place of coalescence of the dentigerous ridges. It is not, however, certain that it was the only osseous element in the palatoquadrate arch, as I have in one head seen what seem to be traces of another ossification near its posterior superior angle.

I have not seen the original specimen from which Dr. Young took the figure which he gives as representing the edge of the mandible as seen from above*. But on comparing that figure (which has certainly nothing to do with the mandible) with the bone we have just considered, there seems to me to be little room for doubt that he has mistaken the tooth-bearing edge of a fragmentary specimen of the palatopterygoid for the dental margin of the mandible, and has placed its posterior extremity forwards as well as its lower aspect upwards.

Hyomandibular, Opercular, and Branchiostegal apparatus.—In fig. 3 the form and connexions of the hyomandibular (*hm*) are clearly displayed. It is an elongated bone passing downwards, and with a very slight inclination forwards, from the side of the cranium below the squamosal towards the articulation of the lower jaw, which, however, it does not reach, but terminates a little above and behind it. It shows a marked constriction a little above the middle; the part above this is laterally flattened and somewhat expanded; below the constriction the bone is slender and cylindrical, and increases a little in diameter as it proceeds downwards. There is no symplectic; and the upper element of the hyoid would be, as in *Polypterus*, attached to the cartilaginous lower extremity of the hyomandibular.

Supported by the hyomandibular are the operculum (*op*) and suboperculum (*s.op*). Both bones are somewhat quadrate in shape and higher than long; but the height of the suboperculum exceeds that of the operculum by about one fourth. The posterior-superior angle of the operculum and the posterior-inferior one of the suboperculum are rounded off, while their

* *Op. cit.* pl. xx. fig. 4.

centres of ossification seem placed near their anterior-superior and anterior-inferior angles respectively. In front of these two bones, and covering a portion of the cheek between them behind and the maxillary and suborbitals in front, is a pretty large vertical plate (*p.op*), which occupies a position similar to that of the great præopercular cheek-plate of *Polypterus*. A precisely similar plate occurs in *Eurynotus* and in *Platysomus*; and there is also a quite analogous one in the Palæoniscidæ, though differing somewhat in form. Dr. Young has stated that an *interoperculum* is present, nearly equal in size to the operculum, and which "overlaps the branchiostegals, which are nevertheless enamelled externally." In none, however, of the heads of *Amphicentrum* which I have examined (many of them exceedingly well preserved in this region) have I ever seen any evidence of any such bone.

The *branchiostegal rays* (*br*, figs. 1–3) form a series of flat, oblong, imbricating plates, with finely tubercular enamelled surfaces, which follow immediately upon the lower margin of the suboperculum. They gradually diminish in length as they pass downwards and forwards; and in front an arrangement quite similar to that seen in *Eurynotus* and in the Palæoniscidæ is observable: viz., the anterior plate of each series is much broader than the rest; and between these and behind the symphysis of the jaw is a median lozenge-shaped one.

Circumorbital ring.—The presence of a narrow chain of small *supraorbital* plates (*sr.o*, fig. 3) is evident in several specimens, though their number is not determinable. The same must be said of the *suborbitals* (*s.o*, figs. 1, 2, & 3), the chain of which, attached above to the postfrontal, seems to be very narrow behind. In several specimens a well-marked suborbital of an elongated form is seen, as in fig. 3, curving round the orbit behind; and at the anterior-inferior part of the orbit, and above the front part of the maxilla, is a very large one (figs. 1 & 2), like the so-called lacrymal of most osseous fishes.

Shoulder-girdle.—Attached to the posterior part of the skull, behind the squamous plate, and passing downwards and slightly backwards, largely overlapped by the operculum, is a powerful *supraclavicular* (*s.cl*, fig. 1). It is broad above, getting narrow below, and, like the corresponding bone in the Palæoniscidæ, is perforated by the lateral slime-canal. The presence of an *upper supraclavicular* (*suprascapular*, Owen) is not very clear; there is, indeed, a small plate above the last-described bone and behind the parietal, which may, however, be a "nuchal" or "supratemporal"*. Descending obliquely downwards and a little forwards from the extremity of the great supraclavicular is a very strong and well-marked *clavicle* (*cl*). The vertical or principal part of the bone is elongated, and greatly curved forwards in a somewhat sickle-shaped manner; it is narrow and pointed above, but expands as it proceeds downwards, and at its broad lower extremity becomes suddenly bent inwards at an angle towards the ventral middle line, the portion internal to the flexure being, however, very short. Attached to the front of the expanded lower extremity of the clavicle is still another element, a small *interclavicular* (*i.cl*), like that of *Palæoniscus*, though much less developed.

Conclusion.—As regards the description of the scales, fins, and internal skeleton, I have nothing of consequence to add to what has been already done by Dr. Young. The new facts brought out in this paper regarding the structure of the head, however, render a revision of the generic characters of the fish necessary. They may be summed up as follows:—

Family **Platysomidæ**.

Subfamily *Amphicentrinæ*.

Genus Amphicentrum.

Form deep and rhombic; dorsal and ventral margins elevated into peaks; tail heterocercal, deeply cleft, nearly equilobate. Dorsal and anal fins with elongated bases, many-rayed, nearly equal, commencing immediately behind the dorsal and ventral peaks, their anterior margins furnished with well-developed fulcra; ventrals not discovered; shoulder-girdle provided with interclaviculars. Scales very high and narrow, and in nearly vertical bands (except on the body-prolongation in the upper caudal lobe, where they are small and acutely lozenge-shaped); lepidopleura very strong, exposed area of external surface tuberculated or striated. Præmaxilla, maxilla, and dentary bone of mandible edentulous, sharp-edged; palatopterygoid and splenial bone of mandible furnished with ridges, on which occur small tubercular tooth-like elevations, a patch of small tubercular granulations, like minute obtuse teeth, occurring also on the palate. Suspensorium nearly vertical, slightly inclined forwards.

Two species are known:—*A. granulosum*, Huxley, from the Coal-measures of North Staffordshire and Lanarkshire; *A. striatum*, Hancock and Atthey, from Northumberland.

* I use the term "supratemporal" here in the original sense in which it was employed by Bakker, Cuvier, Stannius, &c.

EXPLANATION OF PLATE IX.

In all the figures the same bones are denominated by the same letters. *f*, frontal; *p*, parietal; *sq*, squamosal; *p.f*, posterior frontal; *a.f*, anterior frontal; *n*, nasal; *p.mx*, premaxillary; *mx*, maxillary; *d*, dentary of mandible; *sp*, splenial, or internal dentary of mandible; *pa*, palatopterygoid; *hm*, hyomandibular; *op*, operculum; *s.op*, suboperculum; *p.op*, præoperculum; *br*, branchiostegal rays; *s.o*, suborbitals; *sr.o*, supraorbitals; *s.cl*, supraclavicular (*scapular*, Owen); *cl*, clavicle (*coracoid*, Owen); *i.cl*, interclavicular.

Fig. 1. Head of *Amphicentrum granulosum*, natural size. The edentulous edge of the maxilla is shown, though posteriorly in impression only; and a portion of the middle of the bone being broken out, the outer denticulated ridge of the more deeply placed palatopterygoid is uncovered. The edentulous margin of the dentary of the mandible is shown at its fore part; posteriorly it is also broken away, and the denticulated ridge of the splenial element has been exposed, by digging away the matrix with a sharp instrument.

Fig. 2. Counterpart of the same specimen, showing the contour and the sculpturing of the maxilla in impression; the edentulous margin, completely shown in the former figure, is a little injured in front. The edentulous margin of the dentary of the mandible, forming a ridge external to the dentigerous one of the splenial, is seen for the greater part of its length, partly in impression.

Fig. 3 is taken from a plaster mould or impression of a head contained in a hard ironstone nodule. In this specimen the cheek was broken away, so as to expose the outer surface of the palate, and the mandible was split through longitudinally. By softening what remained of the bone of these parts with dilute acid, and then carefully picking and brushing it away from the hard ironstone matrix, a perfect impression of the *inner* aspect of the palate, hyomandibular, and mandible was obtained, the configuration and relations of these parts being therefore accurately reproducible in an impression taken from the preparation thus made. Compare the palatopterygoid and mandible thus exhibited *in situ* with the detached bones represented in figures 5, 8, and 9.

Fig. 4. View of a crushed head of *Amphicentrum*, showing, seen from the internal aspect, the edentulous oral margin of the maxilla, both dentigerous ridges of the palatopterygoid, the beak-like præmaxilla, and the somewhat similarly shaped anterior extremity of the dentary of the mandible, as well as the ridges of the splenial or internal dentary of the latter.

Fig. 5. Inner aspect of the internal dentary of the right mandible, taken from the same specimen figured by Dr. Young as "maxilla." Enlarged one half.

Fig. 6. Another specimen of the same bone, seen from the inner or oral side, natural size.

Fig. 7. The same specimen, seen from the outer side.

Fig. 8. The same specimen, seen from above.

Figs. 9 & 10. Two specimens of the palatopterygoid, seen from the oral aspect, natural size. In fig. 9 the posterior-superior thin expansion is broken off; and in fig. 10 the process descending behind to the articulation of the lower jaw is deficient, and indicated by dotted lines.

XXXVII.—*Description of some new Asiatic Mammals and Chelonia.* By John Anderson, M.D., Calcutta.

Anurosorex assamensis, n. sp.

Snout rather long and pointed; tail very short, as in the type of the genus. The seminude parts of the snout, the scaly limbs, and tail are flesh-coloured; the claws are yellow. The fur is nearly erect, fine, and almost velvety; it is longest on the rump, where it projects backwards a considerable way over the tail, almost hiding it. Numerous strong hairs project beyond the general mass of the fur, and are brown with obscure pale tips. Whiskers well developed; shorter hairs above and between the eyes. The general colour of the face dark slaty, marked with brownish rusty on the long hairs of the rump.

Total length from snout to root of tail 2·92 inches, tail 0·50, fore foot 0·50, hind foot 0·75.

Hab. Subsasugu, Assam.

This species is smaller than the Tibetan *A. squamipes*, from which it also differs in its proportionally larger head and slightly longer tail.

Herpestes Rafflesii, n. sp.

Uniformly rich ferruginous, paler on the head and feet. The hairs with no trace of annulation, and in this respect differing from all other Asiatic mungooses; the longer hairs with a glossy lustre; the underlying pile dense and of a pale ferruginous. Ears clad with short hairs. Feet rather large; claws moderately developed. Upper third of tarsus thickly clad. Tail well clad at base, tapering to a point, and neither tufted nor pencilled.

The specimen is in the British Museum, and was received from Sumatra, whence it was obtained by Sir Stamford Raffles. It is a small animal, and I have not been able to take its measurements; but it is a little larger than a ferret, and has a tail as long as its body.

I am indebted to Dr. Günther for the opportunity of describing this animal.

Pteromys yunanensis, n. sp.

A flying squirrel with a large head and a long tail.

Rich dark glossy maroon-chestnut on all the upper parts, the head and back in some being finely speckled with white, which is most marked in the young, and most profuse on the posterior half of the back. In the adult the upper surface of the parachute is of the same colour as the back, and the hairs are uniformly coloured; but in younger individuals some of the hairs have white rings. The sides of the face below the eye and ear are yellowish grey mixed with chestnut, and the chin is dusky. The paws and the margins of the limbs are rich black. The base of the tail in young individuals is more or less concolorous with the back and grizzled; but in adults the grizzling is absent, but the first six or seven inches are chestnut, the hairs being broadly tipped with black, and passing gradually into that colour, which characterizes the rest of the tail. The under parts of the animal are yellowish white, tending in some to a chestnut line along the middle of the chest and belly, and to a darker tint of the same colour on the margin of the parachute. The basal portion of the fur of the upper parts is dark greyish brown, followed by a palish chestnut band, succeeded by dark maroon-chestnut, which may either have or not have a white subapical band, the tip being glossy deep maroon-chestnut, in some verging on black. The fur of the upper parts and tail is long, soft, and silky, while that of the under surface is more woolly in texture. The ears are large and rounded, and clad with very short hairs. Cheek-bristles present.

Length of body 24 inches, the tail being the same.

Hab. Neighbourhood of Zeugyeehen, Yunan.

Arctomys dichrous, n. sp.

This marmot, four specimens of which have been procured from the mountainous country to the north of Kabul, differs from every known marmot in the marked contrast between the colour of the upper and under parts of the animal, and in the harsh texture of its fur.

It has the general form and structural characters of its fellows; but the upper surface is pale rusty yellow, while the sides of the face are dark brown, tinged with the former colour. The chin, throat, chest, and the lower third of the sides, the inferior two thirds of the fore limb, the upper surface of the hind feet, the belly, and inner side of the limbs are all a dark rich brown. The tail is almost concolorous with the belly; but it is here and there tinged with rich rufous brown, the tip paling to nearly yellowish brown.

Length of body from snout to root of tail 17 inches; length of tail $6\frac{1}{2}$ inches.

A full description and figure of this animal will appear in the 'Proceedings' of the Zoological Society of London.

Geoëmyda depressa, n. sp.

Shell much depressed, the depression increasing from before backwards, the shell being somewhat expanded across the inguinal region. Anterior border broad and posterior slightly concave; posterior margin behind inguinal notch serrated. Vertebrals with an obscure ridge. Anal notch moderately deep. Nuchal small. Gulars well developed, anterior border transverse. Shell above light brown, with a blackish tinge on the external border of the marginals. Sternum rather clear yellow; the interval between the axillary and inguinal notches deep black, the outer halves of the pectoral and anal plates being blackish brown, with a partial reticulation extending across the plates; the gulars, postgulars, and anals have also a tendency to be coarsely and irregularly reticulated with the same colour.

Head of animal rather small; upper and lower jaws deep, and area below the nose slightly convex. Limbs large, especially the hind legs; claws strong, and webs well developed. The anterior aspect of the lower part of the fore leg convex, with large umbonate scales, and smaller scales on the dorsum of the foot, a large scale being at the base of each claw. Hind limb covered with small scales, but with a line of enlarged scales along its posterior margin. Tail moderately long, and covered with small rounded scales. The neck-skin loose, and covered with minute scales. Head (in life) leaden; iris brown; neck and skin of limbs pale yellowish brown. Large scales on limbs dark, almost black, with brownish margin.

Length of shell to caudal notch 9 inches, depth through centre of shell 3, breadth at axillary region 5·9, breadth across inguinal notch 6·7; length of sternum 8·1.

Hab. Arakan.

Trionyx nigricans, n. sp.

Carapace rather flattened on the back, with the vertebral groove ill defined anteriorly, but well marked posteriorly. Nuchal swelling broader than in *T. gangeticus*, but not prominent, the carapace on either side being flattened. Alæ of plastron well defined, projecting equally beyond the carapace. Nuchal flap narrow, and covered with rather large nodose folds; and the hinder portion of the cartilaginous margin of the carapace with little nodosities. The rugosities of the osseous carapace coarser than in *T. gangeticus*. The under surface of the thighs and tail and of all the soft parts, including the head and neck, covered with little papillæ. No trace of rugosities on the azygos plate of the plastron visible through the skin. The tail in the female does not reach to the margin of the cartilaginous portion of the carapace.

Colour of the carapace dark blackish plumbeous, with a tinge of olive, due to the presence of blackish spots, among which are intermixed many rusty brown spots, which overlie as it were the black spots. The head, neck, and upper surface of the limbs are almost black; the upper lip in its two posterior thirds is white; and there is a great white blotch over the ear. The area between the neck and the fore legs is whitish; and there are some white spots on the margin of the carapace. The head is reticulately spotted; and there is a distinct infrapræorbital band, and a trace of another above the eyes; but the head is so black that these markings are difficult to distinguish. The under surface of the head and neck is almost black; and the plastron is densely spotted with blackish purple, especially over the bones, and the tail is similarly marked. The claws are yellow.

Hab. Tanks at Chittagong, Bengal.

XXXVIII.—*Further Contributions to the Ornithology of Australia.* By JOHN GOULD, F.R.S.

IT is with great pleasure that I have to draw the attention of naturalists to some interesting novelties which have just been forwarded to me from Australia by Mr. Waterhouse, whose letter on the subject is subjoined.

"South-Australian Museum,
Adelaide, South Australia.
July 15, 1875.

"MY DEAR SIR,—Mr. F. W. Andrews, who for many years has been collecting birds in this colony, and has added from time to time many rare species to the Museum, has just returned from the Lake-Eyre expedition with a good collection of bird-skins. Among the specimens collected I have selected, and now forward to you by this mail, the following, viz.:—

"2 *Amytis*, n. sp., nearly allied to *A. textilis*, but smaller, general colour much lighter; throat white, flanks (probably of the male only) with a rufous streak.

"1 *Cinclosoma cinnamomeum*, sent for comparison, being lighter-coloured and smaller than any specimens which have hitherto come under my observation.

"2 *Ptilotis*, sp. I have frequently received specimens of this bird from the far north, and am doubtful as to the species.

"1 *Melithreptes*, n. sp. This is the finest I have ever seen of the genus: only four were shot, and I send you the best. The collector remarks that when alive they had a bright yellow rim round the eyes. I remain, very truly yours,

"F. G. Waterhouse."

The box so kindly sent to me by Mr. Waterhouse having arrived, I am able to state that the *Amytis* and *Melithreptes* both appear to be new to science. The *Cinclosoma* I cannot separate from the true *C. cinnamomeum*; and the *Ptilotis* will require further comparison. I now proceed to describe the remaining species, the first of which I shall call after Mr. George Woodroffe Goyder, by whose influence and exertions a natural-history collector was sent to the northern territory with the Lake-Eyre expedition.

Amytis Goyderi, sp. n.

General colour fawn, distinctly streaked with white on the upper surface, each white stripe having a dark-brown lateral border on each side, the streaks becoming sandy-coloured on the lower back and disappearing entirely on the rump and upper tail-coverts, which are consequently uniform fawn; tail-feathers brown, with sandy-coloured shafts, the outer feathers rather broadly edged with fulvous; wings brown, the least coverts minutely and the greater series broadly streaked with sandy buff; quills brown, with light sandy-coloured shafts, and externally margined with rufous, the secondaries much more broadly, the innermost with broad fawn-coloured margins all round and streaked down the centre with sandy rufous; lores and sides of face white, the latter narrowly streaked with blackish brown, more distinctly on the cheeks; throat and breast pure white, as well as the centre of the abdomen; the flanks bright fawn-colour, inclining to paler and more sandy rufous on the thighs and upper and under wing-coverts.

Total length 5·5 inches, culmen 0·45, wing 2·1, tail 2·8, tarsus 0·9.

A second specimen sent, probably the female, is tinged with vinous instead of fawn-colour as in the male.

As Mr. Waterhouse points out in his letter, the new *Amytis* is very closely allied to *A. textilis*; but it differs in being fawn-coloured instead of dull brown, with much broader white streaks on the upper surface; it is also distinguishable at a glance by its white under surface and fawn-coloured flanks.

Melithreptes lætior, sp. n.

Head and nape black, as well as the lores and ear-coverts; the cheeks and a band of feathers round the occiput pure white; back greenish yellow, brighter on the rump and shading off into bright lemon-yellow on the hind neck and sides of the latter; tail brown, with a narrow whitish edging at the tip, all but the outer feathers margined with greenish yellow; wings ashy brown, externally washed with grey, the primaries narrowly margined with whitish; under surface of body white, the breast and flanks shaded with ashy, and the chin black, fading into ashy brown on the throat and producing a distinct chin-stripe; under wing-coverts white, shaded with ashy.

Total length 5·5 inches, culmen 0·6, wing 3·4, tail 2·7, tarsus 0·75.

Although very closely allied to *M. gularis*, Gould, this species is altogether a much more finely coloured bird. In size it is slightly larger, and is at once to be distinguished by its white under surface and the beautiful lemon-yellow of the neck. The ashy shade which pervades the entire lower surface of *M. gularis* is not seen in *M. lætior*.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

April 8, 1875.—Joseph Dalton Hooker, C.B., President, in the Chair.

"First Report of the Naturalist attached to the Transit-of-Venus Expedition to Kerguelen's Island, December 1874." By the Rev. A. E. Eaton.

To the Secretary of the Royal Society.

Royal Sound, Kerguelen's Island,
31st December, 1874.

Dear Sir,—It is difficult, owing to the inexactness of the charts, to inform you of the positions of the Astronomical Stations in whose neighbourhood I have been able to work in this island. The German Station is in Betsy Cove, the American at Molloy Point, Royal Sound. The English Stations also are in this Sound, the second being situated about three miles N. by W. of Swain's Haulover. The first English Station is between these last two on the mainland, six or seven miles N.W. of Three-Island Harbour, in what will be called Observatory Bay. Two days before the Transit of Venus, a party under Lieut. Goodridge, R.N., was detached from the first English Station to observe the transit from a position which he selected near the base of Thumb Peak. I have not yet been able to visit Betsy Cove.

Observatory Bay is one of the minor inlets of a peninsula comprised between two narrow arms of the sea. One of these runs up from the sound, along the western flank of the hills adjacent to Mount Crozier, several miles, and terminates at a distance of three or four hours to the north of us, and about four miles from the inlet near Vulcan Cove. The other arm, opening nine or ten miles away to the southward, proceeds in a north-easterly direction to within three or four miles of the former, and no great distance from Foundry Branch.

Besides the inlets of the sea, numerous freshwater lakes present obstacles to inland travelling. Some in this neighbourhood are two or three miles in length; but in general they are not more than a mile long. They are usually shallow, and appear to be uninhabited by fish. The bogs and streams in this vicinity are not impassable, but can be traversed with ease if ordinary care be taken.

The most salient features of the landscape are the basaltic hills, with irregular terraces of rock on their sides, and broken cliffs at their summits. In lieu of grass, their slopes are clothed with banks and boulder-like clumps of *Azorella selago*, excepting where rich damp loam affords a soil suitable for the *Acæna* and the *Pringlea*. Here and there a fern (*Lomaria*) and grass (*Festuca*) grow in the interspaces of the other plants.

The climate of Royal Sound is far warmer and drier than we were led to expect it would be. In November the weather was very pleasant; since then it has deteriorated, though the snow has not again covered the ground as it did when we first arrived. Probably the previous accounts of its meteorology were based upon observations taken in parts of the island where bad weather prevails; or it may be that the condition of the country in winter has been presumed to be constant throughout the year. In one respect we were rightly informed; for, usually, when there is no breeze there is a gale: a calm day is an exceptional event. Meteorological observations are being taken in Observatory Bay on board the 'Volage' and by the sappers on shore.

Corresponding with the unlooked-for superiority in climate, a difference is noticeable in the vegetation of this part of the island. Some plants which occur at both extremities of the country display, in Royal Sound, marks of luxuriance. For instance, *Pringlea antiscorbutica*, which is elsewhere apetalous, here, in sheltered places, frequently develops petals—some flowers in the same inflorescence possessing one petal only, others having two, three, or four. And the petals are not always of a pale greenish colour, but occasionally are tinged with purple. Again, *Lomaria alpina*, which is mentioned in the flora as rare in the neighbourhood of Christmas Harbour, is excessively common and very finely grown here. There are also more species of flowering plants and of the higher orders of

Cryptogamia here than were found by the Antarctic Expedition at the north of the island; but there are fewer species of Mosses, Lichens, and Algæ. Their paucity, in comparison with those of the other district, is probably due to the nature of the rocks on land, and to the seclusion of the bay from the open sea. The additions to the flora are for the most part Falkland-Islands species.

In speaking of the climate, it may be mentioned that the plants of Kerguelen's Island are not (as was supposed) in flower throughout the year; but probably some of them do not cease flowering until late in the winter. When we first arrived in Royal Sound the ground was covered with snow, and scarcely any thing had begun to come out. The *Pringlea* was far advanced in bud, barely commencing to blossom. The *Acæna* was just beginning to burst into leaf. About the first week in November, *Festuca Cookii* came out, and, a few days later, *Azorella selago*. The young fronds of the ferns were just about to unroll. In the third week of the same month, *Montia fontana* and *Acæna affinis* were in flower in a sheltered spot, and *Leptinella plumosa* was first found in blossom. *Galium antarcticum* appeared about the same date. A week later, *Ranunculus hydrophilus* and a *Festuca* (*purpurascens*?) were out, and *Lycopodium clavatum* was sprouting. By the middle of the month, *Triodia* and *Lyallia kerguelensis* and also *Ranunculus crassipes* were in flower, the *Pringlea* was everywhere past flowering (excepting upon the mountains), and *Aira antarctica* began to shoot forth its panicles. Before the end of the month a *Carex* came out; but *Bulliarda* and other plants delayed still.

A few species of Mammals have been introduced into the island. Mice (evidently *Mus musculus*, L.) are common along the coast, and have been found by us in various places. The Rabbits, transported by order of the Admiralty from the convict settlement in Table Bay, have been landed by H.M.S. 'Volage' in Royal Sound. They share with the birds holes of the Petrels, and are (it is almost superfluous to mention) propagating freely. Their favourite food is the *Acæna*; but they occasionally eat *Pringlea*-leaves and gnaw away the green surface of *Azorella*. In the Crozettes, whose climate and flora are said to resemble those of this island, rabbits have become extremely abundant, and so rank and coarse that the sealers will not eat them. Goats are increasing in numbers on the leeward side of the mainland.

Whales and Porpoises occasionally enter the Sound. Old skulls of the latter, wanting the lower jaw, are cast up here and there on the beaches.

Up to the present time, I have captured only two species of Seals—a female Sea-leopard and two males of a Platyrhine Seal. The other kinds frequent the more open parts of the coast and islands.

Twenty-two species of birds at the fewest, perhaps twenty-three, frequent Royal Sound, viz. a *Chionis*, a Cormorant, a Teal, a Tern, a Gull, a Skua, eleven (perhaps twelve) Petrels, two Albatrosses, and three (perhaps four) Penguins. Of these, I have procured eggs of the first six, also of six Petrels, one Albatross, and two Penguins. The *Thalassidromæ* are preparing for laying.

Fish are rather scarce in Observatory Bay. Only three species have hitherto occurred to us, two of which are common under stones at low water. The remains of a *Raia* have also been picked up on one of the islands by an officer of the 'Volage;' but hardly sufficient is left to enable the species to be determined. It is allied to *R. clavata* and *R. radiata*.

The entomology of the island is very interesting. Most of the larger insects seem to be incapable of flight. I have found representatives of the orders Lepidoptera, Diptera, Coleoptera, and Collembola.

The Lepidoptera comprise a species of the Noctuina (as I suppose) and one of the Tineina. Of the first I have not yet reared the imago; the larva is a moss-eater and subterranean: the adult is probably as large as an *Agrotis* of medium size. The species of Tineina is probably one of the Gelechiidæ, judging from the form of the palpi. Its larva feeds on young shoots of *Festucæ*, and sometimes spins a silken cocoon for the pupa. The imago, of which the sexes are alike, has acute and very abbreviated wings, and the posterior pair extremely minute. In repose the antennæ are widely separated and almost divaricate. When the sun shines the adult is active, and, if alarmed, jumps to a distance of two or three inches at a time. During its passage through the air the wings are vibrated.

The Diptera are represented by species of the Tipulidæ and Muscidæ. There are three of the former family. One of them is a small species of the Cecidomyidæ, which is abundant in mossy places, and presents no marked peculiarity. Another seems to be a degraded member of the Tipulidæ. The antennæ have six joints, the palpi two; the wings are ligulate and very minute. It possesses halteres, and the female has the ovipositor enclosed in an exposed sheath. Although it is unable to fly, it lives upon rocks in the sea which are covered at high water, and there it deposits its eggs in tufts of *Enteromorpha*. The third species has full-sized wings; it was caught in the house. The indigenous Muscidæ are very sluggish in their movements, and are incapable of flight. Four species are common about here. One of them is abundant on *Pringlea*, crawling over the leaves. When it is approached it feigns to be dead, and, tucking up its legs, drops down into the axils of the leaves; or if it happens to be upon a plane surface, one need only look at it closely, and it throws itself promptly upon its back and remains motionless until the threatened danger is over, when it gradually ventures to move its limbs and struggle to regain its footing. Its wings are represented by minute gemmules; and it possesses halteres. The ovipositor is extended, its apical joint alone being retracted. The penis is porrected beneath the abdomen, where it fits into a notch at the apex of the penultimate segment. The larva feeds on decaying vegetable matter. Another species occurs on dead birds and animals, as well as beneath stones near the highest tide-mark. It is completely destitute of even the vestiges of wings and halteres. The sexual organs are concealed. It and the preceding species are rather smooth. A third species, slightly hairy, is common amongst tide-refuse and on the adjacent rocks, which are coated with stunted *Enteromorpha*, on which plant, *inter alia*, the larva feeds. It has very small triangular rudiments of wings, slightly emarginate near the apex of the costa, and possesses halteres. The sexual organs are not exposed. The fourth species occurs amongst grass growing along the shore and also in Shag-rookeries. Its linear and very narrow wings are almost as long as the abdomen. It can jump, but cannot fly. The sexual organs are retracted.

A *Pulex* is parasitic upon *Halidroma*, and one (possibly the same species) on *Diomedea fuliginosa*.

Coleoptera are not uncommon. The larger species seem to have their elytra soldered together. There is a small species of the Brachelytra.

Several species of Nirmidæ have been obtained.

Two *Poduræ* (one black, the other white) are plentiful.

There appear to be few species of Spiders, though individuals are numerous. Penguins and some of the other birds are infested with Ticks. The remaining Arachnida are related to *Oribates*.

The Crustacea, Annelida, Mollusca, and Echinodermata in this part of the island have probably been collected by the 'Challenger' more extensively than I have been able to do; therefore I need not particularize further about them than to state that Entomostraca abound in the lakes, an earthworm is common, and a land-snail is very plentiful amongst the rocks on the hills. This last appears to appreciate comparative heat; for specimens obtained in an exposed place, during the frosty weather, were assembled together for warmth under the drip of an icicle.

In Observatory Bay, Cœlenterata are not numerous. One or two species of Actiniidæ on the rocks and *Macrocystis*-roots, and an Ilyanthid in mud, are the only Actinozoa I have met with. The Hydrozoa similarly have afforded only three species—a Corynid, a Campanularian, and a *Sertularella*.

There are several Sponges.

With the exception of *Limosella aquatica*, and perhaps *Agrostis antarctica*, I have obtained all the flowering plants and ferns given in the 'Flora Antarctica' as indigenous to the island. Besides these, *Ranunculus hydrophilus* and another species, a *Carex*, a *Festuca* (probably *F. purpurascens*; but I have no work containing descriptions of the flowering plants), *Polypodium vulgare*, a fern allied to *Polypodium*, and *Cystopteris fragilis* have occurred to me. There is also a plant which appears to belong to the Juncaceæ. *Lycopodium clavatum* and *L. selago* are common about here. None of the Mosses, Hepaticæ, or Lichens have been worked out as yet; but amongst them are one or two species of *Cladonia*, and some examples of *Lecanora paleacea*. Fungi are represented by *Agaricus* (*Psalliota*) *arvensis*, *Coprinus atramentarius*, and a peculiar parasite on *Azorella*, which grows out from the rosettes in the form of a clear jelly, which becomes changed into a firm yellowish substance of indefinite form. There are also some Sphæriacei on grass and dead stems of plants. At present few additions have been made to the marine flora. The larger Algæ in Royal Sound are usually not cast upon the shore by the waves; and I have almost been entirely dependent upon grapples thrown from the rocks for specimens of the more delicate forms. *Polysiphonia Sullivanæ* and *Rhytiphlœa Gomardii* are amongst the novelties. A large number of zoological and botanical specimens have been lost through my inability to attend to them in time without assistance. This has principally affected the number of duplicates; but in one instance it has led to the loss of a species—one of the Petrels, which was the commonest bird about here when we first arrived. Fortunately it is a well-known species.

The 1st of March is announced as the approximate date of our sailing from Kerguelen's Island. Five weeks later I hope to arrive at the Cape and to forward to you such of the specimens collected as require only ordinary care in their transmission. The more fragile things are likely to reach you in better condition if I keep them until my return to England, than they would if they were sent with the others. I am, dear Sir,

Faithfully yours,

A. E. Eaton.

June 10, 1875.—Joseph Dalton Hooker, C.B., President, in the Chair.

"On the Organization of the Fossil Plants of the Coal-measures. —Part VII. *Myelopteris*, *Psaronius*, and *Kaloxylon*." By W. C. Williamson, Professor of Natural History in the Owens College, Manchester.

In his 'Dendrolithen' Cotta first figured some supposed stems under the name of *Medullosa*, to one of which he gave the name of *Medullosa elegans*. Corda subsequently figured a portion of the same plant, in his 'Flora der Vorwelt,' under the name of *Palmacites carbonigerus*, in the belief that it was the stem of an arborescent palm. M. Brongniart next gave to the plant the name of *Myeloxylon*, and at the same time expressed strong doubts respecting its monocotyledonous character. Goeppert gave this plant the generic name of *Stengelia*. In 1872 Mr. Binney expressed his belief that the plant was "the rachis of a fern, or of a plant allied to one." At the Meeting of the British Association at Bradford, in September 1873, the author described this plant, and pointed out his reasons for believing it to be not only a fern, but to belong to the interesting family of the Marattiaceæ; and in the subsequent January Professor Renault read a description of the plant to the Academy of Sciences at Paris, when, on independent evidence, he arrived at the same conclusion, viz. that it was one of the

Marattiaceæ. Slightly modifying M. Brongniart's generic name, M. Renault designates the plant *Myelopteris*.

The author has obtained well-marked examples of this plant from the Lower Coal-measures near Oldham, from a rachis nearly an inch in diameter to the smallest leaf-bearing twigs and leaflet-petioles. It consists of a mass of parenchyma encased in a hypodermal layer of sclerenchymatous prosenchyma, arranged in anastomosing longitudinal bands, separated, when seen in tangential sections, by vertically elongated areolæ of parenchyma, which latter has probably spread out as a thin epidermal layer investing the entire rachis. These fibrous bands project inwards with sharp wedge-shaped angles; and in some examples portions of them become isolated as free fibrous bundles, running vertically through the peripheral portion of the inner parenchyma of the rachis. Numerous vascular bundles run vertically through this parenchyma. In transverse sections, not distorted by pressure, these bundles are arranged in some degree of regular order. This is especially the case with a circle composed of the peripheral series of bundles. Their component vessels are spiral in the case of some of the smaller ones, and barred, very rarely reticulate, in a few of the larger vessels. Scattered abundantly throughout the parenchyma are numerous narrow intercellular gum-canals. The majority of these are isolated; but in most of the specimens there runs side by side with the vessels, and enclosed within the special cellular sheath which imperfectly encloses each bundle, a canal, of varied sizes and shapes, which appears to have been originally a gum-canal, subsequently enlarged irregularly by the shrinking of the neighbouring tissues. In the larger and more matured petioles these vascular bundles are very conspicuous, both in transverse and longitudinal sections; but in the small, young, and terminal subdivisions of the rachides the vessels are so small as to be almost undistinguishable from the surrounding parenchyma, while the gum-canals of such examples are, on the other hand, conspicuously large. Transverse sections of the most perfect examples of these young rachides exhibit, on their upper surface, a rounded central ridge, flanked on either side by a longitudinal groove, which arrangements are so conspicuous in the corresponding portions of the petioles of the Marattiaceæ and of other ferns. The ultimate leaflet-petioles were given off at right angles to the central rachis from which they sprang, corresponding in this respect with *one* of the types described by M. Renault. The author has not yet found in Lancashire any of the large specimens that have been met with on the continent at Autun and in the localities whence M. Cotta obtained his examples. He has found a few and yet smaller fragments among the sections from Burntisland. The recognition of the Marattiaceous character of these plants excludes the *Palmaceæ* for the present from all claim to share in the glories of the Carboniferous vegetation.

The second plant described by the author consists of clusters of roots with a portion of the outermost parenchymatous layer of the stem of a tree fern, corresponding to those of the *Psaronitæ* long known to characterize the upper Carboniferous deposits of Autun and other localities. The roots of the Oldham specimen, to which the author has assigned the name of *Psaronites Renaultii*, consist of a well-defined cylinder of sclerenchymatous prosenchyma, within which has been a mass of more delicate parenchyma, in the centre of which was the usual vascular bundle. But what characterizes the specimens, distinguishing them from the numerous species decsribed by Corda, is the existence of vast numbers of cylindrical hairs, each composed of a linear row of elongated cylindrical cells: these have obviously been the absorbent root-hairs of the living plant, which may possibly have been some species of *Stemmatopteris*; but of this there is as yet no evidence.

The author then describes a small but very remarkable stem, to which he assigns the name of *Kaloxylon Hookeri*. This is a slender stem, rarely more than from one seventh to one tenth of an inch in diameter. In its young state it consists of a central vascular axis which has a hexagonal section, and which is composed of numerous vessels of various sizes, each of which exhibits the reticulate form of the scalariform or barred type, and which is so common amongst the plants of the Coal-measures. No true barred or spiral vessels have yet been seen in the *Kaloxylon*. In the young twigs this vascular axis is surrounded by a mass of large-celled cortical parenchyma, which, in turn, is encased by an epidermal structure, composed of a double row of what have evidently been colourless cells, and which are elongated vertically, but with square ends.

In the more matured stems, the central vascular axis of the young twigs becomes the centre whence radiate six exogenously developed wedges of vascular tissue, each of which enlarges as it proceeds outwards and terminates at its outer extremity in a slightly rounded contour. Each wedge consists of a series of radiating vascular laminæ, separated by numerous medullary rays, which latter consist of long and, for the most part, single vertical rows of mural cells. These six exogenous wedges are separated from each other by a large wedge of cellular cortical parenchyma, the cells of which are elongated radially and have a somewhat mural arrangement. As those between any two contiguous wedges proceed outwards, they separate more or less definitely into two series, which diverge right and left to sweep round the peripheral extremity of each nearest exogenous wedge, meeting and blending with a similar set coming from the opposite side of the wedge. In doing this they form a sort of loop, enclosing a semilunar mass of smaller cells interposed between the loop and the outer end of the exogenous wedge. The author demonstrates that this enclosed cellular tissue is essentially a cambial layer, out of which all the new vessels and peripheral extensions of the medullary rays were developed. Young vessels are seen at its inner surface in process of formation. External to these two specialized cortical tissues there is, in these matured stems, a mass of the primitive cortical parenchyma seen in the youngest shoots, enclosed, as before, in a double layer of epidermal cells.

The author has traced the development of branches from this axis. They are given off from single exogenous wedges in a very peculiar but eminently exogenous manner, the details of which are given in the memoir. But, besides these, other clusters of vessels are given off which have no exogenous development or radiating arrangement. It is not yet clear what these secondary vascular bundles signify.

The author points out the general resemblance between this development of the detached exogenous wedges and that of the 4-partite woody axes of the Bignonias of Brazil, demonstrating at the same time their very marked differences.

Though no traces of leaves have yet been discovered in connexion with these stems, the author has very little doubt that they belong to some Lycopodiaceous plant. The nature of the vessels and the simplicity of their arrangement alike indicate cryptogamic features, at the same time that their mode of development indicates, with remarkable distinctness, that we have here another example of that exogenous mode of development of which the author has already described so many modifications amongst the fossil stems from the Coal-measures. The occurrence of this physiological process of exogenous growth in a stem which, when matured, was little more than one tenth of an inch in diameter, shows that its occurrence is not merely a question of the size of the plant, as some have supposed, but that it has a deeper meaning, and corresponds more closely than has been supposed with the exogenous developments seen equally in large and small examples of living plants.

MISCELLANEOUS.

On a new intermediate Type of the Subkingdom Vermes (Polygordius ?, *Schneider*). By M. Edmond Perrier.

The study of intermediate types becomes of more and more importance in proportion as one knows more of the organization of the creatures constituting the great primary groups of the animal kingdom. The number of these types, formerly very limited, becomes every day greater as the means of investigation and the naturalists devoted to the study of the organization of animals become more numerous. The subkingdom Vermes has proved particularly fruitful in this respect, so much so that, besides the great classes that every one knows, it has become necessary to create small classes to receive some creatures still completely isolated in existing nature—such as the *Sagittæ*, *Balanoglossi*, *Polygordii*, and many others. I had the good fortune at Roscoff, in the products of the dredgings organized by M. de Lacaze-Duthiers at his experimental zoological laboratory, to meet with one of these intermediate types undoubtedly very nearly allied to the singular animals for which Rathke and Schneider created the genera *Rhamphogordius* and *Polygordius*, but most resembling *Polygordius* by its posterior extremity. To avoid the creation of new generic names, I shall designate it *Polygordius Villoti*. I choose this specific name in memory the fine memoir of M. Villot on *Gordius*, to which Schneider, in the following phrase, has so singularly compared the animals in question:—"It may be said that the *Polygordii* are annulated *Gordii* in the same sense that the *Lumbrici*, the *Eunices*, and the *Hermellæ* may be regarded as annulated Ascarides."

This, as may be seen, does not imply a very close relationship. Nevertheless the author of the 'Monographie der Nematoden' employs expressions which might, in this respect, lead to error, especially where he speaks of *Polygordius* as a Helminth, without giving notice, otherwise than in a table of classification, that he gives the name of Helminthes to the subkingdom or, as the transformists say, the whole stock of Vermes.

In fact the *Polygordius* which we examined at Roscoff is distinguished from allied animals by its length, which is more than one decimetre, while the *Polygordius lacteus* and *purpureus* of Schneider only attain a length of about ten millimetres. The diameter of our animal is hardly a millimetre in the middle region of the body; it becomes thinner towards the anterior region, which terminates by bifurcating so as to form two little horns, about one millimetre in length and slightly widened at their base. The body likewise becomes attenuated behind, where it terminates in an obtuse point, which appeared to be destitute of the papillæ characteristic of *Polygordius purpureus*. Our species is of a flesh-colour, darker in the female, lighter and as it were milky in the male, at least near the time of sexual maturity. The sexes are separated in these animals, as in the greater part of the Nemertians and Annelides, which they approach in many respects, although they cannot be placed in either of the two groups. The agility of these worms is extreme: their cephalic region is constantly in motion; and they bury themselves and travel with remarkable ease in the coarse sand in which they live, and where they are found in company with *Dentalium* and *Amphioxus*, at depths from which the dredge brings up also *Terebratulina caput-serpentis*, *Solaster papposus*, *Palmipes membranaceus*, and particularly a charming species of *Zoanthus*, which comes unluckily to invalidate a result which has lately been a little prematurely advanced before the Academy. Notwithstanding its great vivacity, *Polygordius Villoti* is one of the most fragile of animals; it breaks with great facility, and often spontaneously, when we try to preserve it in captivity, so that speedily no more is left than a small fragment of the anterior extremity. This property is in connexion with the partitioning of the general cavity.

Outwardly the body does not appear to be annulated; the mouth is inferior, a little way from the anterior extremity of the body, and of a triangular form; the part of the body which extends before it may be regarded as a cephalic lobe. The eyes are wanting; but there exists on each side, about the level of the mouth, a vibratile pit of oval form, and of which the greater axis is vertical. These pits, the immediate neighbourhood of the mouth, and a small part of the posterior extremity are the only exterior parts of the body which present vibratile cilia. By this character the *Polygordii* are removed from the Nemertians, in the same manner as they are removed from the Annelides by the complete absence of locomotive setæ.

The cuticle is thick, and presents, as in the greater part of the Annelida, a double system of striæ distinctly inclined to one another; and at the interlacing of a great number of these we see the orifice of a tube perforating the cuticle, and which is only the excretory tube, of small clear glands of diverse forms, and situated in the subjacent layer corresponding to the hypoderm of the Annelida. In transverse sections the striated cuticle seems to be formed of a number of superimposed layers. The *hypoderm*, besides the glands which it contains, is clearly decomposable into beautiful polyhedric nucleated cells. Below the hypoderm there is a layer of transverse muscles, of which the perfectly distinct annular fibres are disposed in a single plane. According to Schneider, this layer is absent in the *Polygordii* that he examined; and it is on this fact that he bases the approximation that he has proposed between *Polygordius* and the Nematoids. Beneath the muscular layer the longitudinal muscles are found disposed in thin radiating lamellæ, stretching almost to the intestine, and in no point resembling the muscular bundles of the greater part of the Annelida and *Lumbrici*. In this there is, in fact, something which slightly reminds us of what is seen in several Nematodes; but this is the only point of resemblance that it is possible to find between the animals now under consideration and the parasitic worms. In a transverse section we see all along the median ventral line a thickening, which at first seems to be continuous with the hypoderm, but which a more minute analysis shows to have a more complex constitution. I have reasons for believing that this is the nervous system; but it is a point that requires further investigation. From the summit of this thickening two partitions, symmetrical with respect to the vertical plane, start obliquely, inclined eighty degrees to each other, and ending laterally at the integuments. These partitions extend through all the extent of the ring; and as another vertical partition binds the intestine to the integuments along the median dorsal line, the general cavity is divided more or less completely into four longitudinal chambers. Transverse vertical partitions also divide it into rings completely separated from one another, and identical with the rings of the Annelida.

The digestive tube presents no special glandular appendages; it has neither trunk nor gizzard, only in the neighbourhood of the mouth two lateral longitudinal folds playing the part of lips. It is constricted in passing through the interannular partitions, so as to present the moniliform aspect so frequent in the Annelida. In this region it is surrounded by a sort of muscular sphincter belonging to the septum; elsewhere it presents the ordinary longitudinal and transverse muscular coats. Its internal epithelium, of a green colour, is very strongly vibratile throughout its whole extent from the mouth to the anus. The circulatory apparatus is composed of a dorsal vessel bifurcating in front at the level of the vibratile pits, but also emitting a little lower down two oblique branches directed forwards and joining the vertical branches resulting from the bifurcation. In each ring the dorsal vessel emits a lateral loop; and all these loops seemed to me to terminate in a median ventral vessel. The vascular apparatus of *Polygordius Villoti* is therefore more complicated than that of its congeners, in which there is no ventral vessel and the lateral loops terminate cæcally.

The genital elements are developed on the walls of the body and of the longitudinal partitions in all the rings behind the first four or five. They are free in the general cavity, where in the males the tails of the spermatozoids may be seen floating and stirring about like a sort of vibratile lining, when the heads are still united in a single group soldered to the walls of the cavity. The heads of the spermatozoids are pointed at the pole opposite the tail; they afterwards swell out into a sphere, and then enlarge a little, so as to form a sort of disk, from the centre of which springs the tail. Spermatozoids of this form have been figured in some Annelides. The ova have a vitellus of an orange colour, and often several germinal spots; they cause the female to be of a more decidedly reddish colour than the male. The evacuation of the products of generation is effected by the intermediation of segmentary organs, which are but little folded upon themselves, and vibratile throughout their length.

By these various characters *Polygordius Villoti*, as may be seen, approaches very near to the Annelida; but the absence of locomotive setæ, and the presence of vibratile pits on each side of the head, would tend to approximate it to the Nemertians, from which, however, it is excluded by the absence of vibratile cilia on the integument and the distinctness of the septation. I see no character which justifies at all clearly the approximation of *Polygordius Villoti* to the Nematodes.

I propose to resume shortly the researches which I have commenced on this interesting type; their results will appear in the 'Archives de Zoologie expérimentale' of Professor de Lacaze-Duthiers.—*Comptes Rendus*, April 26, 1875, p. 1101.

On the Development of the Spinules in the Scales of Gobius niger (*Linn.*). By M. L. Vaillant.

The theories admitted by anatomists with regard to the origin of the spinules may be divided into two principal ones: either these processes result from simple notchings of the posterior margin of the scale, and being calcified with the lamella are only a dependence thereof, as supposed by Agassiz and also by Baudelot; or else these parts are developed at the expense of a special blastema as a kind of teeth, the opinion maintained by M. Mandl. Although this latter view is generally abandoned, the following observations show that it may be regarded as correct, at least in certain fishes.

Gobius niger (Linn.), very common on our coasts, has furnished me with the materials for these researches. Its scales, of which M. Baudelot has given a very good description, are of a very simple type, never having more than a single row of spinules on the posterior margin of the concentrically ribbed lamella. This lamella may even exist alone, either all over the body, as in very young individuals, or only on the ventral parts, as in the adult.

In the complete scales the lamella shows a nearly quadrilateral form, the anterior side being rounded, and the posterior side slightly projecting and angular. The number of marginal notches seems never to exceed nine or ten. The focus, which is usually small and circular, is marginal, approaching the posterior margin; the concentric crests are numerous. The epithelium, in which the pigmentary layer is distinct, clothes all the posterior part of the scale and forms a festoon-like marginal mass, in which the spinules are entirely imbedded. The latter appear in an order well described by authors—that is to say, commencing with a median spinule, then lateral pairs; at least this is what anatomical examination leads us to suppose, which always shows the spinules unpaired in number when there are not more than seven; beyond this it is not rare to find an even number, which may no doubt be attributed to the unequally rapid development of the lateral spinules. The observations related here may explain these facts. The length of the spinules differs at the centre and at the sides, of course only taking into consideration the completely developed spinules. The former are sensibly shorter, and the size regularly increases to the spinules nearest the angles; so that all the points, without coming to the same straight line, form an angle a little more open than that of the posterior margin of the lamella; only the point of the spinules projects slightly beyond the epithelium, which shows at this point particularly well the pigmentary masses distributed in two layers—the first bordering the lamella at the base of the spinules, and the second formed of usually isolated chromoblasts placed in the interspinular spaces all at the same level, producing a very elegant design.

The epithelial cells, it is very important to notice, are of extreme delicacy; simple contact with the sea-water, even only for ten minutes, swells them, breaks them up, and transforms the whole into a magma in which it becomes impossible to detect the relations of the parts. To repeat the observations it is absolutely necessary to have a fish not only fresh but living; in this respect *Gobius niger* is a particularly favourable species, as it may be preserved several days with very little trouble in a very small quantity of sea-water. As soon as the scale is taken off it ought to be placed quickly under the microscope to examine it at once; if it be desired to continue the observation, the tissues must be hardened immediately by the use of reagents, such as alcohol, solutions of chromic acid, picric acid, &c. By these means the preparations are preserved so well that, with precautions, they may be mounted in Canada balsam.

Under suitable conditions, on nearly all the scales there will be found, outside the perfect spinules, two of these organs, one on each side, in course of development; and by multiplying the observations, we may form a clear idea of the origin of these parts.

In the most rudimentary state that I have been able to observe, the spinule is reduced to a sort of flattened cone, 0·03 millim. in diameter at its base, and of about the same height. It is surrounded by cells measuring from 0·009 to 0·014 millim., resembling the other epithelial elements in their aspect and dimensions, but distinguished from them nevertheless by their arrangement in a more or less spherical mass. The cone is composed of a very finely granular substance, especially after the action of certain reagents, such as acetic acid; it must be regarded as intended to furnish the materials necessary for the growth of the spinule—in fact as the *spinular papilla*, the spherical mass representing a true *follicle*.

A little later the follicle becomes less distinct, and even disappears completely; at the same time the other parts become more complicated. The papilla always remains in the same state, and nearly in the same form; but its point is as it were hooded by a transparent hyaline sheath, the first rudiment of the dentinous substance which will form the perfectly developed organ. At this time, if the preparation is treated with acetic acid, the tissue of the papilla becomes granular, while the sheath becomes pale; no effervescence or sensible diminution of volume is observed, which must be attributed to the small quantity of calcareous matter which the tissue then contains compared with the abundance of the organic part.

The development is continued to the complete state by the gradual augmentation of the dentinous cone. One of the first effects is to hide the papilla; then the point lengthens, and ends by piercing the epidermic festoon.

The papilla seems to persist even in the perfectly developed spinules. On treating the scale with a strong acid (such as hydrochloric or nitric acid) to get rid of the calcareous salts, we see the aspect of the spinules become greatly modified. The length becomes scarcely half that of the entire organ; the granular substance constituting the papilla appears in the form of a sort of basal bud, produced, towards the free margin of the epidermic mass, by a cylinder formed of the same substance. In the young spinules the papilla alone remains; in the perfect spinules the cylindrical prolongation is hooded by the organic substance of the decalcified dentine, persisting under the appearance of a transparent, elastic, hyaline layer, in which a sort of fibrous longitudinal structure may be made out. Under the action of the reagent, and in consequence of the disengagement of carbonic acid, this gas is very often accumulated under the epidermis, between the lamella and the row of spinules, and separates them, putting the discontinuity of these parts beyond a doubt.

The study of these facts leads, in the first place, to the conclusion that in these animals the spinules and the lamella are developed independently of each other; and if we take into consideration the relations of these parts to the surrounding tissues, the former belong to the epidermis, and the latter to the deeper part of the integuments—that is to say, to the dermis. Secondly, if we consider these organs in the whole of the class of Fishes, we are led to regard the scales of these Ctenoids as a sort of intermediate type. In the eel, in *Rypticus*, *Grammistes*, and certain Blennioïdei the scale, reduced to the lamella, is subepidermic and destitute of spinules: in the sharks and rays the hard portions of the integuments have quite another origin; they are epidermic. It will therefore be legitimate in *Gobius* and analogous fishes to compare the lamella to the deep-seated scale of the eel, and the free spinules to the scutella of the Plagiostomi.—*Comptes Rendus*, July 19, 1875, p. 137.

On the Larval Forms of the Bryozoa. By M. J. Barrois.

To the type represented by *Alcyonidium* may be referred a numerous series, the whole of which constitute our *first larval form.* In all the representatives of two great divisions of the Bryozoa, the Chilostomata and the Ctenostomata (Alcyonidiina and Vesiculariæ), the development presents, as in *Alcyonidium*, three principal phases:—1, segmentation to the thirty-two stage; 2, formation of the *gastrula*, and production of the *bell-shaped stage*; and, 3, histological differentiation and completion of the organs.

The first two phases are identical throughout, and the bell-shaped stage is always reproduced with the same regularity. The third stage, on the contrary, may differ according to the genera, and the greater or less importance of the changes produced in it; we pass through all states of transition, from the most simple forms, as nearly as possible representing the bell-shaped stage in a permanent state, as in *Alcyonidium*, to the most complex and aberrant types. It is among these last that we must place *Cyphonautes* and the larvæ of the Vesiculariæ, which we shall take here as examples of forms thus modified.

The phenomena which occur in *Cyphonautes* during the third stage of development, after the bell-shaped stage, may be reduced to two fundamental processes:—

1. The furrow which will form the disk, instead of being produced in the middle of the dorsal surface, is produced near the summit, from which results a considerable reduction of that organ and a corresponding extension of the uniting membrane, which thenceforward forms the greater part of the dorsal surface.

2. The ventral surface tends to become invaginated inwards, and the crown to begin to close above by applying to each other its two opposite margins; in this way the vestibule and the bilateral form

of the embryo are produced; the cincture becomes the ciliary fringe of the vestibule, and the uniting membrane the body of the *Cyphonautes*. The test is a simple chitinization of the two halves of the uniting membrane. The disk, situated between these two halves, is, after the formation of the test, included between the two valves, and thenceforward begins to undergo a complete retrogradation.

These embryogenical results are confirmed by the comparison of the different types. Between the two extreme forms *Alcyonidium* and *Cyphonautes compressus*, two new types of transition (*Eucratea* and the *Cyphonautes* of Saint-Vaast) establish an intimate connexion, and constitute an uninterrupted chain, which enables us to trace with certainty the homology of the various organs.

The larvæ of the Vesiculariæ appear, when hatched, in the form of a regular ovoid, slightly flattened at each pole, and having a general covering of long vibratile cilia. At each pole there is a less coloured spot, indicating the presence of a special organ; the spot at the upper pole is slightly prominent, and that at the inferior pole completely flat; the portion of the ovoid situated between the two poles is covered with long, characteristic ribs, and bears, in a longitudinal direction, an aperture resembling the pharyngeal fissure of *Alcyonidium*, and, like it, surmounted by a vibratile tuft. Lastly, to each of the above-mentioned spots there corresponds a system of organs which the opacity of the embryo prevented my distinguishing with the desirable precision.

The phenomena which produce this strange structure result, as in all other cases, from modifications of the bell-shaped stage. They consist simply in an exaggerated development of the crown, the dorsal and ventral parts behaving exactly as in the ordinary larvæ; but each of the cells of the crown undergoes a considerable growth in a longitudinal direction, and becomes converted into a rib occupying the whole length of the embryo. At the close of the development the whole of these ribs forms a sort of sheath, at each extremity of which projects the rest of the dorsal and ventral surfaces in the form of dark-coloured spots.—*Comptes Rendus*, September 6, 1875, p. 443.

On the Migrations and Metamorphoses of the Marine Endoparasitic Trematodes. By M. A. Villot.

The marine endoparasitic Trematodes have been much less studied than their terrestrial and freshwater congeners, and we still know little of their development. Hitherto isolated facts have been collected merely by chance, and very little anxiety has been shown to find a method which might serve to combine these with each other. Experiment, to which most investigators have had recourse, in such cases could not serve this purpose; for, even in case of success, it always leaves a great uncertainty as to the normal host of the parasite. The true course to follow consists in seeking by observation, with the aid of the principle of harmonious correlations, the various animals successively inhabited by the parasite, and thus establishing the series of its metamorphoses. We must study the habits of the definitive host, know its mode of feeding, and the fauna of the localities which it frequents, if we wish to work up to the origin of the parasites it harbours, and ascertain their migrations. By proceeding in this manner, I have been able this year to make some observations which I think are interesting, and to which I now desire to call the attention of naturalists; they have enabled me to ascertain some curious correlations between the conditions of existence of the Helminths, mollusks, crustaceans, and birds that live on our shores.

The sea-lark (*Tringa alpina*), which is so common on all our sandy or muddy shores, usually contains in its intestines two very different *Distoma*. One of these belongs to the group of the armed *Distoma*, or *Echinostoma*, and may probably be referred to *D. leptosomum* of Creplin. It is a fine species, well characterized by its dimensions, which attain 0·010 metre in length and 0·001 metre in breadth; by its ventral sucker, which is greatly developed and not far from the buccal sucker, by the scaly papillæ which cover its body, and the collar of large spines which surrounds its head. The other, which is perhaps *D. brachysomum*, a doubtful species imperfectly described by Creplin, is distinguished from the preceding by its size, which does not exceed 0·001 metre, by its equal and very small suckers, by its scaly penis, by the posterior part of its body being short, broad, and entirely filled by the oviducts, and by other characters, into the details of which I cannot here enter.

These two *Distoma* only become adult in the intestine of *Tringa alpina*; and we can easily follow their development by examining with the microscope the various parts of the digestive tube of that bird. To have them in the larval state and still enveloped in their cysts, we have only to open the gizzard: there we find them, often in considerable number, mixed with débris of all kinds and with the sand required for the trituration of the food. The cysts of *D. leptosomum* are only 0·080 millim. in diameter, and are formed of a very thin, perfectly transparent, double envelope. In their interior we may distinguish a little *Distomum* rolled up, and still destitute of genital organs, but already recognizable by its cephalic armature. Those of *D. brachysomum* are larger, thicker, and of a strong yellow colour; they are 0·200 millim. in diameter. Their envelope is 0·012 millim. in thickness, and consists of two layers which are very distinct in their structure, the external one being formed of fine radiated canaliculi, and the internal one composed of concentric layers. The parasite enclosed in this as yet possesses only rudimentary generative organs; but the form of its digestive apparatus and the proportions of its suckers can leave no doubt as to its specific identity. The cysts remain in the gizzard for a longer or shorter time, and then pass into the duodenum, where they undergo the action of the digestive juices. Their envelope is soon dissolved, and the young *Distomum* set at liberty. It then slowly traverses the numerous folds of the small intestine; but during this course its genital organs are developed, and when it arrives in the rectum its ova are mature, fecundated, and ready to be eliminated.

It remained to learn in what invertebrate animals the Cercariæ encysted themselves. I can tell this now, thanks to the method above indicated. The Cercariæ of *D. brachysomum* are encysted in small Isopod crustaceans belonging to the genus *Anthura*, and to a species very common on the shores of the English Channel—namely, *Anthura gracilis*, Leach. The Cercariæ of *D. leptosomum* become encysted on the siphons and in the foot of a small Acephalous mollusk, which lives at a small distance from the shore—*Scrobicularia tenuis*. This mollusk and crustacean, with a few larvæ of Diptera, constitute the ordinary nourishment of *Tringa alpina*.

I have also observed other encysted Cercariæ which are parasitic on Crustaceans, but of the subsequent development of which I am ignorant. One occurs in *Mysis*, and is distinguished by the larger size of its two suckers. The other inhabits the visceral cavity of *Ligia oceanica*, and is remarkable for its large dimensions: its cyst is 0·280 millim. in diameter and 0·032 millim. in thickness.

Scrobicularia tenuis has furnished me with three species of sporocysts, which perhaps belong to the *Distoma* of which I have spoken. The Cercariæ which issue from them are very fine. Two of them appear allied to *C. dichotoma* and *C. setifera*, found in the free state in the Mediterranean by J. Müller. The third is certainly new, and is characterized by its tail, which is furnished with very short setæ arranged in rings.

I may also mention, in conclusion, three remarkable types of which I only know the adult form:—a *Monostomum* with a winged head and large sucker, which lives in the intestine of *Strepsilas interpres*; a *Holostomum* with scaly integuments, parasitic in the same bird; and a gigantic *Distomum*, a parasite of *Echinorhinus spinosus*, which was described by Risso under the name of *D. scimna*, and which I have just detected at Roscoff in the same Selachian. The large size of this last species, and the consistency of its organs, particularly fit it for histological investigations; I shall give its detailed anatomy in a memoir that I am now preparing.—*Comptes Rendus*, September 13, 1875, p. 475.

Bathybius.

According to some observations of Prof. Wyville Thomson, communicated by Prof. Huxley to 'Nature' (August 19, 1875), *Bathybius* probably consists of sulphate of lime precipitated in a flocculent state by strong alcohol.

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XXXIX.—*Contributions to the Study of the chief Generic Types of the Palæozoic Corals.* By JAMES THOMSON, F.G.S., and H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E., Professor of Natural History in the University of St. Andrews.

Introduction.

THE object of the present communication is to consider briefly the characters of the leading *types of structure* which may be recognized amongst the Palæozoic Corals, irrespective of the question as to whether these types constitute what would technically be called "*genera*" or not. Indeed, as we shall hereafter point out at greater length, the modern development of the doctrine of Evolution has rendered any rigid definition of what constitutes a "genus" an entire impossibility. So far as this point is concerned, each observer must be left, within certain limits, very much to his own judgment. In carrying out the purpose which we have at present in view, it is most convenient to adopt a stratigraphical rather than a zoological arrangement; and we shall therefore commence with those genera which occur in the Carboniferous period. It may be added that only those types will be considered of which the material now in our hands is sufficient to allow of something like a complete elucidation.

The method of investigation pursued has, in the main, consisted in slicing and polishing the specimens in different directions, and in preparing thin sections for microscopic examination. It seems almost needless to point out that in this way, and in this way only, can any thing like a complete knowledge be obtained of the actual and essential points of structure in the fossil corals. Due weight, of course, should be given to external characters; but we feel satisfied that the above method of investigation is the only one which is capable of leading to really sound and reliable conclusions, in spite of the great labour and expense which must be attributed as drawbacks to the process. That the general application of this method of investigation to the fossil corals should in some instances yield unexpected results, or possibly even somewhat derange existing classifications, is hardly more than might have been anticipated. At the same time, in accordance with a well-known scientific canon, we should not be justified in hoping that even experts will at first accept all the conclusions at which we have arrived, unless they are willing to adopt the same method of investigation *.

Hitherto the specific determination of the fossil corals of the Palæozoic formations has very frequently been based upon those points of structure or form which can be made out simply by an examination of the external surface, or of fractured specimens. Only in comparatively few instances have observers had recourse to the more complete research implied by the making of properly prepared sections. That the Palæozoic corals form a group in many respects peculiarly difficult to study cannot be denied; but we believe that the difficulties of the case have been much increased by the imperfect modes of investigation which have been in general employed. To this it must be added that few collections of Palæozoic corals, either public or private, are at present in such a condition as to admit satisfactorily of critical study.

The generic distinctions amongst the Palæozoic corals have usually been based upon the characters of the septal system, the presence or absence of a columella and its characters when present, the existence or non-existence of dissepiments and their form and disposition when present, the nature of the tabulæ, the characters of the wall and exothecal structures, and the general form and mode of growth of the corallum.

* Our collections embrace several thousands of cut and polished specimens of the Palæozoic corals, together with a large number of thin sections for microscopic examination, irrespective of very many that have been left in their native condition. No one, who has not learnt by actual experience, can properly appreciate the great expenditure of time, labour, and money involved in thus preparing for examination a large series of fossil corals. Even as it is, much of the material in our hands is still comparatively unavailable from its not having been submitted to these necessary preliminaries.

No one of these characters, however, can be safely relied upon as, of itself, sufficient for generic distinction; and it seems certain that genera should be founded upon a due consideration and estimation of *all* the morphological characters of the corallum.

As investigated by the method which we have employed, the corals of the Palæozoic period very strongly support the view that they owe their structural peculiarities to some form or another of evolution. Whenever a sufficiently large number of specimens of any given group can be obtained, and submitted to examination by means of sections, a complete passage is usually found to exist into other allied groups. So complete is this transition, and so gradual are the steps by which it is effected, that it becomes impossible for the most painstaking observer to draw any hard-and-fast line of demarcation between such inosculating groups. On the contrary, he is constantly confronted with examples that might be indifferently referred to one or the other of two groups, and which he therefore finds it impossible to place definitely otherwise than as central links in a connected series.

Whilst the important result just enunciated is in many instances capable of complete demonstration, it nevertheless remains certain that in all such anastomosing groups it is possible to pick out certain examples which may be regarded as representatives or *type forms* of the groups. Such forms constitute centres from which their respective groups diverge in different directions; and they are not only constant in their characters, but differ from the intermediate forms in being readily and certainly recognizable, and capable of easy reference to a definite position.

It seems almost unnecessary to mention that these results are not only precisely what would have been expected upon any theory of Evolution, but that they are in complete accordance with the results arrived at by observers in other departments. We may instance more especially the Foraminifera, the Ostracoda, and the Graptolitidæ in support of this statement. Upon any theory of Evolution, allied groups must be linked together by a more or less crowded series of intermediate forms. The advocates of all hypotheses of this nature are therefore compelled to hold that genera and species are merely arbitrary divisions, and that they cease to have any existence in reality the moment we obtain a complete series of transitional forms.

It still remains to consider the course which should be adopted *in practice*, when we come to deal with these connected and inosculating groups for the purpose of systematic study. One course would be to throw all such forms together, as constituting a single "genus," and to consider the different types of the series as so many "subgenera." The objections to this course, however, are twofold. In the first place, as our knowledge increases, and as we obtain a more complete series of forms uniting different groups together, our genera would undergo a proportionate expansion and increase of size, until, in the case of fossil forms at any rate, they would become utterly unmanageable. A "genus" might in this way come ultimately to include all the forms which now constitute a "family;" and from the number and variety of the forms included in it, there would be great difficulty in giving it any precise definition. In the second place, "subgenera," however appropriate and justifiable in theory, are nearly useless, if not absolutely obstructive, in actual practice. We think most working naturalists will bear us out in this view, at any rate so far as concerns all cases where we cannot obtain *complete* materials for determination and examination, as we never can in the case of fossils.

On the other hand, the course may be adopted of selecting certain well-marked and easily recognizable "types," and of giving to these distinctive names. By adopting such a course the actual practical work of determining and classifying specimens is enormously facilitated; and it does not matter to the observer, though his "types" be connected together by a gradational series of transitional forms. He does not thereby hamper his theoretical conceptions as to what constitutes a "genus" or a "species;" nor is he pledged to believe that his selected types are all of the same value. He is not even bound to express a positive opinion as to whether his "types" are to be regarded as "genera" or as "subgenera." This, indeed, must be a comparative matter of indifference to him, since, upon all theories of Evolution, these terms are of merely conventional value, elastic, and incapable of precise definition, and owing their existence at all, in any definite form, to our own imperfect knowledge. Nor does it seem that the reproach can justly be made that the adoption of this course opens the door to a wide and undesirable multiplication of names. "Subgenera" have distinctive names applied to them just as much as "genera," with the disadvantage that they are infinitely more perplexing and more difficult to work with.

In working out the Palæozoic corals we have thought it best to adopt the course above indicated. We have chosen certain structural "types," which the observer can always recognize with certainty when he is provided with properly prepared specimens; and to these we have given distinctive names, where such did not exist before. We do not for a moment deny that in many instances these types can be shown to pass into others by regular and almost imperceptible gradations, and that possibly all of them may, some day, be shown to be similarly connected with one another. Nor are we prepared to maintain that all these types, even where they have by common consent been regarded as of generic value, are so distinctively separated from others as to deserve the name of "genera," in the ordinary acceptation of this term. We have had, however, to face a difficulty which will increasingly meet the worker in any department of Invertebrate Palæontology; and we think that this is, in the meanwhile, the best practical solution of it. Even if a better solution of the difficulty be ultimately found, no retardation or impediment to the progress of science in this department will result from our present adoption of this course. No type will be described by us which is not at the same time accurately figured; and the *facts* thus recorded will remain unchanged, and will retain their value, whatever alteration may take place in our method of interpreting them.

[To be continued.]

XL.—*Descriptions of new Mammalia from Persia and Balúchistán.* By W. T. Blanford, F.R.S.

The following descriptions have been in print for more than a year; but, owing to unforeseen delays, the work on Persian zoology in which they appear has not yet been published, and it is, I hear, likely that some time must elapse before it will be ready. Under these circumstances it appears to me desirable to describe the species of Mammalia supposed to be new, so as to avoid confusion of synonymy from the delay.

1. *Vespertilio desertorum*, Dobson, MS.

V. fusco-fulvus; auribus magnis, ad apices rotundatis, margine exteriore juxta apicem emarginata, inde ad basin tragi recta, concha punctis glandularibus confertim instructa; trago longo, angusto, acuto, margine interiore convexiuscula, exteriore concava; digitis tertio quartoque fere æqualibus; vertebra ultima caudæ membranam excedente; alis a basi digitorum pedum orientibus.

Long. corporis cum capite 2·1, caudæ 1·65, auris 0·65, tragi 0·35, radii 1·65, tibiæ 0·8 poll. Angl.

Hab. ad Jalk, Balúchistán.

The description is by Mr. Dobson, who very kindly examined and determined the few bats which I collected in Persia, as he had previously described those obtained by Major St. John (Journ. As. Soc. Bengal, 1870, vol. xl. pt. 2, p. 455).

2. *Erinaceus macracanthus*, sp. nov.

E. affinis *E. aurito*, Pall., aculeis longioribus, ad tergum posticum sesquipollicaribus, nigris, basin versus albido biannulatis; corpore subtus pilis longiusculis albidis, ad latera partim atque postice omnino fuscis induto; pedibus fuscis.

Long. tota 9·5, cranii 2·2, caudæ 1·25, auris 2, palmæ 1·2, plantæ 1·5 poll.

Hab. in Carmania.

This hedgehog is distinguished from all allied species by its long spines and the coloration. It is most nearly allied to *E. megalotis*, the Kandahar species; but the spines are longer, and entirely black towards the ends in the adult.

3. *Vulpes persicus*, sp. nov.

V. pallidus, rufescenti-isabellinus, fronte ferruginea; auribus extus pallide rufis, apices versus nigris, marginibus isabellinis; pilis dorsalibus pallidis, canescentibus, plerumque nigro terminatis, postice magis rufis, vellere purpurascenti-cinereo, lanoso, longo; lateribus ventreque pallide isabellinis, vellere cinerascente vel albido; cauda rufescente vel isabellina, subtus pallidiore, apice albo vel nigro nullo; pedibus extus rufis, nonnullis pilis nigris sparsis immixtis.

Long. corporis cum capite (ad corium exsiccatum) circum 24, caudæ 14, auris 3·5, pedis posterioris cum tarso 5, cranii 5·15 poll.

Hab. in Persia, circum Shiraz, Isfahan, &c.

A near ally of *V. leucopus*, Blyth, but larger, with much larger teeth, and differently coloured.

4. *Meles canescens*, sp. nov.

M. affinis *M. Taxo*, sed minor, canescenti-griseo, haud fusco, dentibus posticis angustioribus.

Hab. in Persia circum Isfahan, &c.

This badger is much paler in colour than the common European species, and exhibits many cranial differences. A stuffed skin measures 2 feet 9 inches from the nose to the insertion of the tail. The skull is 5·1 inches long, 2·9 broad. It is broader between the orbits, and the nasal portion is shorter, than in *M. Taxus*; and whilst the last upper molar in a series of skulls of the European badger varies in the proportions of its breadth to its length between 1 : 1·12 and 1 : 1·2, in *M. canescens* the same tooth exhibits the ratio of 1 : 1·35.

5. *Sciurus fulvus*, sp. nov.

S. affinis *S. syriaco,* sed valde pallidior, dorso griseo rufescente, antice magis rufo, gastræo isabellino, fronte rufa, genis isabellinis ; cauda media superne ferruginea, ad latera subtusque fulva, multo breviore quam corpore ; auriculis haud penicillatis.

Hab. in quercetis haud procul ab urbe Shiraz in Persia.

A stuffed specimen measures from nose to rump 7 inches, tail to the end of the hairs $7\frac{1}{2}$, fore foot $1\frac{1}{4}$, hind foot 2·1.

6. *Myoxus pictus*, sp. nov.

M. dorso pallide rufescenti-murino, gastræo albido, margine rufa colorem dorsalem a ventrali utrinque secernente, et ad femora, humeros lateraque colli infra aures in maculas ferrugineas dilatata ; facie antice a fronte pallida, grisescente, utrinque fascia nigra a nari ad extremitatem anteriorem auris ducta, regionem ocularem amplectente, marginata ; mystacibus superioribus nigris, inferioribus albis ; auribus rotundatis, parum pilosis, fere nudis ; cauda corpus longitudine subæquante, ubique hirta, pilis longis induta, supra grisea, subtus albescente ; pedibus parvis, supra albis, subtus pallidis.

Long. corporis cum capite 3·5, caudæ 3·5, auris 0·6, palmæ 0·4, plantæ 0·78 poll.

Hab. ad Kohrud in Media (Persia hodierna septentrionali).

Near *M. Dryas,* but distinguished by the tail being whiter in colour, by the presence of a patch of red hairs beneath the ear, by the ears being larger and more hairy, and especially by the smaller feet, the sole of the hind foot measuring nearly an inch in *M. Dryas*, whilst it only measures 0·78 in the present species.

For the above distinctions I am indebted to Professor Peters, who obliged me by comparing a specimen which I sent to him for the purpose, as there was no specimen of *M. Dryas* in London.

7. *Mus erythronotus*, sp. nov.

M. supra ferrugineus, nigrescente lavatus, lateribus magis rufis ; infra albus, coloribus bene discretis, haud transeuntibus ; cauda fere nuda, corporis longitudinem subæquante ; auribus magnis, rotundatis, fere nudis ; pedibus superne albis, plantis nudis, fuscis ; mammis 6, duabus pectoralibus, quatuor inguinalibus.

Long. corporis cum capite circum 4, caudæ 4·2, auris 0·55–0·7, lat. ejusdem 0·45–0·5, long. palmæ 0·4, plantæ 0·9 poll.

Hab. ad Kohrud in Media.

This mouse is allied to *M. sylvaticus.*

8. *Gerbillus persicus*, sp. nov.

G. affinis *G. indico*, supra ferrugineus, infra albus; cauda corpus longitudine excedente, superne rufescenti-brunnea, apicem versus nigra, subtus albida, ad latera haud pallide striata; auribus longis, sed minoribus quam in *G. indico*, parum pilosis, plantis latioribus, subtus sordide viridescentibus, vibrissis longioribus confertioribusque; dente molario superiore postico in adultis simpliei rotundo.

Long. corporis cum capite 6·25, caudæ (vertebrarum) 6·5, pilorum ultra apicem 1, cranii 1·75, auris 0·85, palmæ 0·6, plantæ 1·55 poll.

Hab. in Persia.

This species, though very near *G. indicus*, is at once distinguished by wanting the dark line down the lower surface of the tail; the shape of the skull, too, is very different.

9. *Gerbillus nanus*, sp. nov.

G. parvus, longicaudatus, cauda corporis longitudinem duplam æquante, supra cervinus, infra albus, genis superciliisque albidis; cauda superne brunnea, subtus albescente, apice vix fuscescente, pilis apicalibus vix elongatis; auribus mediocribus, fere nudis; mystacibus plerumque albis, superis ad basin fuscis.

Long. capitis cum corpore 2·6, cranii 1·05, caudæ (pilis apicalibus inclusis) 5, auris 0·45, plantæ 0·9 poll.

Hab. in Gedrosia (Balúchistán).

One of the smallest forms of the genus. A very closely allied species is common on the Abyssinian coast of the Red Sea, and was, probably incorrectly, referred by me to *Dipus Gerbillus*, Olivier.

10. *Dipus Loftusi*, sp. nov.

D. supra fusco-isabellinus; pilis mollissimis, basin versus pallide griseis, ad uropygium duntaxat nigro terminatis; subtus albus; femore extus fascia lata alba transversa signato, postice haud fusco; mystacibus brunneis; auribus rotundatis, mediocribus, intus extusque pilis sparsim indutis; cauda supra brunnea, subtus pallida, apicem versus nigra, albo terminata.

Long. corporis cum capite 5–6, caudæ (vertebrarum) 6, pilorum ultra apicem 0·75, auris 0·75, tarsi cum pede posteriore 2 poll. (dimensionibus ad corium exsiccatum mensis).

Hab. ad Mohumrah in Mesopotamia (teste Loftus).

This species belongs to the subgenus *Scirtopoda*, section *Haltomys* of Brandt. It is distinguished from all its allies by its colour and proportions. The only specimens I have seen are in the British Museum, and form part of the collections brought by the late Mr. Loftus from the banks of the Euphrates.

11. *Lepus craspedotis*, sp. nov.

L. supra fuscus ex nigro cum isabellino vermiculatim mixto, pilis mollissimis basin versus pallide cinereis, juxta apicem nigris, isabellino terminatis; subtus albus; nucha, collo posteriore pectoreque fusco-rufescentibus; auribus magnis, extus brunneis, postice apicem versus nigris, intus fere nudis, margine posteriore isabellina, anteriore pilis longioribus albidis induta, apicem versus nigra; cauda supra nigra, ad latera subtusque alba.

Long. corporis cum capite 15, caudæ (vertebrarum) 3·5, auris 6 poll., lat. ejusdem 3·25, long. tarsi 4·25 (dimensionibus ad feminam nuper occisam mensis).

Hab. in Gedrosia.

This hare differs greatly from all Indian species, and resembles *L. mediterraneus*, but it is less rufous and has much larger ears. A still more nearly allied form is a hare imperfectly described by Dr. Gray (Ann. & Mag. Nat. Hist. 1867, ser. 3, vol. xx. p. 222) as *Eulagos judææ*: this, however, is larger, the tarsus measuring 5·1 inches; and the fur is differently coloured.

XLI.—*Descriptions of new Species of New-Zealand Fish.* By F. W. Hutton, Curator of the Otago Museum.

Toxotes squamosus.

D. $\frac{5}{23}$. A. $\frac{3}{23}$. P. 20. V. 1 | 5. L. lat. 85. L. transv. 11/18.

Length twice and a third the height of the body, or nearly four times the length of the head; length of the snout equal to the width between the orbits. A single row of teeth on each palatine bone, none on the vomer; teeth in the jaws cardiform, the exterior row on the intermaxillaries larger. Diameter of the eye goes three times and a half into the length of the head. Maxillary extends back nearly to the vertical from the centre of the orbit. Operculum, præoperculum, and maxillary scaly, their margins smooth. Dorsal and anal fins covered with scales; the first soft ray of the dorsal and anal longest, behind which the fins suddenly contract and then maintain a uniform level along the tail. Pectorals long and pointed. Ventrals small, with a set of elongated scales just above the base of each. Caudal deeply forked, the lobes equal to the length of the pectorals.

Colour uniform silvery, getting darker on the back.

Total length of the specimen 22 inches.

Hab. Cook Straits.

This description is from a stuffed specimen belonging to W. T. L. Travers, Esq., F.L.S., of Wellington, who kindly sent it to me for description. He informs me that several years ago he saw other specimens of this fish on the shores of Massacre Bay.

In general appearance it much resembles *T. jaculator*; but, besides the differences in the fin-rays and scales, the anterior superior profile of the snout is more blunt, the vertical fins are more deeply contracted behind the first soft rays, the anal spines are much more slender, and the spinal portions of the fins are covered with scales quite as much as the soft portions.

Therapon (?) *rubiginosus.*

D. $\frac{12}{11}$. A. $\frac{3}{10}$. L. lat. 80. L. transv. 12/23.

Length three times the height of the body, or four times the length of the head; the diameter of the eye goes three times and a half into the length of the head. Scales ctenoid. Body compressed, the greatest height under the third dorsal spine. Mouth small, nearly vertical. A series of very minute teeth in each jaw; palate apparently toothless. Præoperculum denticulated on its posterior margin, smooth below; operculum smooth, armed with two small flat spines. Dorsal single, deeply notched; the third spine, which is the longest, goes nearly twice and a half into the length of the head. Spines of the dorsal and anal very strong. Anal and soft dorsal half-covered with scales, the spiny parts scaleless; caudal and exterior surfaces of pectorals and ventrals more or less covered with small scales. Caudal forked, each lobe about equal to the length of the head. The dorsal commences at the base of the ventrals, and ends at a distance from the caudal equal to about two thirds of the length of the head. Pectorals pointed; the upper rays the longest, but not so long as the head, and not extending so far back as the point of the ventrals. Ventrals inserted behind the pectorals, and extending to about one half the distance to the vent.

Colour apparently reddish, fading to greyish yellow.

Total length of the specimen 16 inches.

Hab. Coast of Otago.

This fish is described from a single stuffed specimen in the

Otago Museum. It differs from *Therapon* in the oblique cleft of the mouth, the forked caudal, and the greater development of the scales on the vertical fins; but I hesitate to draw up generic characters for it until I can get a fresh specimen.

Trachichthys Trailli.

B. 8. D. $\frac{5}{13}$. A. $\frac{3}{10}$. V. $\frac{1}{6}$. P. 12. C. $\frac{7}{\frac{22}{6}}$. L. lat. ca 95.

Length twice and one fourth the height, or three times the length of the head; snout about half the diameter of the eye, which goes twice and two thirds into the length of the head. Maxillary extending to posterior part of the orbit, dilated at the end. All the teeth on the jaws, palate, and vomer very small. Interorbital space convex, equal to the diameter of the eye. Scales ending before the middle of the eye. Nostrils and ridges on the top of the head as in *T. elongatus*. Snout with two spines directed forward, one from each ridge. Infraorbital slightly crenated along its inferior margin. Præoperculum divided by a deep channel, which is crossed at the angle by a strong, rough, projecting spine, which extends to the gill-opening. Operculum with radiating rough ridges and a single spine. Cheeks scaly. Scapular bone with a spine equal to that on the operculum. Spines of the dorsal short and smooth; the third soft ray the longest, and as long as the pectorals, which are rounded and one fifth of the length of the body. Caudal forked, composed of twenty-two soft rays, with seven spines above and six below. Spines of the anal small. Ventrals situated on either side of the vent, slightly behind the pectorals; they extend back to the end of the pectorals; ventral keel with eleven scales, each armed with a strong spine directed backward.

Colour greyish yellow; fins yellow.

Total length of the specimen $7\frac{1}{2}$ inches.

This fish was found dead and floating on the surface of the water near Stewart Island by Mr. C. Traill, who presented it to the Otago Museum, and after whom I have much pleasure in naming it.

Notothenia angustata.

B. 6. D. 4–5 | 28–29. A. 22–24. V. $\frac{1}{5}$. P. 19.
L. lat. 52–58. L. transv. 6/13–15.

Length four times and a half the height of the body, or three times and a half the length of the head; breadth of the head equal to the height of the body; interorbital space rather more than twice the diameter of the eye. Top of the head flat, roughened; a bony ridge over each eye, extending back to the posterior margin of the præoperculum. Eyes lateral. Mouth wide, with rather strong teeth in the jaws and a band of villiform teeth behind them; vomer and palatine bones smooth. Præoperculum scaly behind the eye, its margin denticulated. Operculum with two points above the shoulder. Lower jaw slightly longer. Spines of first dorsal flexible. Ventrals in front of the pectorals. Caudal rounded.

Variable in colour from dark olivaceous black to olive-green, slightly mottled with blackish on the back; lips speckled with white; axil of pectorals yellow; caudal and dorsal blackish.

Total length 14·5 inches.

Hab. Dunedin.

This fish and the next differ from the rest of the species of *Notothenia* in having the head narrower and the eyes lateral.

Notothenia microlepidota.

B. 6. D. 7 | 26. A. 23. V. $\frac{1}{5}$. P. 18. L. lat. 91. L. transv. 12/32.

Length four times and a half the height of the body, or three times and a half the length of the head; breadth of the head not much more than half its length. Interorbital space rather less than twice the diameter of the eye, flat, slightly roughened. Præoperculum scaly behind the eye, its margin entire, straight; operculum with a semicircular notch above the shoulder. Eyes lateral. Teeth as in the last species. Lower jaw longer. Ventrals a little in front of the pectorals. Caudal emarginate. No pores on the head.

Purplish brown above, greyish below; throat, gill-membranes, axil of pectorals, and opercles yellowish.

Total length 17·25 inches.

Hab. Dunedin and Moeraki.

Psychrolutes latus.

B. 7. D. 9. A. 9. C. 10. V. 2.

Length nearly three times and a half the height of the body, or about twice and three fourths the length of the head. Breadth of the head equal to its length; height of the head about four fifths of its breadth. Snout rounded, jaws equal, maxillary not extending to the middle of the eye. Anterior nostril with a very short tentacle. Diameter of the eye about one third of the interorbital space. Top of the head and operculum covered with soft skin. Operculum produced into a flexible posterior process; the gill-opening commences above that process, and is not continuous with that of the other side. Body compressed posteriorly, covered with soft, rather loose skin. Pectorals rounded, the middle rays longest, extending beyond the vent. Ventrals very short, situated below the middle of the base of the pectorals, and at a distance from one another of rather more than the length of the fin; the base of each is surrounded by a fold of loose skin. Dorsal and anal opposite one another, situated far back on the tail, almost entirely enveloped in skin. Caudal rounded. Vent situated rather nearer the origin of the anal than the root of the ventrals.

Dark greyish brown, irregularly spotted with white.

Total length 8 inches, length of head 2·5, breadth of head 2·5, height of body 2.

Hab. Dunedin and Bluff harbours.

Trygon brevicaudata.

Trygon thalassia (?), Hutton, Cat. Fish. N. Z. p. 85, nec Columna.

Female. Disk rather broader than long, the anterior margins forming a very obtuse angle, which is interrupted by a short projection of the snout. Body smooth, with a single small oval tubercle in the centre of the back. Tail not longer than the body, with a cutaneous fold along the lower side, but no upper ridge; armed with two serrated spines, the anterior one the smaller, and in front of these a row of large ossifications; sides of the tail with smaller stellate ossifications.

Brown above, whitish below.

Length of disk 44 inches, breadth 48; tail 32 + inches.

Hab. Dunedin Harbour.

The end of the tail of this specimen is broken off; but it is evident that it could only have extended a few inches further.

XLII.—*On a new Genus and Species of Trap-door Spider from South Africa.* By the Rev. O. P. Cambridge, M.A., C.M.Z.S., &c.

[Plate X.]

In the 'Field' of October the 10th, 1874, there appeared an account of a trap-door spider whose nest is formed in the bark of trees. Not long since examples of the nest (in one of which was a female of the spider) were forwarded to me, with a request that I would write a short notice of them for the 'Field;' a brief account of the genus and species was accordingly published in that newspaper on the 28th of August, 1875 (vol. xlvi. p. 257). The present article contains a full description of this interesting spider, of which both the genus and the species appear to me to be new to science. The name (*Moggridgea*) conferred upon the new genus will, I feel sure, commend itself to those who have read the able work on Trap-door Spiders written by the late Mr. J. Traherne Moggridge; and in thus connecting this interesting new genus with the name of my kind and lamented friend, I desire to give my sincere testimony to the great value and importance of his too early interrupted observations on the habits of spiders of the trapdoor-nest-building group.

Family **Theraphosides.**

Gen. nov. Moggridgea.

Generic characters.

Cephalothorax broad-oval, truncated before; caput not elevated beyond a general curved slope from the hinder part.

Eyes eight, in the usual four pairs, forming (when looked at from above and behind) a large, somewhat **W**-shaped figure; those of each lateral pair are widely separated; the four lateral eyes describe a transverse oblong figure whose front side is longer than the hinder one, the latter being double the length of the line formed by each lateral pair.

Legs short, strong; the tibiæ and metatarsi of the first and second pairs of a broad flattened form, armed on either side near the underpart with strong spines: each tarsus ends with three curved claws springing from a small claw-joint; the superior pair strong, and furnished with one or two teeth, the inferior claw small; no scopula on any of the tarsi.

Falces destitute of spines at their fore extremity on the upperside.

Maxillæ short, strong, very divergent, cylindrical, with only a small prominent point at their inner fore extremity.

Labium short, but somewhat pointed at the apex; the greater part of the front (both of the labium and maxillæ) thickly studded with small tooth-like spines.

This genus is allied to *Cteniza* and *Nemesia*, but differs from both in having no spines on the falces; from the former it differs in the comparatively low caput, and from the latter in the wide separation of the eyes of each lateral pair. Like the spiders of those genera, the present forms a tubular nest closed with a hinged valve or lid.

Moggridgea Dyeri, sp. n.

Adult female, length $4\frac{2}{3}$ lines; length of cephalothorax $2\frac{1}{4}$ lines; breadth of cephalothorax, in the thoracic region, nearly 2 lines; breadth of caput, at the fore margin, $1\frac{3}{4}$ line.

The *cephalothorax* has a very slightly and gradually curved slope from the eyes to the hinder margin, so that the caput does not rise abruptly from the thorax as in *Cteniza* and many spiders of the genus *Nemesia*; the thoracic junction is marked by a small but deepish subangular indentation, the angle directed forwards; the oblique indentation on either side of the caput, next to the thorax, is pretty strong, the thoracic indentations slight: the surface of the cephalothorax is smooth, glossy, and of a deep brownish black colour; a few long bristly hairs stand up, nearly erect, from the ocular area; and two long ones, in a transverse line, are directed a little forwards from a point close to the thoracic junction: the height of the clypeus does not much exceed the longest diameter of the fore lateral eyes; immediately in front of each of these latter is a deepish curved indentation, the curve of which is directed forwards.

The *eyes* are rather small; they may be described as in the four usual pairs, or else in two transverse curved rows, the curves opposed to each other, forming very nearly the figure of the letter **W**: the fore lateral eyes are the largest of the eight, seated on tubercles, and rather of an oval form; each of these is separated from the fore central eye on its side by an interval a little exceeding its own longest diameter, and in front of each, rather on the inner side, is a strongish curved indentation; the fore centrals are round and separated by rather more than a diameter's distance from each other, and close behind them is a small transverse indentation: the hind lateral eyes are also seated on slight tubercles, and each, with the fore lateral and fore central eye on its side, forms very nearly an equilateral triangle; the hind central eyes are of somewhat irregular shape, smallest of the eight, of a shining pearly lustre, and very near (but not quite contiguous) to the hind laterals.

The *legs* are short and strong; they do not differ greatly in length, their relative length being 4, 1, 2, 3; they are of a dark brown colour tinged with olive, the basal joints being the lightest, the outer and under sides of the metatarsi of the second pair, however, are nearly white: the tarsi and metatarsi of the first and second pairs are broad and flattened on the under or lower sides; each lateral margin of the lower side is armed with a series of strong, slightly curved spines articulated to tubercles: the femora, especially of the first and second pairs, are strongly curved and hollowed or flattened inside: all the legs are furnished with hairs and bristles; of the latter there is a small group or tuft of prominent ones under the femoral joints of each of the first, second, and fourth pairs of legs, and the basal joints of each of the first three pairs has a patch of small, prominent, red-brown tooth-like spines at its base, close to the hinder angle: the tarsi end with two superior, strong, curved claws, each with a single strongish unidenticulate tooth towards its base on the underside, and an inferior curved claw, short, and of a nearly conical form; these terminal claws spring from a small supernumerary or claw-joint; the tarsi of the first two pairs are very short, not much exceeding half the length of those of the third and fourth pairs; and none of them is furnished with a scopula.

The *palpi* are strong, moderately long, similar in colour to the legs, and furnished with hairs and bristles; the humeral joints are much bent and flattened on their inner sides; the digitals are shorter, and less strong, than the radial joints, and each terminates with a curved unidenticulate claw.

The *falces* are strong and massive, but moderate in length and not very prominent; they are similar to the cephalothorax in colour, but have no spines at the fore extremity on the upperside.

The *maxillæ* are not very long, but strong, cylindrical, and very divergent; each has its fore extremity on the inner side rather subangularly prominent; and the greater part of their exterior surface is pretty thickly studded with small red-brown, tooth-like, prominent spines, rather stronger, but of a similar nature to those on the basal joints of the legs; the colour of the maxillæ is a reddish yellow-brown.

The *labium* is rather small, of a somewhat curviangular form at its apex, a little constricted towards its base, and marked off from the sternum by a strongish transverse, slightly curved indentation; its colour is similar to that of the maxillæ, and the outer surface of the upper half is, like them, also studded with similar, but rather stronger denticulations.

The *sternum* is large, flat, of a somewhat oval form, and increases gradually in width from the labium to its hinder extremity; its colour is a yellowish brown, tinged with olive.

The *abdomen* is of moderate size, pretty convex above, projects considerably over the base of the cephalothorax, and is of a purplish brown colour; its surface has a somewhat coriaceous and rugulose appearance; it is thinly clothed with hairs, and is pretty thickly studded above and on the sides with small roundish tubercles, some of which have a shining appearance, and from many of them there issues a single long, prominent, tapering bristle; the rugulosities of the surface are marked by being paler than the rest, but they do not present any definite pattern: the spinners are four in number; those of the superior pair are strong but very short, especially the second and third joints, which are but just perceptible; those of the inferior pair are small, tapering, one-jointed, and near together: the spiracular plates are of a pale brownish yellow colour; and the underside of the abdomen is of a paler hue than the upperside.

A single example of this very distinct spider, accompanied by several nests, was received (through the entomological editor of the 'Field' newspaper) from South Africa.

The nest is a tubular one, formed in the crevices and rugulosities of the bark of the oak tree; it scarcely exceeds an inch and a half in length; and it is closed externally by a hinged lid, of about 4–5 lines diameter. The exposed surface of the tube, as well as the lid, is covered with small particles of outer bark, and thus exactly resembles the bark itself. The lid is peculiar in combining both the separate types observed in the trap-door nests of Europe, and described in 'Harvesting Ants and Trap-door Spiders' by the late Mr. Moggridge—that is, the *cork* and *wafer* types; it has its central portion thicker than the rest; this part shuts into the circular entrance of the tube; and its thinner rim closes over the edge, entirely concealing the nest. The form of the lid is round or sometimes slightly oval; and it seems to be placed at the upper end of the tube—*i. e.* the tube running downwards* in the bark. This, however, is not certain, since there was nothing in the detached pieces of bark received to show conclusively in what direction they grew; so it is possible that the tube may run upwards: this latter would perhaps better insure the keeping close of the lid, since the opening of the tube is oblique, and the lid when closed lies very nearly in the same plane as the surrounding level of the bark. Direct evidence, however, is wanted upon this point.

I have taken the liberty to connect the name of its discoverer (Dr. Dyer, of Uitenhage, South Africa) with this spider, the finding of which must be hailed as an important addition to our knowledge of trap-door spiders. Hitherto all known spiders, of the trapdoor-forming habit, have their tubes made in holes in the earth; and (no doubt to assist in excavating

* In a notice of this spider in the 'Field,' August 28, 1875, it is stated that the tube appears to run upwards; but subsequent examination of the pieces of bark &c. leads me now to question this.

them) the upper fore extremity of their falces is furnished with strong spines. In the present spider, whose nest is made in channels already existing, the crevices and rugulosities of the bark of trees, there is no need of such spines; and their absence is thus accounted for. An interesting speculation suggests itself here, *i. e.* whether the present spider is prior or subsequent in point of genealogical relationship to the trap-door spiders that form a nest in the earth, and are specially furnished with spines on the falces to excavate the holes for it. It is, it seems to me, most conceivable that spiders should first take advantage of sites already suited for their habitations, and that subsequently the species fitted for forming their own sites should be gradually developed.

EXPLANATION OF PLATE X.

Fig. 1. *a*, spider, enlarged; *b*, ditto, in profile, without legs or palpi; *c*, eyes, from above and behind; *d*, underside of cephalothorax, showing maxillæ, labium, sternum, and basal joints of the legs; *e*, tarsus of one of the second pair of legs; *f*, natural length of spider.

Fig. 2. A, nest in piece of bark; B, another nest in groove of a piece of wood; C, lid of nest detached, showing the inner side.

XLIII.—*On the true Nature of the so-called* "Bathybius," *and its alleged Function in the Nutrition of the Protozoa.* By G. C. Wallich, M.D.

At no previous period in the history of deep-sea research had a more boldly conceived, but, as I venture to think, more untenable doctrine, been offered for acceptance by the scientific public, than when the alleged discovery of this extraordinary Protozoon was formally announced by Prof. Huxley.

In 1868 this distinguished biologist published an elaborate paper "On some Organisms from great depths in the North Atlantic," in which he expressed the opinion that certain masses of protoplasmic matter, found in specimens of deep-sea mud which had been submitted to him for examination in 1857, constitute a new phase of living being, to which he gave the name of "*Bathybius*." In referring to this subject in their first "Preliminary Report on Deep-sea Dredgings," published just afterwards in the 'Proceedings of the Royal Society,' viz. in Dec. 1868, Drs. Carpenter and Wyville Thomson say that "the examination which Prof. Huxley has been good enough to make of the peculiarly viscid mud brought up in our last dredging at the depth of 650 fathoms, *has afforded him a remarkable confirmation of the conclusion he announced at the recent Meeting of the British Association, that the coccoliths and coccospheres are imbedded in a living expanse of protoplasmic substance, to which they bear the same relation as the spicules of Sponges or of Radiolaria do to the soft parts of those animals. Thus it would seem that the whole mass of this mud is penetrated by a living organism of a type even lower, because less definite, than that of Sponges and Rhizopods.*" And they add that, to whichever of the two great kingdoms in nature we refer it, "*there seems adequate reason for regarding this* Bathybius *as one of the chief instruments whereby the solid material of the calcareous mud which it pervades is separated from its solution in the ocean-waters.*" To this description Dr. Carpenter adds, in a footnote, that "*the discovery of this indefinite plasmodium covering a wide area of the existing sea-bottom should afford a remarkable confirmation, to such (at least) as still think confirmation necessary, of the doctrine of the organic origin of the serpentine limestone of the Laurentian formation. For if* Bathybius, *like the testaceous Rhizopods, could form for itself a shelly envelope, that envelope would closely resemble* Eozoon. *Further, as Prof. Huxley has* proved *the existence of* Bathybius *through a great range, not merely of depth but of temperature, I cannot but think it probable that it has existed continuously in the deep seas of all geological epochs*" *.

At a Meeting of the Royal Geographical Society on the 29th Nov. 1870 †, Prof. Huxley himself still further signalized his reputed discovery in these words:—"*The* Bathybius *formed a living scum or film on the sea-bed, extending over thousands upon thousands of square miles; evidence of its existence had been found throughout the whole North and South Atlantic, and wherever the Indian Ocean had been surveyed, so that it probably forms one continuous scum of living matter girding the whole surface of the earth. This opinion had been confirmed in all its essential details by Prof. Haeckel, who had published an admirable account of specimens obtained by him*" ‡.

It is almost superfluous to point out that emphatic and authoritative statements such as these, published in the journals and, to this extent, under the august prestige of two of the

* "Preliminary Report on Deep-sea Dredgings," by Dr. Carpenter and Dr. Wyville Thomson (Proceedings of the Royal Society, Dec. 17, 1868, pp. 190, 191).

† 'Proceedings of the Royal Geographical Society,' March 23, 1871, vol. xv. no. 1, p. 38.

‡ The italics in the above paragraphs are mine.—G. C. W.

first Scientific Societies of Great Britain, were well calculated to be accepted—and, as a matter of fact, are well known to have been accepted—by nearly all the leading biologists of the day, both in this country and abroad; whilst they necessarily served to block out entirely, and, as events have proved, to throw discredit upon any attempt to controvert them. How far the circumstances warranted such results, the facts about to be narrated will doubtless attest.

Prof. Huxley's paper announcing the discovery of "*Bathybius*" appeared in 'The Quarterly Journal of Microscopical Science' in 1868*. In that paper Prof. Huxley says, "I conceive that the granule heaps and the gelatinous matter in which they are imbedded, represent masses of protoplasm. Take away the cysts which characterize the Radiolaria, and a dead *Sphærozoum* would very nearly resemble one of the masses of this deep-sea 'Urschleim,' which must, I think, be regarded as a new form of those simple animated beings which have recently been so well described by Haeckel in his 'Monographie der Moneren.' . . . From the manner in which the youngest *Discolithi* and *Cyatholithi*† are found imbedded among the granules, from the resemblance of the youngest forms of *Discolithi* and the smallest corpuscles of *Cyatholithus* to the granules, and from the absence of any evident means of maintaining an independent existence in either, I am led to believe that they are *not* independent organisms, but that they stand in the same relation to the protoplasm of *Bathybius* as the spicula of sponges, or of the Radiolaria, do to the soft parts of those animals" ‡.

Here, then, we are furnished with a description, meagre indeed, but nevertheless the sole description which, so far as I am aware, Prof. Huxley has published of *Bathybius*. It will be seen from it that the varieties of "*coccoliths*" spoken of under the name of "*discoliths*" and "*cyatholiths*" were

* "On some Organisms from Great Depths in the Atlantic," by Prof. Huxley, F.R.S. (Quarterly Journal of Microscopical Science, Oct. 1868, no. xxxii. p. 210).

† Names given by Prof. Huxley to varieties of "*coccoliths*."

‡ Prof Huxley having stated, in confirmation of the accuracy of his observations, that he had "employed higher powers of the microscope when he examined the North-Atlantic mud, than subsequent observers seem to have employed, his great help having been an excellent $\frac{1}{12}$ by Ross, which easily gives a magnifying-power of 1200 diameters and renders obvious many details hardly appreciable with the $\frac{1}{8}$ objective he used in 1857," I may be permitted to mention that all my work has been done with Ross's lenses, ranging up to $\frac{1}{12}$, and a Hartnack's immersion-lens, No. 10, specially made for me. These lenses cannot be surpassed in defining-power. As most microscopists know, perfect definition is a quality of much greater consequence than simple amplification.

regarded by him as integral and essential portions of its structure. It followed, therefore, if the "*coccoliths*" could be shown *to bear no physiological relation whatever* to the viscid matter described as protoplasm, but to be purely accidental accompaniments of the matter composing the mud generally, the fabric of *Bathybius* must fall to the ground.

It therefore becomes absolutely necessary to recapitulate in this place, not only the history of the "*coccoliths*" but of the *coccospheres*, which were first discovered by me in 1860, and were shown, on evidence which can no longer admit of a shadow of doubt, to constitute the complete organism of which the "*coccoliths*," whether "*cyatholiths*" or "*discoliths*," are nothing more than the *disjecta membra*. Partly on these grounds, but chiefly because my own personal observation had satisfied me that "*Bathybius*" is the *effete product*, *instead of being the source* of any of the vital forces which are already in operation at the sea-bed, I ventured, with confidence in the justice of my cause, though with but too well-founded misgiving regarding the consequences to myself of daring to gainsay the conclusions of so deservedly high an authority as Prof. Huxley, to show that the alleged existence of *Bathybius* was wholly *illusory*.

I may here state that the substance of the present paper was written six months ago, and that within the past six weeks Prof. Huxley has himself virtually acknowledged the error into which he had been betrayed, in a few lines appended to an extract from a letter addressed to him by Dr. Wyville Thomson, dated Yeddo, June 9, 1875, which was published in 'Nature' of August 19 of the present year. The following is the text of Prof. Huxley's statement:—"Prof. Wyville Thomson further informs me that the best efforts of the 'Challenger's' staff have failed to discover *Bathybius* in a fresh state, and that it is seriously suspected that the thing to which I gave that name is *little more than sulphate of lime*, precipitated in a flocculent state from the sea-water by the strong alcohol in which the specimens of the deep-sea soundings which I examined were preserved. The strange thing is that this inorganic precipitate is scarcely to be distinguished from precipitated albumen, and it resembles, perhaps even more closely, the proligerous pellicle on the surface of a putrescent infusion (except *in the absence of all moving* particles), colouring irregularly, but very fully, with carmine, running into patches with defined edges, and in every way comporting itself like an organic thing. Prof. Thomson speaks very guardedly, and does not consider the fate of *Bathybius* to be as yet absolutely decided. But since I am mainly responsible for the mistake, if it be one, of introducing this singular substance into the list of living things, I think I err on the right side in attaching even greater weight than he does to the view which he suggests."

With reference to this remarkable withdrawal of opinion and of previously assumed facts, it only remains for me to say that, rejoiced though I am to find my views on the subject so fully substantiated, the persistent mode in which my published observations have for a long series of years been ignored, and the fact that Prof. Huxley to the last moment ascribes the rectification of his error altogether to Prof. Wyville Thomson, who has *throughout* his writings upon the "*coccoliths*"-and-*coccosphere* question, as on numerous other equally important points, failed to accord to my observations the recognition to which his not unfrequent appropriation of their substance, and even of the very words in which they were couched, proves me to have been entitled, renders it more than ever indispensable that I should place in the clearest light the methods by which these ends have been gained, quite as much in the interest of scientific truth as in vindication of my own claims*.

In the appendix to Captain Dayman's Report on 'Deep-sea Soundings in the North Atlantic Ocean,' taken in 1857, published in 1858 †, Prof. Huxley, who was then intrusted with the examination of the materials, observes that he "found in almost all these deposits a multitude of very curious rounded bodies, to all appearance consisting of several concentric layers surrounding a minute clear centre, and looking, at first sight, somewhat like single cells of the plant *Protococcus*; as these bodies, however, are rapidly and completely

* The contradictory nature of Prof. Thomson's statements will appear from the following passages. In his work, 'The Depths of the Sea,' published in 1873, p. 413, he says, with a singular disregard of accuracy in his quotation of my opinion, that "the 'coccoliths' are sometimes found aggregated on the surface of small transparent membranous balls; and these, which seemed *at first* to have something to do with the production of the 'coccoliths,' Dr. Wallich has called coccospheres;" whereas, in a communication dated from the 'Challenger,' and published in 'The Proceedings of the Royal Society' for Nov. 1874 (p. 38), he unhesitatingly renounces the opinion just cited, and informs us that "*his* observations have placed it beyond a doubt that the 'coccoliths' are the separated elements of a peculiar calcareous armature which covers certain spherical bodies (the coccospheres of Dr. Wallich)." Thus while he repudiated, in the first instance, my conclusion, supported as it was by direct and detailed evidence, he now claims the merit of the discovery, without having offered a particle of evidence on the subject!

† 'Deep-sea Soundings in the North Atlantic,' made in H.M.S. 'Cyclops' by Lieut.-Commander Dayman, in June and July 1857: London, 1858, p. 64.

decomposed by dilute acids, *they cannot be organic*, and I will, for convenience sake, simply call them *coccoliths*." No further description was given of these bodies at that period.

In my preliminary sketch of the results obtained by me on board the 'Bulldog,' in the North Atlantic, in 1860, entitled, "Notes on the Presence of Animal Life at vast Depths in the Ocean"*, written at sea, and published in November of that year within a few days of my return from the expedition, I made the following statement:—"In almost every sample of *Globigerina*-ooze these bodies (the '*coccoliths*') have been detected by me. But I have invariably found associated with them, in greater or less quantity, certain large cell-like masses the average diameter of which is about $\frac{1}{1000}$th of an inch, *on the immediate surface of which minute bodies were regularly ranged at intervals, so closely resembling the free 'coccoliths' in look and structure as to leave little doubt that the latter are given off from the former.* The cell-like central portion, together with the '*coccolith*'-like bodies, are imbedded in a gelatinous-looking capsule, the exact nature of which it was out of my power to determine accurately at sea. The association of the largest number of both these kinds of bodies in the soundings in which the *Globigerinæ* were in greatest quantity and in the purest condition, is worthy of notice, and is almost suggestive of their being the larval condition of these organisms. The smallest *Globigerina*-shell met with by me in this material measured $\frac{1}{600}$th of an inch in diameter, and contained but two chambers, the size of the free '*coccoliths*' being $\frac{1}{3000}$th of an inch in diameter, or five times smaller. In some specimens the 'minute clear centre' was most distinctly divided into two portions. Much additional investigation will, however, be necessary before any reliable deductions can be arrived at as to the nature and functions of these very remarkable structures"†.

Again, in the 'Annals and Magazine of Natural History' for July 1861, in a paper "On some novel phases of Organic Life at great Depths in the Sea," I observed that, "in the deepest soundings taken during the recent expedition to the

* 'Notes on the Presence of Animal Life at vast Depths of the Ocean' (Taylor & Francis, London, 1860). This pamphlet was originally printed for presentation only to scientific societies and scientific men, both here and abroad. Almost immediately afterwards, by permission of the Hydrographer to the Admiralty, a new edition was printed and sold in the usual fashion, reviews of it appearing in various scientific journals of the time.

† *Op. cit.* p. 14.

North Atlantic, I detected these very curious bodies (the '*coccoliths*' of Prof. Huxley) in great numbers, occurring not only in the free state noticed by Prof. Huxley, but as adjuncts to minute spherical cells, *upon the outer surface of which they were adherent in such a manner as to leave no doubt of that being their normal position.* Whilst alluding to their occurrence in my published 'Notes' [above referred to] I ventured a surmise as to their being a larval condition of some of the Foraminifera:—first, in consequence of their being invariably present in greatest quantity in such of the deep-sea deposits as were most prolific of these organisms; secondly, because in one or two instances coccoliths had been met with by me adherent to Foraminiferous shells in such a manner as to render it highly improbable that they could have attained their position by accident; and, lastly, because the spherical cells to which reference has been made, when entirely freed from their adherent coccoliths, presented no discernible points of difference, save as regards somewhat inferior dimensions, from the minute and nearly hyaline solitary cells of the earliest stage of the *Globigerinæ.*"

"On reference to the annexed woodcut it will be seen that the composite bodies to which I allude, and to which I propose to give the name of coccospheres, are minute spherical cells having a defined limitary wall, and that upon their outer surface the coccoliths of Prof. Huxley are arranged at nearly regular intervals. The cells, when crushed, are seen to contain a homogeneous, gelatinous, and almost colourless matter, exhibiting no visible trace of organization, and, in all probability, consisting of sarcode. The wall of the cell may be distinctly seen under a high power; but, from the minuteness of the entire structure, I had found it impossible to do more than attest its existence. Accordingly there is nothing visible to show whether the wall is formed of one or more than one layer. Cells are sometimes met with in a fractured condition; but I have never observed a collapsed specimen, or flattened-out fragment, such as would frequently occur were the *basis* of the wall formed of any thing more yielding than *calcareous matter.* In like manner, I have hitherto failed to detect markings or apertures in the limitary wall of the coccosphere. The solitary cells vary in diameter from $\frac{1}{1000}$ to $\frac{1}{1250}$ of an inch, when seen separately. Forming part of a series, as in the specimen of *Textularia*

No. 1. *Coccosphere* with its superimposed "*coccoliths.*" No. 2. *Coccosphere-cell* without its "*coccoliths.*"

presently to be described, some cells, however, attain a much larger size"*.

"The coccoliths (to which term I would restrict the minute bodies described by Prof. Huxley) are of oblong shape, concave on their internal aspect, namely that on which they are attached to the surface of the coccosphere-cells, and convex externally; in short, they are spoon-shaped, only with a much less marked convexity and concavity. In some specimens a single aperture, only, occurs at the central portion. In others the aperture appears to be double; or, rather, there are two perforations, placed side by side, in the direction of the long axis of the body, and separated from each other by an extremely delicate transverse band; whilst the external marginal surface, which thus constitutes a quoit-like but oblong ring round the central perforated portion, is striated in a radiate manner. When the two perforations are present the little mass closely resembles a miniature plate of *Synapta*. The coccoliths, like the spheres upon which they rest, are transparent and devoid of colour. Their mode of attachment is not distinguishable, owing to their extreme minuteness. They appear, however, to be simply placed in contact with the surface of the coccosphere-wall, and to be retained in position by the delicate gelatinous layer in which the entire organism is invested. We may thus account for the seeming facility with which the coccoliths are detached, and the vast numbers of free coccoliths which crowd many of the deposits"†.

Apart, therefore, from the primary question whether "*Bathybius*" does or does not possess the characters attributed to it—characters which, if existent, must have wholly revolutionized our views regarding both the biological and geological relations of the sea-bed—it must be obvious that the true relation of the "coccoliths" to the coccospheres, and the equally significant facts (pointed out by me *some years* previously), first, that the coccospheres are normally *free-floating organisms*, inhabiting the surface-waters of the open ocean ‡, *where there exists no protoplasmic matrix for them to be imbedded in*,

* In a collection of microscopic slides illustrating the nature of the North-Atlantic deposits, which was presented by me to the Microscopical Society in 1867, there are numerous examples both of Textularian and Rotalian shells, the outside of the chambers of which are studded with coccoliths as here described.

† "On some novel Phases of Organic Life at great Depths in the Sea," by G. C. Wallich, M.D. &c. (Annals and Magazine of Natural History, July 1861, p. 52).

‡ See paper "On the Structure and Affinities of the Polycystina," by G. C. Wallich, M.D. &c. (Quarterly Journal of Microscopical Science for July 1865, footnote).

and subsiding to the bottom in a disintegrated condition only after death—secondly, that coccospheres are to be met with in abundance in dredgings along the coasts of the British Channel*—and, lastly, that coccoliths occur also in abundance in the post-tertiary fossil-earths of America†,—assume an importance that would not, under other circumstances, have pertained to them.

It has been shown that, whereas Prof. Huxley, in his original report, declared that the coccoliths "*cannot be organic*," I proved them to be organic; whereas he doubted their being the *disjecta membra* of the coccospheres, I proved them to be so; and whereas he alleged that they normally, as "coccoliths," "discoliths," or "cyatholiths," constitute part and parcel of the living thing to which he gave the name of *Bathybius*, I distinctly proved that the "coccoliths" have no physiological connexion with the viscid matter in which they are imbedded at the bottom of the sea, but are detached and normal appendages of coccospheres which have lived in the superficial waters of the ocean, and subsided to the bottom only after death.

As already stated, Prof. Huxley's announcement of *Bathybius* appeared in the 'Quarterly Journal of Microscopical Science' for October 1868. In the following number of the same journal (Jan. 1, 1869), in a paper upon "The Vital Functions of the Deep-sea Protozoa," I entered very fully into a refutation of Prof. Huxley's alleged discovery of *Bathybius*, quoting, much more *in extenso* than I should be justified in doing here, the whole of Prof. Huxley's published observations on the subject up to that date, and also Dr. Carpenter's views regarding the organization and mode of nutrition of the Foraminifera, with many points of which my own observations were at direct variance. To that paper I beg those who take sufficient interest in the question to refer. At present I must confine myself to giving the following extracts as bearing most directly upon *Bathybius*‡.

* See paper "On *Amœba villosa* and other indigenous Rhizopods," by G. C. Wallich, M.D. &c. (Annals and Magazine of Natural History, June 1863, footnote p. 445); and also a paper "On the Vital Functions of the Deep-Sea Protozoa," by same author (Monthly Microscopical Journal, Jan. 1, 1869).

† "On the Structur eand Affinities of the Polycystina," by same author ('Quarterly Journal of Microscopical Science' for July 1865, footnote).

‡ "On the Vital Functions of the Deep-Sea Protozoa," by G. C. Wallich, M.D. &c. (Monthly Microscopical Journal, Jan. 1, 1869, pp. 38 & 39). Of the contents of this paper not the slightest notice has been taken, either by Prof. Huxley, Dr. Carpenter, or Dr. Wyville Thomson. I am quite content to submit to the verdict of every impartial critic, whether

"Regarding the expediency of attempting to establish a new grade of animal life possessing characters as yet so obscure and indefinite as that on which Prof. Huxley has conferred the name *Bathybius*, I beg with great deference to express my doubts:—in the first place, because I can see no reason to deny to the structure called a coccosphere, quite as independent an individuality as is observable in *Thalassicolla* or *Collosphæra*; in the second, because the very name *Bathybius*, if its substance is supposed to have any immediate connexion with the presence, the development, or the nutrition of the lower forms of animal life which inhabit the ocean, is in direct antagonism to the occurrence of surface-living forms, for the nutrition and development of which a separate provision would have to be made; and, in the third and last place, because it appears to me that analogy and the bulk of direct evidence is in favour of the supposition that this widely distributed protoplasmic matter is the *product*, rather than the *source*, of the vital forces which are already in operation at the sea-bed."

"It is true that the evidence afforded by *Eozoön* may be cited in support of *Bathybius*. But we must not lose sight of the fact that of the animal of *Eozoön* we know as yet extremely little beyond its having been recognized by Professor Carpenter as distinctly of a Rhizopodous type*, and certainly not enough to warrant the inference that its body-substance was less highly differentiated than that of an ordinary Foraminifer, or that each individual, within certain limits, may not have been distinct, though inhabiting a structure as vast, in its general proportions, as the coral reef."

"But, apart from the insufficiency of the evidence on which the existence of *Bathybius* rests, it appears to me that, even were it to be accepted as conclusive, we should not approach a single step nearer to the solution of the problem it may be

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this fact, viewed in connexion with the recently demonstrated and *admitted* validity of my disproof of the existence of "*Bathybius*," is at all consistent with the established rules of scientific inquiry and discussion.

* In the same number of 'The Monthly Microscopical Journal,' at pp. 60, 61, the following statement is given on the authority of Dr. Carpenter:— "Dr. Carpenter then referred to the protoplasmic network which Prof. Huxley had termed *Bathybius*, and which, as Dr. Wallich had stated, was limited to the warm area, and not found where the arctic currents prevailed." This statement (for which I do not hold Dr. Carpenter responsible) is wholly incorrect, and in direct antagonism to the opinions I have throughout entertained and expressed regarding "*Bathybius*." No remark has, at any time, been made by me with reference to the distribution of the so-called "*Bathybius*." The assertion here conveyed must evidently, therefore, have originated in some misconception of the writer's.

desired to elucidate—that is, the mode in which the earliest existing form of animal life manifests itself, and, in the absence of the conditions without which vegetable life of the most primitive kind cannot be present, obtains nutriment, and becomes, in its turn, food for organisms of a somewhat more complex structure."

It would appear that the analysis of deep-sea mud upon which Prof. Huxley based his original conclusions with regard to *Bathybius* was made with material which had been preserved "in spirits" since the year 1857, when it was obtained by Capt. Dayman—that is to say, during a period of nearly eleven years. But, according to Dr. Carpenter's report in the Royal Society's 'Proceedings' for December 1868, these conclusions received "*remarkable confirmation*" on Prof. Huxley's examination of mud recently obtained in a dredging, made at a depth of 650 fathoms by Dr. Carpenter and Prof. Wyville Thomson in the autumn of that year, to the westward of the Faröe Islands, "*the coccoliths and coccospheres being imbedded* in a *living* expanse of protoplasmic matter, to which they bear the same relation as the spicules of sponges or of Radiolariæ do to the soft parts of those animals. . . . It may be that the *Bathybius* (which bears a very striking resemblance to the Rhizopod-like *mycelium* of the Myxogastric Fungi) has so far the attributes of a vegetable that it is able to elaborate organic compounds out of the materials supplied by the medium in which it lives, *and thus to provide sustenance for the animals imbedded* in its midst"*.

The drift of these remarks is obvious; and it was with a view to show their fallacy that I wrote as follows (*loc. cit. suprà*, pp. 39, 40, 41), towards the conclusion of the paper "On the Vital Functions of the Deep-Sea Protozoa," from which the last of my quotations was an extract:—

"Like most theories which admit of being directed towards the solution of the mystery in which the boundary between the animal and vegetable kingdoms has hitherto been shrouded, the idea of a widely pervading protoplasmic layer (drawn, on the one side, from the assumed analogy of *Eozoön*, and, on the other, from a substance of the exact relations of which we have also still much to learn, namely *Æthalium*) would merely thrust before us one difficulty instead of another. For, even if we allow the existence of *Bathybius* as an independent organism, it would still become necessary to invest it with an exceptional specific property—namely, of being able to convert inorganic elements into its own body-substance.

* "Preliminary Report," by Dr. Carpenter and Prof. Wyville Thomson ('Proceedings of the Royal Society,' Dec. 17, 1868, p. 191).

"This is, no doubt, in direct opposition to preconceived notions of the distinction existing between the Protophyta and Protozoa; but I cannot help thinking that, on a closer scrutiny of the grounds upon which the distinction is based, it will be found to have its foundation in words rather than in established facts, and that the vital attribute now claimed for the lowest Protozoon is, in reality, as compatible with reason and observed phenomena as some of the other attributes which have been unhesitatingly acceded both to the Protozoa and the Protophyta"*.

"According to Dr. Carpenter, 'There is reason to consider the shell-substance of the Foraminifera as an *excretion* from the protoplasmic mass of which the body itself is composed, just as the cellulose wall of the vegetable cell, which may be consolidated by carbonate of lime (as in Corallines) or by silex (as in Diatoms), is an excretion from the contained endochrome'†. But inasmuch as the term 'excretion' involves vitality, or, to put the case in other words, since the shell-substance *would not be excreted were the animal dead*, it is obvious that the process is, in point of fact, one of *secretion*, dependent, in the first instance, on the creature's power of eliminating carbonic acid and lime from the waters it inhabits, and, in the second, of reproducing these materials in the shape of its shell-substance. Unless we admit this explanation, it is difficult to see how we can escape the more serious dilemma of having to assume that solid atoms of carbonate of lime are merely passed mechanically through the animal's body, going in at one side in the shape of solid atoms, and coming out at the other in the shape of specially conformed shell-tissue. And, be it observed, the same objection holds good as regards the *process* by which the "consolidation" of the cellulose wall —by carbonate of lime or silex, as the case may be—takes place in the Protophyte; for it is only so long as we consent to be hoodwinked by a definition which cannot, under any

* It shall be shown in a future paper that my views on the question of nutrition have within the past six months been absolutely verified by the independent observations of Messrs. W. H. Dallenger and J. Drysdale, 'On the Life-history of the Monads.' The entire subject of the nutrition of the Protozoa will then be fully entered into. Meanwhile I may be permitted to observe that the very important researches of Dr. Hooker and Mr. Darwin "On Carnivorous Plants" have demonstrated the fallacy of the old established preconceived notions respecting the immutability of the boundary-line which has been so vainly and arrogantly drawn between the animal and the plant, based, as it was, almost wholly on the mode of nutrition.

† "On the Systematic Arrangement of the Rhizopoda," Natural History Review, no. 4, October 1861, p. 472.

circumstances, be accepted as universally applicable, that any doubts can arise as to there being a gradual and not a sudden transition from the confines of one great division of the organic world to the other. But, for reasons already assigned, this transition from the vegetable side is *not, and probably cannot be*, completed under those conditions which prevail below certain fixed limits of depth in the ocean."

"If we admit this much as regards the process of shell-deposit, the ground is at once cleared for us; and, *mutatis mutandis*, the elimination from the surrounding waters of the elements entering into the composition of body-substance, and their conversion into this substance by a special vital faculty inherent in the protoplasmic mass itself, become at once as easy of comprehension as any purely vital act can be."

"Lastly, if *Bathybius* be assumed to constitute the nutritive substance of *Globigerina*, it follows that, where the largest and purest deposits of that Foraminifer present themselves, there ought to be the greatest supply of the nutritive protoplasm. But, as already shown, this is the reverse of what we find to be the case, inasmuch as amongst the purest Globigerine deposits, where these organisms amount to 80 or 85 per cent. of the entire mass, hardly a trace of gelatinous matter is observable"*.

But it remains for me to show still more definitely what are Prof. Wyville Thomson's opinions concerning *Bathybius* and the nutrition of the Protozoa generally. In the preface to his work 'The Depths of the Sea,' published three years later, namely in 1873 (Preface, p. viii), Prof. Thomson tells us that "the domain of biology is his own particular province." What he has to say on any such important subject as the attributes of *Bathybius* ought therefore to command respectful attention; for the same reason it is indispensable to quote his *ipsissima verba* on the subject.

"Prominent among these special groups we find the first and simplest of the Invertebrate subkingdoms, the Protozoa, represented by three of its classes, the Monera, the Rhizopoda, and the Sponges. . . . The German naturalists of the new school, in their enthusiastic adoption of the Darwinian theory of evolution, naturally welcome in these 'Moners' the essential attribute of the 'Urschleim;' an *infinite capacity for improvement in every conceivable direction*; and to more prosaic physiologists they are of the deepest interest, as presenting

* "On the Vital Functions of the Deep-Sea Protozoa," by G. C. Wallich, M.D. &c. ('Monthly Microscopical Journal,' January 1, 1869, pp. 39, 40, 41).

the essential phenomena of life, nutrition and irritability, existing apparently simply as the properties of a homogeneous chemical compound and independent of organization"*. . . .

"In this dredging" [Prof. Thomson here alludes to the 650-fathom sounding taken off the Faröes to which Dr. Carpenter, as already shown at p. 332, has referred], "as in most others in the bed of the Atlantic, there was evidence of a considerable quantity of soft gelatinous matter, enough to give a slight viscosity to the mud of *the surface*-layer. If the mud be shaken with weak spirit of wine, white flakes separate, like coagulated mucus; and if a little of the mud in which this viscid condition is most marked be placed in a drop of sea-water under the microscope, we can usually see, after a time, an irregular network of matter, resembling white of egg, distinguishable by its maintaining its outline and not mixing with the water. This network may be seen gradually altering its form, and entangled granules and foreign bodies change their relative positions. The gelatinous matter therefore is capable of a certain amount of movement; and *there can be no doubt that it manifests the phenomena of a very simple form of life*"†. . . . . "The circumstance which gives its special interest to *Bathybius* is its enormous extent; whether it is continuous in a vast sheet, or broken up into circumscribed individual patches, it appears to extend over a large part of the bed of the ocean"‡.

Referring to the "coccoliths" found imbedded in the substance of *Bathybius*, Prof. Thomson says, "they are very probably taken into it with a purpose, for the sake of the vegetable matter they may contain, and which may afford food for the animal jelly. . . . Living *upon* and among the *Bathybius* we find a multitude of other Protozoa; and we as yet know very little of the life-history of these groups. There can be no doubt that, when their development has been fully traced, many of them will be found to be di- or poly-morphic, and that, when we are acquainted with their mode of multiplication, we shall meet with many cases of pleo-morphism and wide differences between the *organs* and products involved in propagation and in reproduction" §.

Prof. Thomson sums up his singularly infelicitous and, so far as what has gone before is concerned, singularly inconsistent statement, as follows:—"I feel by no means satisfied that *Bathybius* is the permanent form of any distinct living

* The Depths of the Sea. By Prof. W. Thomson, LL.D., F.R.S., &c. London: 1873, pp. 408, 409.

† Depths of the Sea, p. 410. ‡ Ibid. pp. 411, 412.

§ Ibid. pp. 414, 415.

being. It has seemed to me that different samples have been different in appearance and consistence; and although there is nothing at all improbable in the abundance of a very simple shell-less Moner at the bottom of the sea, I think it not impossible that a great deal of the '*Bathybius*' (that is to say, the diffused formless protoplasm which we find at great depths) may be a kind of mycelium, a formless condition connected either with the growth or the multiplication, or with the decay, of many different things"!*

In the words of Prof. Karl Möbius:—"To suppose that the simplest organisms originate at the bottom of the sea by primitive generation has something very seductive in it. It suits wonderfully well with old cosmogonies and *new theories.* But we shall never succeed in demonstrating its occurrence there; and even if we could methodically produce primitive generation in our laboratories, we could assert nothing further than that perhaps such primitive generation may take place at the bottom of the sea"†.

This is perfectly true, and serves to explain why advanced biologists should have been so eager to hail the alleged "discovery" of an "independent," "living," "indefinite plasmodium, extending over enormous areas of the seabed," as rapturously as Archimedes would have hailed the much-coveted plot of ground from which he pledged himself to move the world. Messrs. Carpenter and Thomson ‡ allege that "there is no difficulty in accounting for the alimentation of the higher animal types with such an unlimited supply of food as is afforded by the *Globigerinæ* and the *Sponges* in the midst of which they live, and on which many of them are known to feed." But they add, with laudable frankness, "*Given the Protozoa, every thing else is explicable. But the question returns,—On what do these Protozoa live?*" Here was the true Archimedean difficulty revived. Prof. Thomson cuts the Gordian knot after a new fashion when he says §, "It is *therefore* [?] quite intelligible that a world of animals should live in these dark abysses; *but it is a necessary condition that they should chiefly belong to a class capable of being supported by absorption through the surface of matter in solution, deve-*

* Depths of the Sea, p. 415.

† "Whence comes the Nourishment for the Animals of Deep Seas?" by Prof. Karl Möbius. Translated by W. S. Dallas, F.L.S., from a separate copy of the paper sent by the author to Dr. J. E. Gray, F.R.S. ('Annals and Magazine of Natural History,' September 1871, p. 203.)

‡ "On the Scientific Exploration of the Deep Sea," by Messrs. Carpenter, Jeffreys, and Thomson, 'Proceedings of the Royal Society,' Nov. 18, 1869, p. 477.

§ *Loc. cit.* p. 478.

loping but little heat, and incurring a very small amount of waste by any manifestation of vital activity." He then dogmatically affirms, without furnishing any thing whatever in the shape of rational proof, that "*it is the distinctive character of the Protozoa that they have no special organs of nutrition, but that they absorb water through the whole surface of their jelly-like bodies.*"

I venture to say that, in all the annals of scientific research, such startling hypotheses succeeded by such facile verification, such unguarded assumptions put forth with the authority of facts, such oracular solutions of most important questions as that involved, first, in the production of substantiatory evidence with regard to *Bathybius*, and, secondly, in the prospective compromise, equally capable of negative or affirmative interpretation, which is apparent in the paragraph in which Dr. Wyville Thomson sums up by saying he "*does not think* Bathybius *is the permanent form of any distinct living being*," have never been equalled.

Though I do not presume to offer myself as an apologist for Prof. Huxley, I fully appreciate the extreme difficulties under which he worked when analyzing material unquestionably altered in its most important characters by the admixture of alcoholic preservative solutions. I can attest, from personal and long-continued experience, that it is simply impossible to arrive at a correct knowledge of the characters of the recent and unadulterated material from material that has been thus preserved. The fact is that there is as marked a distinction between the aspect of pure fresh sponge-protoplasm, for example, seen instantly on its arrival at the surface, and its aspect a very brief period afterwards, as there is between that of the living Foraminifera or Polycystina of the open ocean immediately after capture, and after they have been consigned to some preservative solution. In addition to other important changes produced in the protoplasm of the Protozoa, both marine and freshwater, by being long kept or preserved in such preservative solutions as alcohol when calcareous matter exists in solution, molecular changes take place, the normally homogeneous protoplasm then frequently being converted into minute globular masses, which, when seen under the microscope, resemble sago grains in miniature, and may readily be mistaken for molecular granules of the organism within or upon which they occur. I can produce specimens of Polycystina, and, to a certain extent, of Foraminifera, the rich and varied brilliancy of colour in which has been retained for years, in some cases, even when mounted in balsam; but there all identity in the appearance of the soft parts ends: and so it must be with any protoplasmic matter. On the other hand, every one conversant with the behaviour of viscid fluids such as albumen, when *squeezed* between the glass slide and cover for the purpose of microscopic examination, will no doubt recollect how constantly, partly through capillary attraction and partly through the faint elasticity resident in such substances, movements, which *simulate* vital ones, may be observed. But Prof. Thomson has distinctly asserted that in the examples cited above by him there "*can be no doubt that the gelatinous matter manifested the phenomena of a very simple form of life*"*.

I submit that the case has been widely different as regards Drs. Carpenter and Wyville Thomson's opportunities. They undoubtedly enjoyed opportunities of the first order for arriving at the truth on this question. For, whilst Prof. Huxley's original observations with respect to "*Bathybius*" were based on the microscopical analysis of materials which had been bottled up for upwards of ten years in alcohol, and the whole bulk of which might have been estimated in *grains*, the "remarkable confirmation" which the reputed discovery was alleged to have received almost immediately afterwards was based on a *dredging* made by Drs. Carpenter and Thomson at a depth of 650 fathoms; in describing which they triumphantly state that "Our Dredge" brought up $2\frac{1}{2}$ cwt. of mud at a haul †—a quantity which, in less accomplished hands, and with far less perfectly organized means than Drs. Carpenter and Thomson commanded, might have sufficed to elicit the truth from the sea-bed. It may fairly be assumed that Drs. Carpenter and Thomson examined some of this mud as soon as their dredge arrived at the surface; for we are told that "*the mud was actually alive*; it stuck together in lumps as if there were white of egg mixed with it; and the glairy mass *proved* under the microscope to be *living sarcode.* Prof. Huxley regards this as a distinct creature, and calls it '*Bathybius*'"‡. With reference to this statement, it seems quite impossible to understand how, in the perfectly fresh material which Prof. Wyville Thomson so graphically describes, this "*glairy* mucus, *proved* to be *living sarcode*," and which was said above to be *the* veritable "*Bathybius*," can really be "*little more than sulphate of lime, precipitated* in a *flocculent* [!] state *from the sea-water by strong alcohol*"!

* Depths of the Sea, p. 410.

† "Preliminary Report," by Drs. Carpenter and Thomson (Proc. Roy. Soc., Dec. 17, 1868, pp. 175 & 190).

‡ Prof. Thomson, "On the Depths of the Sea," Annals and Magazine of Natural History, Aug. 1869, p. 121.

Surely the dredge never rendered more sorry service to science than when it was made to yield up this "remarkable confirmation."

It is with a sense of amazement, therefore, that I have in vain searched the numerous writings of Drs. Carpenter and Thomson for any thing in the shape of satisfactory, or even generally consistent, evidence to justify so many hasty assumptions and so many mere assertions put forth as *facts* under cover of expressions alleging that they are "well known," or "there cannot be the least doubt," &c. &c. It is obvious that the entire significance of *Bathybius* rested on the truth or fallacy of the supposition that it *lives*, and is "*an independent*" and "*indefinite*" *organism.* Were further proof needed to show that Drs. Carpenter and Thomson recognized this fact, it is to be found in their observation that "*the indefinite protoplasmic expansion named* Bathybius *is amongst the most important results obtained by the sounding-apparatus*"*. They might with truth have added by the "*Dredge.*"

In one expression of Prof. Wyville Thomson's, when referring to the advanced school of German naturalists, I heartily concur—namely, "in the infinite capacity of the '*Urschleim*' for improvement *in every conceivable direction.*"

Regarding the true origin and functions of the protoplasmic, *non-living* substance which is found associated with certain deep-sea deposits, I shall do my best to give an account in a future communication.

XLIV.—*Description of a supposed new* Actinura *from the Dafla Hills.* By Major H. H. Godwin-Austen, F.R.G.S., F.Z.S., &c., Deputy Superintendent, Topographical Survey of India.

Among the birds collected by me on the Expedition into the Dafla hills, Assam, last winter, one of the most interesting forms is the *Actinura* I now describe. As might be expected, its nearest ally is *A. nipalensis*, Hodgs., the coloration above being very similar on the back and tail, but with less rufous barring. The crest, however, is quite different; and in this respect the species approaches *A. Waldeni* from the Naga hills, on the south of the Brahmaputra valley, only that the crest is far fuller. The general blotchy streakiness of the throat

* In a communication to the Royal Society dated June 17, 1869. See Proceedings.

and breast is also a mark of connexion with *A. Waldeni*. On comparison, it is seen that *Actinura daflaensis* bears the same relation to *nipalensis* that *Waldeni* does to *Egertoni*.

The genus is a very well-marked one; and we can now record from the Indian region five species (including *A. Ramsayi* from Tonghoo, in Burmah, described by Viscount Walden in 'Ann. & Mag. Nat. Hist.' for June 1875), viz.:—1. *A. Egertoni*, Gould; 2. *A. nipalensis*, Hodgson; 3. *A. Waldeni*, Godwin-Austen; 4. *A. daflaensis*, Godwin-Austen; 5. *A. Ramsayi*, Walden. The last is a very distinct and interesting bird, a departure from the East-Himalayan type, but yet in every point a true *Actinura*.

Actinura daflaensis, n. sp.

Male. Above—head ash-brown; feathers in front spatulate, behind elongated into a full crest, narrowly pale-edged; the ash tint pales on back of neck, and merges into the strong rusty brown of the back and upper tail-coverts; base of tail-feathers of same colour, followed by four or five black bars, and the terminal half all black, the three outer tipped white, with a slight tendency to barring on the extreme outer web; side of head ash-grey, the ear-coverts with light silky reflections; shoulder of wing rusty brown; first primary coverts tipped with grey, forming a distinct narrow band, the last (covering the first seven primaries) black, forming a patch; the primaries are sienna-brown, outermost edged with hoary grey, black on inner webs and extremities, and narrowly barred with black on the terminal outer web; secondaries evenly and narrowly barred black and pale olivaceous umber. Beneath—the chin and throat pale dingy white, becoming a dirty ochry ash on the breast, with a blurry striation particularly on the throat; flanks and under tail-coverts rusty brown; tail beneath ashy black, the outermost feathers distinctly barred. Bill dark horny, legs the same; irides ——?

Length 7·5 inches, wing 3·5, tail 3·2, tarsus 1·3, bill at front 0·68.

Hab. In high forest at 7000 feet, Dafla hills, and first shot on Shengorh Peak in February.

I trust to give a figure of this bird in the Journal of the Asiatic Society of Bengal as soon as I have completed the list of birds collected in the Dafla hills, which is now being worked out.

XLV.—*On some new or undescribed Species of Crustacea from the Samoa Islands.* By Edward J. Miers, Zoological Department, British Museum.

The species of which descriptions are here given form part of a large series collected by the Rev. S. J. Whitmee, who is at present resident in the Samoa Islands, and presented by him to the Trustees of the British Museum. The collection contains in all nearly fifty species; and many of the specimens are remarkable for the beauty of their colouring and the excellence of their preservation.

Chlorodius samoensis, sp. n.

Carapace regularly arcuate in front, strongly areolated, with deep longitudinal grooves, and with a strongly marked transverse line extending across the carapace to the base of the fifth tooth on either side. Latero-anterior margins with five small, equal and equidistant teeth (the external orbital angles included); front prominent, four-toothed (the internal orbital angles excluded). Anterior legs granulous externally; wrist with two small tubercles; hand with a single small tubercle on its upper surface, close to the articulation with the wrist; mobile finger with a small tubercle at its base. Ambulatory legs short, very hairy. Colour greenish grey; fingers brown, the brown colour extends a little over the lower part of the hand.

Length $\frac{5}{8}$ inch, width $\frac{1}{2}$ inch.

Hab. Samoa Islands.

This species is closely allied to the *Chlorodius dentifrons* of Stimpson (Proc. Acad. Nat. Sci. Philad. 1858, p. 34), from Loo-Choo; but it differs in the sculpture of the anterior legs, which in *C. dentifrons* have two or three small teeth on the wrist and three or four on the hand.

Thalamita speciosa, sp. n.

Carapace transverse, covered with a uniform short close pubescence; the transverse ridges, the margins of the frontal lobes, and the teeth of the antero-lateral margins naked. Front divided into eight teeth, separated by rather deep fissures, the two median equal, truncated at the extremity; the next two on each side unequal, rounded at the extremity; the external tooth on each side very broad, with the inner margin arcuate, and separated from the next inner tooth by a very wide fissure. Latero-anterior margins with four equal teeth. Basal joint of the external antennæ with a series of two or three spines. Anterior legs rather long; arm with three or four spines on the front margin; wrist with a very long spine on its inner margin, and two or three smaller spines on its outer surface; hand with five spines on its upper surface, three on the outer and two on the inner margin; external surface granulous. Third joint of posterior legs with a strong spine at its infero-distal extremity. Colour of a rich blood-red.

Length $1\frac{5}{8}$ inch; breadth at fifth marginal tooth $2\frac{1}{4}$ inches.

Hab. Samoa Islands.

This species is distinguished by the close short pubescence, the form of the frontal lobes, and the existence of only four teeth on the antero-lateral margins. The species of the genus have normally five teeth, of which the fourth may be rudimentary. The rudimentary fourth tooth, however, according to M. Alphonse Milne-Edwards (Nouv. Arch. Mus. Hist. Nat. 1873, ix. p. 163), is occasionally absent in *Th. Savignyi*, a species with only four frontal lobes.

Leucosia Whitmeei, sp. n.

Carapace subglobose, closely punctate on the sides, narrowed and produced anteriorly. Front slightly relevate, concave above, obscurely tridentate; the median tooth very small, and not more prominent than the lateral ones. Thoracic sinus deep and well-defined, with a smooth, obscurely beaded margin, narrow at base, slightly widened anteriorly and rounded in front. Anterior legs of moderate length; upper surface of arm with an anterior and a posterior longitudinal line of tubercles, several above and below at the base, and two or three placed in an oblique series on the upper surface near the base, of the arm; wrist quite smooth; hand rather longer than broad, compressed, outer margin with a thin smooth ridge, inner with an obscurely beaded line; fingers small, meeting only at the tips. Abdomen of male narrowest between the penultimate and antepenultimate joints; the tubercle on the penultimate joint very small, acute. Colour greyish brown above, pinker on the sides and on the legs, with a semicircular line of five brown spots, two at the back of each branchial and one at the back of the cardiac region, and six white spots, three on each side of the gastric region.

Length nearly $\frac{3}{4}$ inch, greatest width $\frac{5}{8}$ inch.

Hab. Samoa Islands.

This species may be distinguished from all others with a tridentate front by the slight prominence of the median tooth, the form of the thoracic sinus, and the coloration of the carapace.

Alpheus lineifer, sp. n.

Slender. Frontal margin of carapace entire. Beak narrow, triangular, acute, arising between the bases of the eyes. Scale of the external antennæ acuminate, reaching beyond the peduncle of the inner antennæ. Anterior legs with the larger (right) hand suboblong, not contorted, margins rounded, smooth, but with a faint incised line extending longitudinally along the upper surface of the hand for about two thirds of its length, and thence backward obliquely across the outer surface; a transverse groove along the upper surface near the base of the mobile finger, and a triangular notch on the lower surface at the base of the immobile finger. Left anterior leg small, with a spine at the infero-distal extremity of the arm. Fingers of both hands hairy. Terminal segment and caudal appendages small, ciliate. Colour pale yellowish pink, hands of a deeper orange-pink; finger of larger hand black at base, white at tip.

Length $\frac{5}{8}$ inch.

Hab. Samoa Islands.

This species may be distinguished from all the others of the genus, in which the beak rises between the bases of the eyes and the front is entire, by the form and sculpture of the larger hand.

Palæmon gracilirostris, sp. n.

Carapace smooth, rounded above. Beak very slender, not reaching to the extremity of the peduncle of the inner antennæ; upper margin convex, with ten teeth, of which seven form a longitudinal series posterior to the eyes, and extending backward over more than half the carapace; lower margin with two teeth, apex bifid. Scale of the external antennæ large, reaching beyond the end of the peduncle of the internal antennæ. Second pair of legs reaching to about the end of the flagella of the internal antennæ, slender, scabrous; wrist scarcely longer than palm; fingers hairy, about as long as the palm, without teeth on the inner margins.

Length between tip of beak and end of terminal segment $2\frac{1}{2}$ inches.

Hab. Samoa Islands, Upolu.

This species may be distinguished from all the others of the genus which have the wrist shorter than the hand, by the remarkably slender rostrum, the apex of which is minutely bifid at the extremity. It appears to be nearly allied to *P. boninensis* of Stimpson (Proc. Acad. Nat. Sci. Philad. 1860, p. 41)—which has more numerous teeth on the rostrum, and the inner margins of the fingers toothed.

Gonodactylus graphurus, sp. n.

Gonodactylus graphurus, List Crust. Brit. Mus. p. 85 (1847), sine descr.

Narrow, of uniform width throughout. Carapace oblong, anterior angles rounded. Rostral plate quadrilateral, narrowest at base; anterior margin with a long median acute spine. Terminal joint of the large prehensile legs slender, and destitute of spines; basal tubercle ovoid. Penultimate segment of the abdomen with six tubercles, usually terminating posteriorly in spines; caudal appendages ciliate; terminal segment with six marginal spines and seven tubercles on the upper surface, of which the median is the longest and the lateral decrease regularly in size. Colour dull olive-green; branchial appendages pink.

Length about $1\frac{3}{4}$ inch.

Hab. Samoa Islands, Upolu.

This species is distinguished from all its congeners by the number and relative size of the tubercles on the terminal segment of the abdomen.

XLVI.—*Description of a new Species of* Trichoglossus *from Fiji*. By E. L. Layard, Esq., F.Z.S., Consul for Fiji and Tonga.

Trichoglossus aureicinctus, Layard.

Upper parts all green, except the tip of the tail-feathers, brightest on the rump, cheeks, and forehead; body below green; a deep crimson patch extends from the base of the bill as far as, but below, the eye, down the chin and throat to the chest, where it is bordered by a golden band, the feathers between this and the green of the body being more or less scale-like in their markings: tail-feathers—three outer ones red at the base, yellow on the point, half black markings on outer webs; fourth black at base, with red spot, and yellow at point; rest black at base, yellow at point: bill and feet red; eyes dark buff; wing-feathers, inner web black, outer broadly bordered with green.

Length $6\frac{1}{2}$ inches, wing $3\frac{1}{2}$, tail $3\frac{1}{4}$, tarse 4 lines, bill 6 lines.

This species was first indicated by my son, Mr. Leopold Layard, who saw flocks of them at Taviuni in company with *Lorius solitarius*, but could not obtain one. A few were subsequently shot (I believe, on Ovalau) by some one; and one passed into my possession.

XLVII.—*Conspectus of the Suborders, Families, and Genera of* Chiroptera *arranged according to their Natural Affinities.* By G. E. Dobson, M.A., M.B., F.L.S., &c.

The system of classification described in this paper having been adopted by me in the MS. of my descriptive Catalogue of the Asiatic Chiroptera, I here anticipate its publication, with the view of expressing more fully my reasons for classifying the genera according to a plan differing in some important points from those previously used *, and also for the purpose of pointing out some important structural characters, of great value in the systematic arrangement of the families and genera, hitherto either unnoticed or insufficiently recognized.

The Chiroptera fall naturally into two subdivisions which may be called suborders, hitherto known as *Chiroptera frugivora* and *Chiroptera insectivora*; but as those names have not been framed in accordance with the accepted rules of zoological nomenclature, and as, moreover, the second part of the name of the second suborder has been previously applied to an order of Mammals, I use here instead the terms *Megachiroptera* and *Microchiroptera* to express these divisions respectively. These terms are relatively correct; for, although some species of the Carnivorous Bats very much exceed in size many species of the Frugivorous, nevertheless the Frugivorous Bats taken collectively are very much larger than the Carnivorous, contrasting with them in size almost to the same extent as, among other Mammals, the Ungulata contrast with the Carnivora.

Order CHIROPTERA.

Suborder I. **MEGACHIROPTERA.**

Crowns of the molar teeth smooth, marked with a longitudinal furrow; bony palate continued behind the last molar, narrowing slowly backwards; index finger generally terminating in a claw; sides of the ear-conch forming a complete ring at the base; *pyloric* extremity of the stomach greatly elongated.

Frugivorous.

Limited to the tropical and subtropical regions of the eastern hemisphere and Polynesia.

* Two complete systems only, of classifying the genera of Chiroptera, have been published—that of Prof. Peters in 1865 (MB. Akad. Berlin, 1865, p. 256), and that by Dr. J. E. Gray in a series of papers to be found in the 'Ann. & Mag. Nat. Hist.' and in the 'Proc. Zool. Soc. Lond.' for 1866.

Suborder II. MICROCHIROPTERA.

Crowns of the molar teeth acutely tubercular, marked by transverse furrows; bony palate narrowing abruptly, not continued laterally behind the last molar; index finger generally terminating in a claw; sides of the ear-conch commencing anteriorly from separate points of origin; stomach simple, or with the *cardiac* extremity more or less expanded or elongated.

Carnivorous, feeding principally upon insects *.

Inhabiting the tropical and temperate regions of both hemispheres.

Suborder I. MEGACHIROPTERA.

Family I. Pteropidæ.

Synopsis of Groups of Allied Genera.

A. Tongue moderate; molars well developed. Group 1. PTEROPI.
(*Pteropus*, Brisson; *Cynopterus*, F. Cuvier; *Cynonycteris*, Peters; *Harpyia*, Illiger; *Epomophorus*, Bennett; *Cephalotes*, Geoff.)

B. Tongue very long; molars weak, scarcely elevated above the gum .... Group 2. MACROGLOSSI.
(*Macroglossus*, F. Cuvier; *Eonycteris*, Dobson; *Notopteris*, Gray.)

Suborder II. MICROCHIROPTERA.

Analytical Table of Natural Families.

A. Tail contained within the interfemoral membrane.
  a. Middle finger with two phalanges †.
    a'. First phalanx of the middle finger extended (in repose) in a line with the metacarpal bone.
      a''. Nostrils opening in a depression on the upper surface of the muzzle, surrounded by foliaceous cutaneous appendages.
        a'''. Tragus none; premaxillary bones rudimentary, represented by thin osseous laminæ suspended from the nasal cartilages in the centre of the space between the canines.................. **Rhinolophidæ.**

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* Some species of Phyllostomidæ, especially the species of the group *Stenodermata*, have been shown to be frugivorous; but they are probably carnivorous also. In form their teeth in no respect resemble those of *Megachiroptera*; but the true molars, in their narrow external cutting-edges, resemble those of *Carnivora* even more so than those of the truly insectivorous species with their W-formed cusps.

† Except in *Thyroptera tricolor* and in *Mystacina tuberculata*.

b'''. Tragus distinct; premaxillary bones cartilaginous or small, separated by a space in front. **Nycteridæ***.

b''. Nostrils opening by simple crescentic or circular apertures at the extremity of the muzzle, not surrounded by distinct foliaceous cutaneous appendages †; premaxillary bones small, lateral, separated by a wide space in front; tragus distinct .... **Vespertilionidæ.**

B. Tail perforating the interfemoral membrane and appearing on its upper surface, or produced considerably beyond the truncated membrane ‡.

b'. First phalanx of the middle finger folded (in repose) on the dorsal surface of the metacarpal bone §.

c''. Nostrils opening by simple circular or valvular apertures, not surrounded by foliaceous cutaneous appendages; tragus distinct .... **Emballonuridæ**‖.

b. Middle finger with three phalanges; first phalanx of the middle finger short; nostrils in the front part of the cutaneous nasal appendages, or opening by simple apertures at the extremity of the muzzle; chin with warts or erect cutaneous ridges; premaxillary bones well developed, united in front. **Phyllostomidæ.**

Synopsis of Subfamilies.

Rhinolophidæ.

I. Toes unequal, first toe with two, remaining toes with three phalanges each; ilio-pectineal spine not connected by bone with the antero-inferior surface of the ilium . . **Rhinolophinæ.**

II. Toes equal, of two phalanges each; ilio-pectineal spine united by a bony isthmus with a process derived from the antero-inferior surface of the ilium, forming a large preacetabular foramen .... **Phyllorhininæ.**

Nycteridæ.

I. Nostrils at the bottom of a concavity on the extremity of the muzzle, concealed by the base of an erect cutaneous process; tail very short, in the base of the large interfemoral membrane; premaxillaries cartilaginous .... **Megaderminæ.**

II. Nostrils at the anterior extremity of a deep longitudinal facial groove; tail long, produced to the hinder margin of the interfemoral membrane .... **Nycterinæ.**

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* Nycteridæ = Megadermata, Peters (in part.), *l. c.*

† A rudimentary nose-leaf in *Nyctophilus* and in *Antrozous.*

‡ In *Macrotus*, *Macrophyllum*, and *Lonchorina* alone the tail is contained in the interfemoral membrane.

§ Except in *Noctilio* and in *Mystacina.*

‖ Emballonuridæ = Brachyura et Molossi, Peters, *l. c.*

Vespertilionidæ.

Not divisible into subfamilies.

Emballonuridæ.

I. Tail slender, perforating the interfemoral membrane and appearing upon its upper surface; legs long, fibula very slender; premaxillary bones generally separated by an interval in front; incisors weak .... **Emballonurinæ.**

II. Tail thick, produced considerably beyond the short interfemoral membrane *; legs very short and stout; fibula well developed; premaxillary bones close together in front or united; upper incisors strong .... **Molossinæ** †.

Phyllostomidæ.

I. Nostrils on the upper surface of the muzzle, surrounded by cutaneous appendages; chin with warts .... **Phyllostominæ.**

II. Nostrils in the front of the muzzle, opening by simple apertures near the margin of the upper lip; chin with erect cutaneous ridges .... **Lobostominæ.**

Synopsis of Groups of Allied Genera.

	Genera.
Fam. **Rhinolophidæ.**	
Subfam. **Phyllorhininæ**	*Cœlops*, Blyth. *Phyllorhina*, Bonap. *Rhinonycteris*, Gray. *Triænops*, Dobson.
Subfam. **Rhinolophinæ**	*Rhinolophus*, Geoffr.
Fam. **Nycteridæ.**	
Subfam. **Nycterinæ**	*Nycteris*, Geoffr.
Subfam. **Megaderminæ**	*Megaderma*, Geoffr.
Fam. **Vespertilionidæ.**	
A. Crown of the head flat or slightly raised above the face-line; upper incisors close to canines.	
a. Ears very large, generally united. Group PLECOTI	*Antrozous*, Allen. *Nyctophilus*, Leach. *Otonycteris*, Peters. *Corinorhinus*, Allen. *Plecotus*, Geoffr. *Synotus*, Keys. & Blas. *Histiotus*, Gervais.

* Except in *Mystacina tuberculata*.

† These subfamilies nearly correspond to the families Brachyura and Molossi of Peters, and to the Vespertilionidæ (in part) and Noctilionidæ of Gray. The genera of Emballonuridæ, however, with the exception of *Rhinopoma* and *Noctilio*, are so connected that any attempt to divide them into subfamilies must be very artificial. The genera fall naturally into six groups, which I shall define further on.

b. Ears moderate, separate.
Group Vespertiliones ...... *Vesperugo*, Keys. & Blas.; *Chalinolobus*, Peters.; *Scotophilus*, Leach.; *Nycticejus*, Rafinesque.; *Atalapha*, Rafinesque.; *Murina*, Gray.; *Vespertilio*, Keys. & Blas.; *Kerivoula*, Gray.

B. Crown of the head greatly elevated above the face-line; upper incisors separated from the canines, and also in front.
Group Miniopteri.......... *Natalus*, Gray.; *Thyroptera*, Spix.; *Miniopterus*, Bonap.

Fam. **Emballonuridæ.**

Subfam. **Emballonurinæ.**

A. First phalanx of the middle finger folded (in repose) on the dorsal surface of the metacarpal bone; upper incisors weak.

a. Frontal bones convex.
Group 1. Emballonuræ .... *Furia*, F. Cuvier.; *Saccopteryx*, Illiger.; *Rhynchonycteris*, Peters.; *Emballonura*, Temm.

b. Frontal bones with a distinct concavity.
a'. Premaxillary bones separate in front.
Group 2. Taphozoi .... *Colëura*, Peters.; *Taphozous*, Geoffr.; *Diclidurus*, Wied.

b'. Premaxillary bones united.
Group 3. Rhinopoma .... *Rhinopoma*, Geoffr.

B. First phalanx of the middle finger extended (in repose) in a line with the metacarpal bone; upper incisors strong.
Group 4. Noctiliones ...... *Noctilio*, L.

Subfam. **Molossinæ.**

C. First phalanx of the middle finger folded (in repose) on the dorsal surface of the metacarpal bone; upper incisors large, well developed.
Group 5. Molossi .... *Mormopterus*, Peters.; *Molossus*, Geoffr.; *Nyctinomus*, Geoffr.; *Cheiromeles*, Horsf.

D. First phalanx of the middle finger folded (in repose) on the inferior surface of the metacarpal bone; tail perforating the interfemoral membrane; upper incisors strong, well developed.
Group 6. Mystacinæ........ *Mystacina*, Gray.

Fam. **Phyllostomidæ.**

Subfam. **Lobostominæ.**

Group 1. Mormopes	*Chilonycteris*, Gray. *Pteronotus*, Gray. *Mormops*, Leach.

Subfam. **Phyllostominæ.**

A. True molars present; upper incisors 4.

a. Muzzle long; outer side of true molars with W-formed cusps.

a'. Tongue moderately long, terminating in an obtuse tip; upper surface of the lower lip not divided in the centre. Group 2. Vampyri	*Macrotus*, Gray. *Lonchorhina*, Tomes. *Macrophyllum*, Gray. *Vampyrus*, Geoffr. *Schizostoma*, Gervais. *Lophostoma*, D'Orb. *Trachyops*, Gray. *Phyllostoma*, Peters. *Carollia*, Gray. *Rhinophylla*, Peters.
b'. Tongue very long, much attenuated towards the tip; upper surface of the lower lip divided by a deep groove in the centre. Group 3. Glossophagæ	*Glossophaga*, Pall. *Monophyllus*, Leach. *Ischnoglossa*, Sauss. *Phyllonycteris*, Gundl. *Lonchoglossa*, Peters. *Glossonycteris*, Peters.
b. Muzzle short, broad and obtuse; outer side of true molars with a notched cutting-edge. Group 4. Stenodermata	*Artibeus*, Leach. *Phyllops*, Peters. *Vampyrops*, Peters. *Stenoderma*, Geoffr. *Pygoderma*, Peters. *Ametrida*, Gray. *Chiroderma*, Peters. *Sturnira*, Gray. *Brachyphylla*, Gray. *Centurio*, Gray.

B. No true molars; upper incisors 2.

Group 5. Desmodontes	*Desmodus*, Wied. *Diphylla*, Spix.

In the accompanying Diagram I have represented the families of Microchiroptera diverging along two distinct lines of descent from some ancestral group now extinct, which I have for convenience designated Palæochiroptera. These allied families form two natural alliances, which may be called the Vespertilionine and Emballonurine alliances respectively; and these alliances correspond very closely to their geographical distribution, to which I shall refer particularly hereafter.

The Vespertilionidæ and Emballonuridæ are evidently connected through the genera included in the groups Miniopteri and Emballonuræ, more particularly by the genera *Natalus* and *Furia*—not directly, however, but most probably through the family or group, now extinct, referred to above.

[*To face* p. 350.

Pteropidæ.**

Glossophagæ.

Vampyri.

PHYLLOSTOMINÆ. **Phyllostomidæ.†**

Stenodermata.

Desmodontes.

Emballonuridæ.

o the Eastern Hemisphere.
o America.
o the Eastern Hemisphere and Polynesia.
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the whole suborder *Microchiroptera*.

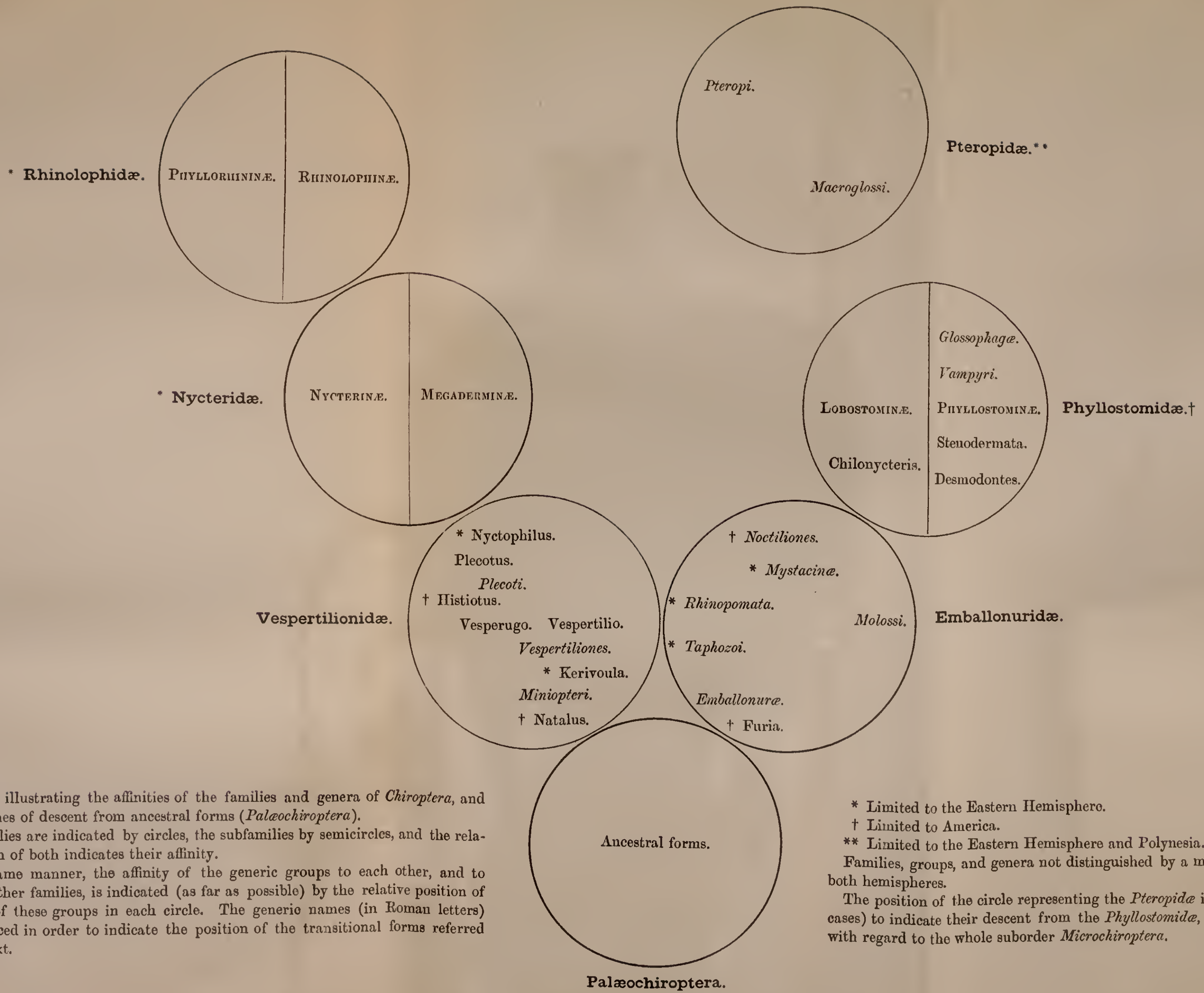

Diagram illustrating the affinities of the families and genera of *Chiroptera*, and probable lines of descent from ancestral forms (*Palæochiroptera*).

The families are indicated by circles, the subfamilies by semicircles, and the relative position of both indicates their affinity.

In the same manner, the affinity of the generic groups to each other, and to groups of other families, is indicated (as far as possible) by the relative position of the names of these groups in each circle. The generic names (in Roman letters) are introduced in order to indicate the position of the transitional forms referred to in the text.

* Limited to the Eastern Hemisphere.
† Limited to America.
** Limited to the Eastern Hemisphere and Polynesia.

Families, groups, and genera not distinguished by a mark, as above, are found in both hemispheres.

The position of the circle representing the *Pteropidæ* is not intended (as in other cases) to indicate their descent from the *Phyllostomidæ*, but to show their position with regard to the whole suborder *Microchiroptera*.

The Vespertilionine Alliance.

(Vespertilionidæ, Nycteridæ, Rhinolophidæ.)

Analysis of Natural Affinities.

In some specimens of *Plecotus auritus* the glands on the sides of the muzzle, between the nostrils and the eyes, form rounded prominences, rising slightly above the margins of the naked crescentic depressions behind the nostrils. These prominences in a closely allied genus (*Corinorhinus*) are greatly developed vertically, forming high conical processes on the sides of the face, which processes, bending inwards over the nasal grooves, meet in the centre above and behind the nostrils, concealing the grooves beneath. In front the nasal apertures are margined by a small horizontal cutaneous ring. In *Nyctophilus* (which is closely connected with *Plecotus* and *Synotus*) the same prominent glands of the muzzle have become united in the centre above the nasal grooves (evidence of their distinct origin being given by the presence of a longitudinal furrow above); while the cutaneous marginal rings surrounding the nasal apertures in *Corinorhinus* have become expanded and also united behind, forming a small nose-leaf, which is supported behind by the united glandular prominences *.

In the much more highly differentiated nasal processes of *Megaderma*, especially in *M. spasma*, the homologies of these parts with the glandular prominences and rudimentary nose-leaf of *Nyctophilus* will be readily recognized. But *Megaderma* shows its affinities to the Rhinolophidæ in the peculiar pubic appendages and in the form of the wings and ears—indeed, by many zoologists has been placed in that family; and the very complicated nasal appendages of *Rhinolophus* are evidently but differentiated forms of the simpler nose-leaves of *Nyctophilus* and of *Megaderma* †.

Thus the intimate connexion of the genera of the three families constituting what I have called the Vespertilionine alliance can be traced through *Plecotus*, *Nyctophilus*, and *Megaderma*; and this view of their relations is still further

* In a similar manner most probably the nasal appendages in all genera of Chiroptera with nose-leaves have been developed.

† *Nyctophilus* is much more closely related to *Plecotus* than to *Megaderma* or to *Nycteris*. This is shown by the skull, which, when compared with that of *Plecotus*, presents differences which would scarcely warrant generic separation if taken alone. Prof. Peters has pointed out the affinities of *Antrozous* with *Nyctophilus*, the skulls and skeletons of which scarcely differ. Consequently *Antrozous* cannot be placed among the Nycteridæ, though differing from all genera of Vespertilionidæ in possessing four lower incisors only.

strengthened by an examination of the minute structure of the hairs composing the fur, which will be found to agree in a very remarkable manner in these families, and to differ not less remarkably from that in the allied genera united in what I have termed

The Emballonurine Alliance.

(Emballonuridæ, Phyllostomidæ.)

Analysis of Natural Affinities.

The Vespertilionidæ are connected with the Emballonuridæ by *Miniopterus*, which agrees with all the genera in the shortness of the first phalanx of the middle finger; with the genus *Furia* in the great elevation of the crown of the head, in the position and form of the upper incisors, and in the tail, which ends *in* the interfemoral membrane, not even the extreme tip projecting. *Natalus* also resembles *Furia* closely in the very short thumb, in the peculiar form of the tragus, and in the tenuity and venation of the membranes.

The very peculiar genus *Rhinopoma*, which I have placed in a separate group, is connected apparently more closely with *Taphozous* than with any other genus. The very long tail, produced nearly double its length beyond the short truncated interfemoral membrane, really perforates the membrane (as in other species of the subfamily Emballonuridæ) near its posterior margin; and the short first phalanx of the middle finger is imperfectly flexed upon the dorsal surface of the metacarpal bone, as in *Furia*—thus also agreeing with other species of this subfamily except *Noctilio*. If *Rhinopoma Hardwickii* and *Taphozous nudiventris*, which inhabit the same regions, be compared, the general resemblance of these generically very distinct forms is sufficiently evident. Both agree in the frontal depression between the eyes, in the *quality and distribution of the fur*, in the great deposits of fat about the base of the tail; while *Rhinopoma* agrees generally with the genus *Taphozous* in the form of the foot and in the presence of a few scattered long hairs near the extremity of the tail. This last-named character may appear to be a superficial one; but I consider it very indicative of affinity. The position of this very curious genus (which differs from all the Microchiroptera in possessing two distinct phalanges in the index finger, as in the Megachiroptera) among the Emballonuridæ is further shown by the microscopical characters of the fur, in which it agrees with that family and with the Phyllostomidæ, and differs from all species of the Vespertilionine alliance. The presence of a small nose-leaf, the longitudinal fissure on the muzzle, the shortness of the middle finger, and the existence of a pair of abdominal (not pubic) appendages (like those in *Megaderma*, but smaller) connect this remarkable genus with the Nycteridæ.

Mystacina, represented by *M. tuberculata* (Gray), Tomes, from New Zealand, connects the *Emballonurinæ* with the *Molossinæ.* It possesses characters common to both subfamilies, resembling the species of the first in the form of the ears and in the short tail perforating the interfemoral membrane, the second in dentition and in the general form of the body; so that its position is clearly among the *Molossinæ.* Unlike the other genera of Emballonuridæ, the middle finger has three phalanges, as in *Thyroptera* among the Vespertilionidæ, and the first phalanx is flexed downwards upon the metacarpal bone.

Noctilio connects the Emballonuridæ, especially the subfamily *Emballonurinæ*, with the Phyllostomidæ through the *Lobostominæ.* I have placed *Noctilio* provisionally in this family; for its affinities appear to me to be with *Chilonycteris* and the genera allied thereto. These affinities are shown by the presence of a small incisor on each side external to the large central upper incisors, by the development of the mastoid and paroccipital processes, by the short first phalanx of the middle finger, which is not flexed upwards (in repose) on the dorsal surface of the metacarpal bone (as in other species of Emballonuridæ), and by the erect cutaneous ridges on the chin, and especially by the form of the nostrils and ears and by the microscopical characters of the fur.

The PHYLLOSTOMIDÆ are divisible into two subfamilies, the *Lobostominæ* and the *Phyllostominæ* :—the first containing the genera *Chilonycteris*, *Pteronotus*, and *Mormops*, united by Prof. Peters into a group *Mormopes*; the second the remaining genera of the family. If the genus *Noctilio* were placed among the *Lobostominæ*, it would form a separate group distinguished by the presence of two phalanges only in the middle finger.

I have followed Prof. Peters's divisions of the genera of *Phyllostominæ*, retaining his names of subfamilies for what I consider groups of allied genera*. Between these groups transitional forms exist, which have not yet been found between the *Phyllostominæ* and the *Lobostominæ.* Thus *Rhinophylla* leads from the *Vampyri* to the *Glossophagæ*; and the close connexion of the *Vampyri* with the *Stenodermata* is seen in the similarity of the warts of the lower lip. *Brachyphylla* is evidently so closely related to *Desmodus* that it appears diffi-

* Prof. Peters has devoted so much attention to the Phyllostomidæ, and his knowledge of the species of this family is so profound, that I hesitate to make any change in his system of grouping the genera.

cult to regard these genera, though differing so widely in dentition, as belonging to different groups; yet *Desmodus* has been considered the type of a primary division of the Chiroptera.

Megachiroptera.

Pteropidæ.

Analysis of Natural Affinities.

The natural affinities of these bats with any of the families of Microchiroptera is not easily traced. Some zoologists consider that they form but another family of Chiroptera and cannot be separated into a distinct suborder, and support their opinion by enumerating the many points of agreement in structure between *Macroglossus* and the species of the group *Glossophagæ* of Phyllostomidæ. But, in the form of the wings, and even in the microscopic characters of the fur, the Pteropidæ are also connected with the families of the Vespertilionine alliance; while they differ altogether (as described in the definition of the suborder) from the Microchiroptera in the general form of the ear-conch, of the teeth, and of the bony palate—also in the tail being inferior to the interfemoral membrane, not contained in it or appearing on its upper surface, as in all other families of Chiroptera. These very different natural characters lead me to trace the descent of the Pteropidæ from a group of Palæochiroptera, distinct from that from which the Vespertilionine and Emballonurine alliances have sprung, but with affinities to that section of the latter group from which the Emballonuridæ are derived. Thus the connexion of the Pteropidæ with the Emballonurine alliance has left traces in the index finger of *Rhinopoma* with two distinct bony phalanges (found in no other genus of Microchiroptera), in the very large and peculiarly shaped feet of *Noctilio* and in the form of its wings, in the well-developed premaxillary bones and upper incisors of Phyllostomidæ generally, and particularly in the long tongue and muzzle and feeble molars of the *Glossophagæ*, and in the frugivorous or semi-frugivorous habits of some species of this family.

It is not, however, in the agreement of certain characters (which may have resulted from similar adaptative causes) that we should seek for proof of special affinity, but in the general agreement of all the natural characters considered together; and it would be, in my opinion, as unphilosophical to consider the Heaths and Campanulas (to take an example from the vegetable kingdom) united in one order because they agree in the insertion of the stamens, or, conversely, to distinguish them merely by the different mode of dehiscence of the anthers.

Natural Characters of the Vespertilionine and Emballonurine Alliances compared.

(Vespertilionidæ, Nycteridæ, Rhinolophidæ.)	(Emballonuridæ, Phyllostomidæ.)
1. Tail always contained within the interfemoral membrane, projecting by the tip only from its posterior margin, in no case perforating the membrane, generally long, never absent.	1. Tail rarely contained within the interfemoral membrane, generally perforating the membrane and appearing upon its upper surface, or produced considerably beyond the truncated membrane, frequently short or absent.
2. First phalanx of the middle finger extended (in repose) in a line with the metacarpal bone.	2. First phalanx of the middle finger more or less completely folded forwards (in repose) upon the superior or inferior surface of the metacarpal bone*.
3. Premaxillary bones rudimentary; upper incisors small, weak.	3. Premaxillary bones well developed (except in some genera of *Emballonurinæ*); incisors generally large.
4. Hair-scales imbricated, the tips of the scales in an oblique line, not terminating in acute projections†.	4. Hair-scales in a transverse series, the tips of the scales in a straight line at right angles to the longitudinal axis of the hair, nearly always terminating in acute projections†.

* This folding of the middle finger (in repose) is, I believe, directly related to the habits of the animals, and not to the comparative length of the finger. The differences in habit between the animals of the two alliances I shall describe in a separate paper to be published hereafter.

† Not satisfied with my own examination alone, I submitted the slides on which the specimens of hairs (taken in every case from between the shoulders) were mounted to the inspection of Dr. J. D. Macdonald, F.R.S., asking him in each case to which alliance (as defined by me) the hair under examination belonged. Answers in accordance with the generalization adopted above were obtained in all cases, except in the genera *Miniopterus* and *Mystacina*. These exceptions rather support the generalization than otherwise; for, as I have already remarked, *Miniopterus* is very closely allied to the Emballonuridæ, forming, in fact, the connecting link between that family and the Vespertilionidæ. *Mystacina* has fur of a totally different kind from that of every other species of bat, and the hair-scales are with difficulty distinguished. *Chalinolobus* and *Nyctophilus* appear to me to be exceptions to the rule that the hair-scales in the species of the Vespertilionine alliance are not terminated by acute projections. However, further investigation may show that this is more apparent than real; for in all genera the under-fur shows a general resemblance in structure, the points of contrast being observed in the longer hairs.

Dr. J. D. Macdonald has very kindly, at my request, permitted me to publish here the following note on the results of his examination of the specimens of hairs of different genera submitted by me to him for his remarks, which agree in all respects with my previous observations stated above:—

"In perhaps all cases the hair is flattish or not quite round, so as to

The last-described character, derived from examination of the minute structure of the hairs, is a valuable one. I was much satisfied to find that it agreed with the system of classification I had sketched out previously. Thus the proper position of *Rhinopoma* among the Emballonuridæ is further shown, and the close affinity of *Noctilio* to the *Mormopes* additionally demonstrated. I have arrived at this generalization from examinations of the minute structure of the fur in almost every genus of the Vespertilionine, and in most of the genera of the Emballonurine alliance*.

Magnified hair of *Corinorhinus Townsendi*, typical of the Vespertilionine Alliance.

Magnified hair of *Mormops megalophylla*, typical of the Emballonurine Alliance.

DISTRIBUTION OF THE FAMILIES OF CHIROPTERA.

As I have remarked above, the lines of descent correspond very closely to the geographical distribution of the Chiroptera. Thus the Nycteridæ and Rhinolophidæ are confined to the

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give the deceptive appearance of growing thicker and thinner at intervals. The arrangement of the scales upon the hair presents almost as much variety as the phyllotaxis of plants. Thus they are, naturally as it were, alternately disposed; but opposition and whorling are frequently seen; they may be specially attached to the broad surfaces, or to the borders, or to both, in four or more series. The optical section of the scales often gives the appearance of sharp spines besetting the sides of the hairs.

"It is a curious fact that imbrication, with the tips of the scales in an oblique line, should mark one, and a symmetrical disposition with transverse lines characterize the other of the two alliances into which Mr. Dobson proposes to divide the families of Chiroptera."

* I have examined the microscopic structure of the hair in the following genera:—

1. *Vespertilionidæ.* Miniopterus, Natalus, Thyroptera, Murina, Chalinolobus, Vespertilio, Vesperugo, Atalapha, Scotophilus, Plecotus, Corinorhinus, Otonycteris, Nyctophilus, Antrozous.
2. *Nycteridæ.* Nycteris, Megaderma.
3. *Rhinolophidæ.* Rhinolophus, Phyllorhina, Rhinonycteris.

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4. *Emballonuridæ.* Furia, Diclidurus, Coleura, Taphozous, Rhynchonycteris, Noctilio, Rhinopoma, Nyctinomus, Molossus, Mystacina.
5. *Phyllostomidæ.* Chilonycteris, Mormops, Carollia, Rhinophylla, Trachyops, Glossophaga, Monophyllus, Vampyrus, Centurio, Artibeus, Brachyphylla, Desmodus.

Eastern Hemisphere, while the Phyllostomidæ are limited to America, the Vespertilionidæ and Emballonuridæ, as directly derived from the ancestral group (Palæochiroptera), being common to both hemispheres. But another distributional fact may also be observed—namely, that the most highly differentiated and most highly organized species of the Vespertilionine and Emballonurine alliances respectively belong to families of very limited distribution. Thus the closely allied Nycteridæ and Rhinolophidæ have nearly the same distribution—the former family being confined to tropical and subtropical Africa, Asia, and Australia, the latter to the same continents, a few species extending into Europe; while the Phyllostomidæ are absolutely limited to tropical America. The Pteropidæ, including the largest bats, are strictly limited to the tropical and subtropical regions of the Old World from Western Africa to the Navigators' Islands; and of these the genera containing the most highly differentiated forms have also the most strictly defined range. This is precisely what we should expect if we regard these families as later developments of the Vespertilionidæ and of the Emballonuridæ. While the older forms are found in both hemispheres, the later developments are still limited to the regions, or remains of the regions, in which they first originated, restricted by changes which had taken place in the distribution of land and water previous to their origin, but subsequent to the appearance of the forms from which they were derived.

XLVIII.—*On the "Cow-fish"* (Tursio metis) *of the Sounds on the West Coast of Otago, New Zealand.* By F. W. Hutton, Curator of the Otago Museum, Dunedin.

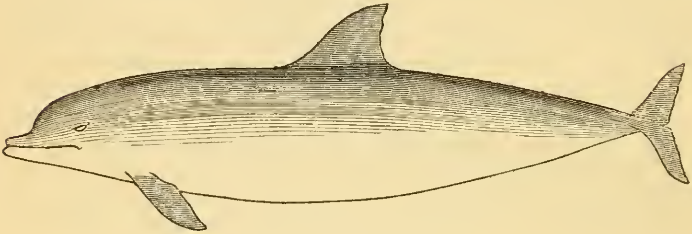
Tursio metis, Gray, Zool. Erebus and Terror, p. 38, t. xviii.

Female. Teeth $\frac{23\,.\,23}{22\,.\,22}$, exactly three in an inch. Body elongate, thickest in front. Dorsal fin falcate, commencing before the middle of the back; its height less than the length of the pectoral fins. Pectoral fins as long as the gape, falcate, on a restricted base. Lower jaw longer; attenuated portion of the snout short.

Colour. Above and upper jaw dark slate-blue, passing gradually into white below; the white of the underparts not reaching to the caudal fin. Dorsal, pectorals, and caudal slate-blue, without spot.

Measurements.

	ft.	in.
Total length along the curve of the side	7	6
,, ,, ,, of the back	7	6
Length from tip of snout to blowhole	1	2
,, ,, to eye	1	1
,, ,, to commencement of dorsal fin	3	5
Dorsal fin—width at base	1	0
,, height	0	9
,, anterior margin	1	3
Pectoral fins—length	1	1
,, breadth at base	0	5
Caudal fin—spread	1	10
,, anterior margin of lobe	1	1



Tursio metis, Gray.

The specimen here described was presented to the Otago Museum by Captain Fairchild, of the Colonial steamer ‘Luna,’ and is one of two captured in Useless Bay, Dusky Sound, on the 10th of May, 1875. The other specimen was also a female, and measured $9\frac{1}{2}$ feet in length; on being captured it emitted large quantities of milk.

The following are the dimensions of the skull:—

	inches.
Total length	19
Length of beak	11
Width at orbits	9
,, notch	$4\frac{1}{2}$
,, middle of beak	3
Length of lower jaw	15
,, teeth-line	$8\frac{1}{2}$

The skull agrees very well with the figure of that of *T. metis* in the ‘Zoology of the Voyage of the Erebus and Terror;’ but the teeth are rather closer together.

It is remarkable how very closely the measurements of the body of this animal agree with those given by Dr. Hector, in the 'Trans. N.Z. Institute,' vi. p. 85, of a porpoise from Cook Straits that he refers to *Delphinus Forsteri*. The Dusky-Sound specimen, however, differs considerably both in colour and form from the figure of *D. Forsteri* in the 'Voyage of the Erebus and Terror;' while Dr. Hector says that the Cook-Strait specimen "does not differ sufficiently from that copied last year after Forster to make it worth reproduction."

The skeleton is being prepared for the Otago Museum.

XLIX.—*On the Geological Structure of the Amazons Valley.* By Professor JAMES ORTON*.

THE valley of the Amazons is a very shallow basin of vast extent and of an oval shape, with the small end pointing eastward. Between December and June a large part of it resembles a huge undrained swamp, and people sail half the year above districts where for the other half they walk. Were the forest removed from the Lower Amazons, a great mud flat would be exposed (lower than the island of Marajó), threaded by a network of deep channels, partially covered by every tide, and deluged by the annual flood. From the marked feature (first noticed by Chandless) that the tributaries enter the main stream at a very acute ongle, and have exceedingly tortuous courses, it is inferred that the rest of the valley is a nearly level plain gently inclined from west to east, and with very little slope on either side toward the centre of drainage.

Between Borja and Pará, a distance of 29°, the inclination is only 500 feet. A section from Exaltacion, on the Upper Madeira, which has the same altitude as Borja, to San Carlos, on the Upper Negro (which is elevated only 212 feet above the Atlantic), would show a depression at Fonte Boa, on the Amazons, of only 150 feet in 1000 miles. The Negro is a sluggish stream (San Carlos being on a level with Tabatinga); the Napo is more rapid; and the Pastássa is a torrent. In the last thousand miles, the Madeira descends 430 feet, the Purús 225, and the Ucayali 400; while the Huallága has probably a swifter current than any of the southern affluents.

The basin of the Great River is principally enclosed by the

* Communicated by the Author, being Chapter XLI. of the forthcoming new edition of his work on the Andes and the Amazons.

sedimentary slopes of the Andes and the metamorphic regions of the Casiquiare and Central Brazil.

As the rise of the Andes was the creation of the Amazons, the study of the mountain should precede that of the river; indeed the structure of the basin cannot be understood without a knowledge of the "rim." The geology of the Andes is not sufficiently advanced to warrant a classification of the ranges with respect to their periods of elevation. Yet it is very probable that the coast Cordillera was the first to emerge, and very certain that the eastern did not reach its present elevation until after the Cretaceous age. The characteristic rocks of the maritime range are trachytes and porphyries; of the oriental, sandstones and slates.

The annexed profile of the Andes of Northern Peru gives the relative heights of the ranges and the main formations. I found no fossils in the Pacasmáyo beach; but at Payta, further north, there are many—among them *Turritella patagonica*, Sow. (which Darwin found also on the coasts of Patagonia and Chile), and *Pecten modisonus*, Say, and *Crepidula fornicata*, Say, identical with Miocene species on the east coast. The beach was therefore raised in late or post-Tertiary times; and there is evidence that a

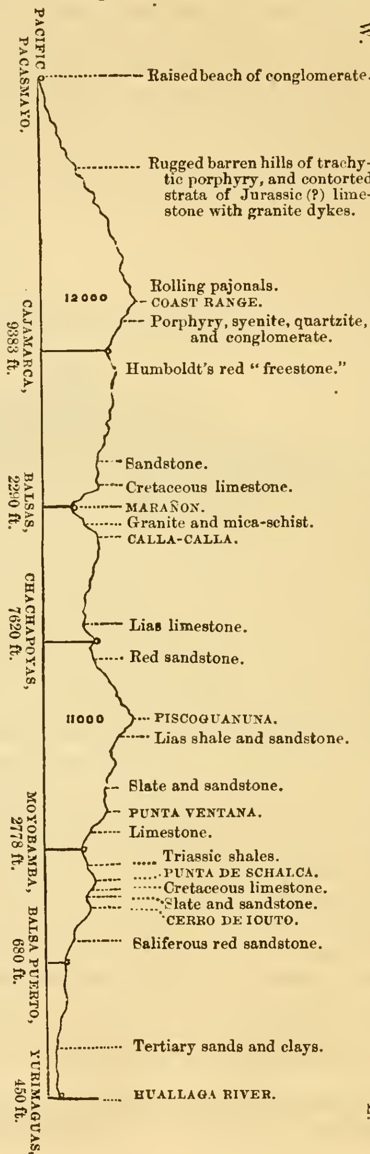


Diagram of Route from the Amazons Valley to the Pacific.

subsidence has taken place since the Conquest*; for an Incarial road, with side-walls intended to run along the coast, starts from Pacasmáyo, and ends in the sea some three miles south.

The western Cordillera is doubtless Mesozoic, the Pacific side being probably Jurassic, as in Southern Peru, and the oriental side Cretaceous. From the slope facing Pacasmáyo I obtained Jurassic Cardiums and Ostreas, and an Ammonite resembling *A. Murchisoni.* Above Balsas, near Tomependa, Humboldt found and Von Buch determined Echini, Isocardias, Pectens, Ostreas, and Ammonites of Cretaceous age; and similar forms were discovered by Raimondi below, within the department of Ancachs. Half a day's journey west of Chachapoyas is a highly fossiliferous limestone, abounding with Ammonites and Pectens, which, according to Professor Hyatt, are Liassic†. The fossils are most common along the left bank of the Utcubamba, near Tingo. Some of the Ammonites are a foot in diameter. Belemnites and Starfishes have also been found further down the Utcubamba, near Bagua; and at San Carlos is an extensive salt deposit. The dark-brown shale near the summit of Piscoguañuna, dipping strongly to the eastward, contains numerous Middle-Lias Ammonites. The rapid Cachiyacu, tearing its way down from the Punta de Schalca, brings along many Ammonites and Brachiopods of Cretaceous

* I have elsewhere called attention to the singular fact that every successive measurement of the Andes gives a reduced elevation, tempting one to believe that either the chain is sinking or the atmospheric pressure increasing. Thus, Humboldt (1803) made the altitude of Quito 9570 feet; the writer (1867), 9520; Reiss and Stübel (1870), 9350. Pichincha, according to Humboldt, is 15,922 feet; according to the writer, 15,827; according to Reiss and Stübel, 15,704. In 1827 Pentland very carefully estimated the altitude of Lake Titicaca at 12,795 feet; and Friesach, in 1858, determined it to be 12,630; but the recent railway-levellings from the coast make it only 12,493.

† The following is an abstract of Professor Hyatt's paper presented to the Boston Society of Natural History, January 20, 1875, entitled "Notice of Jurassic and Cretaceous Ammonites collected in South America by Professor James Orton, with an Appendix upon the Cretaceous Ammonites of Professor Hartt's collection":—

"Jurassic Ammonites (Lias):—*Arnioceras ceras*, Agassiz (*Amm. ceras*, Giebel): under this name I have been obliged to describe several badly preserved specimens, which resemble in their characteristics very closely this well-marked species of the Lower Lias: *loc.* Piscoguañuna, Northern Peru. *Arnioceras miserabilis*?, Hyatt (*Amm. miserabilis*?, Quenst.): *loc.* Piscoguañuna. *Caloceras Ortoni*, Hyatt: this new species is closely allied to *Amm. sironotus*, Quenst., also a Liassic species: *loc.* Tingo, Northern Peru. *Phylloceras Loscombi*, Hyatt (*Amm. Loscombi*, D'Orb.): this is another Lias form, probably Middle Lias, from the same locality. *Perisphinctes anceps*, Waagen: this species indicates the presence of the higher divisions of the Jura, the Lower Oxford of Oppel, perhaps age. This Punta, the saddle which divides the rivers Cachiyacu and Mayo, continues northward; and through its limestone strata the Marañon has cut the Pongo de Manseriche. The limestone at the Pongo yielded me a *Protocardia*, a linguiform *Ostrea*, and an *Exogyra* of Cretaceous type. All the Pongos on the Upper Marañon are made through limestone mountains. The Punta de Schalca is also a prolongation of the calcareous range which crosses the Huallága at the Pongo de Aguirre. It is probable therefore that this western wall at the head of the Amazons valley is of Cretaceous age.

The Cerro de Icuto is flanked on the east with saliferous red sandstone. It contains the valuable salt-mines of Cachipuerto, on the Cachiyacu; and without doubt the salt-hills of Chasuta and Pilluana on the Huallága belong to the same formation, as also the gypsum-beds in the elevated ridge separating the Huallága from the Ucayali. The Cerro de Sal, further south, near the head of the Pachitea, may likewise be contemporaneous*. The Icuto rock is unfossiliferous, and I could not find its relation to the Schalca limestone. The great Moyobamba valley, enclosed between the Schalca and Piscoguañuna ranges, is lined with friable shales of divers colours (red, yellow, purple, blue, and black), with overlying soft white sandstone. Drs. Raimondi and Spruce refer this to the Triassic. Near Tarapoto, where the shales contain Ammonites of immense size, there are jointed columns of traprock and cliffs of white salt.

In crossing the Andes in the latitude of Lake Titicaca eastward, we first find Oolitic formations largely covered with intrusive rocks. After passing the summit of the coast Cordillera

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the Kelloway division of that formation: *loc.* Compuerta, near Lake Titicaca, fifty miles north-west of Puno, altitude of 13,500 feet. *Stephanoceras macrocephalum*, Waagen: the identity of this, as well as the former, with European species cannot be doubted; it indicates the same division of the Jura: *loc.* Caracolis, near Lake Titicaca. It is probable that the whole series of Jurassic rocks exist in Peru and Bolivia.

"Cretaceous Ammonites.—The remarks upon the specimens in this division are interesting simply because they have furnished me the means of establishing a new genus to include the forms which have hitherto been regarded as Cretaceous Ceratites. This genus I have called *Buchiceras*, in honour of the great German geologist Leopold von Buch. It includes the following species:—*B. bilobatum*, Hyatt, n. sp., *loc.* Punta de Schalca, Northern Peru; this would be generally supposed to be identical with the *Amm. syriacus*, Von Buch, but the comparison of authentic specimens shows specific differences; *B. serratum*, Hyatt, n. sp., *loc.* Cachiyacu, Northern Peru, doubtless washed down from the Punta de Schalca."

* The gorge of Tunkini on the Upper Ucayali is described by Castelnau as "freestone."

we have purely sedimentary strata, contorted, but dipping easterly—conglomerate, sandstone, slate, and Jurassic limestone. Then follow, in succession :—Triassic beds (remarkably like those in the Moyobamba valley, capped with white sandstone, and broken by protruding igneous rocks); Carboniferous, at the south end of the lake, and reappearing east of Cochabamba on the headwaters of the Chapara ; and the Devonian and Silurian, forming the mass of the high Andes.

If now we examine the valley of the Amazons, we shall be struck with its remarkably uniform character, such as is presented by no other region on the globe of equal area. From the Andes to the Atlantic, and from the Falls of the Madeira to the Orinoco, scarcely any thing is visible but clays and sandstones.

The fundamental rock is metamorphic, chiefly gneiss and granite. It is exposed at the falls of the tributaries, especially on the Madeira; it is greatly disturbed, and frequently broken through by porphyritic dykes. The granite contains little mica and much quartz. The valley is bounded on the north and south by immense metamorphic areas. The low watershed between the Amazons and Paraguay is covered with Tertiary beds; but the still lower region of the Upper Rio Negro is one great undulating sheet of granite and gneiss completely denuded of the stratified rocks that once overlay it, save here and there a thin covering of white sand and red loam filling the hollows, and abrupt peaks that suddenly rise from the plain.

Silurian formations are rarely visible. The gold and topaz-bearing rocks of Minas Geraes probably belong to this age; but they are greatly altered. In the Bolivian Andes, facing the Madeira valley, is an extensive development of Silurian slates and sandstones. The only undoubted Devonian formation in the valley is the plain north of the Serra of Ereré, discovered by Hartt.

The horizontal limestone strata at Itaituba on the Tapajos, and on the Trombetas across the Amazons, abound with Brachiopods of the Coal-measures. D'Orbigny and Forbes have pointed out isolated Carboniferous deposits in the Titicaca basin and near Santa Cruz, on the Mamoré. From the Pichis, which flows directly from the Cerro de Sal (a spur of the eastern Cordillera), I obtained several fossils of limited vertical range which go to show that the Pichis, Bolivian, and Itaituban beds are identical. The Pichis, Titicaca, Oruro, and Guaco (province of San Juan) deposits lie in the same line, north-west south-east, along the Andes. The altitude of the Tapajos beds is 125 feet, of the Pichis over 700 feet, of the

Titicaca 12,500 feet; and Raimondi has found Carboniferous rocks on the Apurimac at the height of more than 14,000 feet. It is evident that through the Palæozoic ages at least the basin of the Amazons was an open sea*.

No Mesozoic rocks are visible east of the Andes, except the Cretaceous conglomerate found by Chandless on the Upper Purús, which, however, was evidently washed down

* A pebbly bottom is first struck in ascending the Ucayali about fifteen miles up the Pachitea. Now and then bluffs of yellowish-grey sandstone abound on the Pachitea; but the Ucayali, for 700 miles from its mouth, flows through a vast pampa, overflowed in the rainy season. The rocky bed of the Pichis (lat. 10°, long. 75°) is filled with fragmentary fossiliferous limestone of an ash-grey colour. At Puerto Tucker, the highest point navigable in canoes, lofty mountains are seen about seven miles distant, extending east and west. I am indebted to the Hydrographical Commission for specimens from the bed of the Pichis. Among them are two corals, which I have submitted to Professors Hall and Pourtalès. One is cyathophylloid, having the structure of *Amplexus*; but it is compound. The other has the aspect of *Syringopora*, and may be an *Edriophyllum* of small size. The evidence is in favour of their Carboniferous age. The following note on the mollusks is by Mr. Orville A. Dewey, of Cornell University:—" On his return from Peru in 1874, Prof. James Orton submitted to me for examination a piece of fossiliferous limestone from the Pichis river. The mass was a waterworn pebble of dark-blue stone, scarcely larger than one's fist. The fossils being silicified, the specimen was treated with acid, and a number of species of Brachiopoda obtained. The only other fossil was a slender ramose coral or Bryozoan, which, being imperfectly silicified, could not be obtained for identification. The number of individuals and species occurring in so small a mass indicate an exceedingly rich fauna in the locality. The following are the species determined:—

" Spirifera camerata, Morton: this widely distributed species is represented by several specimens, one of which is of considerable size, and shows unmistakably the characteristics of the species; the fasciculated arrangement of the ribs, though distinct, is not strongly marked; and in this as in other respects it agrees with the forms found on the Tapajos. The occurrence of this form in the Andes strengthens the view which I had taken in my paper on the Brazilian Carboniferous Brachiopods (Bull. Cornell Univ. vol. i.), that *S. condor*, D'Orb., from Lake Titicaca is identical with the North-American species. Spirifera or Spiriferina, sp.: there is also a fragment with rather coarse simple ribs not recognizable specifically; the aspect is that of a *Spiriferina*; but no puncta have been observed. Spirifera perplexa, M'Chesney: a single dorsal valve is referred to this species. In the paper above cited I have endeavoured to show that this well-known and widely distributed American form is distinct from the European *S. lineata*, Martin, to which it has usually been referred. An exceedingly small specimen, presenting the characters of a smooth *Spirifera*, is probably the young of this species or of *S. plano-convexa*, Shumard. Eumetria Mormonii, Marcou (*Retzia punctulifera*, Shumard), is by far the most abundant species, being represented by ten or a dozen specimens in the rock examined; one of these is figured on pl. viii. fig. 8 in my paper referred to. Terebratula bovidens, Morton (?): a crushed specimen agrees perfectly with Morton's species from Missouri in the characters of the beak and in general form, as far as the latter can be observed. This species is known from two Bolivian localities. Salter identified it, from a higher locality further south*. The Andean region was covered by the Jurassic sea, and was afterward elevated (in Northern Peru) 11,000 feet. The moment the Andes began to rise, the topography of the Amazons valley was foreshadowed. The superficial Cretaceous strata up the Paranapura, at the Pongo de Manseriche, and from Tomependa up the remarkable longitudinal valley of the Upper Marañon to Balsas, into the department of Ancachs, would indicate that so much at least of the great river began to exist in the early Tertiary. Without doubt, during the Cretaceous period the Atlantic and Pacific were continuous oceans, flowing over not only the Panama isthmus, but also over all Equatorial America, save a few islands and reefs. We are not surprised therefore to find the same Cretaceous (and even Miocene) species on both sides of the Andes†.

The vast basin (whether Carboniferous or Cretaceous I will not say) formed by the rise of the Andes and the metamorphic regions on the north and south received an immense sheet of coloured clays, sands, and sandstones. This deposit, unique in its extent and origin, is known as the Amazonian Tertiary formation. It was the sediment of a brackish Mediterranean, or of a quiet lake to which brackish water had occasional access. The argillaceous and loamy beds are universal; the sandstone has been reduced by subsequent denudation, and is now nearly confined to the Lower Amazons‡. Excepting this

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under the name of *T. millepunctata*, among some specimens brought from Santa Cruz by Mr. Cummings (Quart. Journ. Geol. Soc. vol. xvii. p. 50); and Toula describes an apparently identical form from Cochabamba as *T. Hochstetteri* (Proc. Vienna Acad. lix.). Ryhnchonella or Camarophoria, sp.: a small specimen; ovate, about as long as wide; ventral valve depressed, convex, with a broad shallow sinus extending but little beyond the middle, and marked by two rounded ribs; dorsal valve gibbous; surface smooth. Should this prove to be new, I would suggest the name of R. (or C.) Ortonii. Of these species, *S. camerata*, *S. perplexa*, and *E. Mormonii* occur on the Tapajos in beds equivalent to the North-American Coal-measures, of which the same species, with *T. boridens*, are characteristic. I have endeavoured to show (Bull. Cornell Univ. vol. i. part 2, p. 6) that the fossils found in various Bolivian localities belong to the same division of the Carboniferous age. The existence of a Carboniferous basin in Peru quite widely removed from the Titicaca basin on the south, and from the Tapajos basin on the east, is an exceedingly interesting point in South-American geology.

* Dr. Galt brought an Ammonite from the mouth of the Pichis on the Pachitea (Upper Ucayali), which appears to be Cretaceous. It was probably washed down from the south.

† Mr. Bland informs me, after an examination of my land-shells, that the general aspect of the living *Bulimi* from the Peruvian Andes is remarkably like the Lower Californian.

‡ Vesicular ferruginous sandstone occurs far up the Madeira and Negro. I am not aware of its existence in any part of the Marañon region.

sandstone, the material is so thoroughly comminuted that a pebble is a rarity. The Marañon Indians, upon returning from up the Ucayali and other tributaries, bring home rocks to sharpen their knives. I have seen, however, concretions, nodular and stalactiform, strikingly similar to the marly concretions noticed by Darwin in the Pampean mud.

Previous to the expedition of the writer across the continent in 1867, this vast homogeneous formation along the great river had not yielded a single fossil. In the words of Professor Agassiz, "Tertiary deposits have never been observed in any part of the Amazonian basin." And it was on this negative evidence mainly that the distinguished naturalist hazarded the conjecture that the formation was drift*. But the banks of the Marañon prove to be highly fossiliferous. At Pebas, near the mouth of the Ambiyacu, I discovered in one of the beds of blue clay, 12 feet below the surface, a multitude of fossil shells. Below this bed is a seam of lignite, and then another layer of fossils. I engaged Mr. Hauxwell, an English collector, to search for other localities; and in 1870 he reported a large deposit on the south side of the Marañon, below Pebas, at Pichana. The shells were larger and more plentiful than at Pebas, and were found from 6 to 20 feet beneath the soil. In revisiting the Amazons in 1873, I discovered at Iquitos, more than a hundred miles west of Pebas, a still more prolific bed†. Here the shells occur above, below, and in the lignite band, beginning about 20 feet from the surface. They are best exposed about two miles below the town. A well dug at Iquitos shows:—first, 7 feet of variegated clays, 9 feet of fine

* The history of the attempt to find the traces of glaciation in this equatorial region is short. The Cambridge professor, who had berated other naturalists for theorizing without facts, entered the mouth of the Amazons for the first time in his life with the confidence of a prophet, foreordaining boulders, moraines, striæ, and all the other appurtenances of a gigantic glacier. All proved to be imaginary; yet the chief and his satellites stoutly kept their original faith. Professor Hartt, after propounding several modifications, the last one being the possible glacial origin of the superficial layer (to which the Pebas shells had driven him), finally owns that, "having no evidence whatever of the former existence of glaciers in the Amazons, the question of the glacial origin of the valley need not be raised." For evidence against the supposition of a glacial epoch at the Equator, see 'Ann. & Mag. Nat. Hist. 1871, vol. viii. p. 297. Keller, in his late exploration of the Madeira, searched diligently for erratic boulders; but not a trace of the "foundlings" could he discover. "I never believed for a moment," writes Mr. Darwin, "in Agassiz's idea of the origin of the Amazonian formation."

† It is very singular that Castelnau and Herndon overlooked the shells at Pebas, since they are plainly exposed—and still more strange that Mr. Steer, who examined the beds at Pebas and Pichana in 1871, found nothing at Iquitos, where I found shells even more abundant than below. All the known localities were discovered by myself and by Mr. Hauxwell, under my instructions.

sand; next, several feet of pebbles; and then blue clay containing shells. From the collections made at these localities, the following thirty species have been determined:—

BIVALVES.	UNIVALVES.
Pachyodon carinatus, *Conrad.*	Isæa Ortoni, *Gabb.*
—— obliquus, *Gabb.*	—— lintea, *Conrad.*
—— tenuis, *Gabb.*	Liris laqueata, *Conrad.*
—— erectus, *Conrad.*	Ebora crassilabra, *Conrad.*
—— cuneatus, *Conrad.*	Nesis bella, *Conrad.*
—— ovatus, *Conrad.*	Neritina Ortoni, *Conrad.*
—— cuneiformis, *Conrad.*	Dyris gracilis, *Conrad.*
—— dispar, *Conrad.*	Hemisinus sulcatus, *Conrad.*
Dreissena scripta, *Conrad.*	—— Steerei, *Conrad.*
Anodon Batesii, *Woodward.*	Iquitosa tuberculifera, *Conrad**.
—— pebasana, *Conrad.*	Pachytoma tertiana, *Conrad.*
Triquetra longula, *Conrad.*	Toxosoma eborea, *Conrad.*
Ostomya papyria, *Conrad.*	Cirrobasis venusta, *Conrad.*
Haplothærus capax, *Conrad.*	Liosoma curta, *Conrad.*
	Cyclocheila pebasana, *Conrad.*
	Bulimus linteus, *Conrad.*

These interesting fossils have attracted much attention by their extraordinary character, and by the light which they throw upon the largest continuous Tertiary formation in the world. All the species and twelve of the genera are extinct. The impalpable clay in which they were imbedded was admirably fitted for their preservation. Some have retained their colours and epidermis; and the bivalves generally occur with the valves united and closed. They exist also in such vast numbers that they must have lived and died on the spot. The bivalves are most abundant at Pichana, and the univalves at Iquitos—localities at least 150 miles apart: the former may be the lower stratum, and the other the upper. The *Hemisinus* is particularly abundant at Iquitos, and very rare in the Pebas district. Mr. Gabb led me astray in saying that these shells are marine. Most of them are freshwater; many are estuarine (but might have lived in fresh or brackish water); and a few are terrestrial. Mr. Conrad, who examined my large collections, and is better prepared to speak than any other palæontologist, considers the beds *Eocene*†.

* This beautiful and characteristic shell was originally described, in Proceed. Acad. Nat. Sci. Philad. vol. xxvi., as a *Hemisinus*; but Mr. Conrad has since decided that it belongs to a new genus, distinguished by its high *Melania*-like spire and short patulous aperture. "Subulate, subturreted; whorls numerous, spirally ribbed; aperture short, oval; columella regularly arched, solid, subtruncated at base; outer lip regularly curved." The name is derived from Iquitos, Peru, where it is very abundant. *Hemisinus* and *Triquetra* are characteristic genera of South-American rivers.

† *Per contra*, Professor Hartt, who has never seen the Marañon, decides "that it was in the latter part of the stage of growth of the basin that the clays of the Upper Amazon were deposited and the Pebas shells lived. This appears to have been near the close of the Tertiary."

I am not prepared to give the vertical or horizontal distribution of these fossils. So far as visible at low water, they appear to range over 20 feet of depth, coming nearer to the surface at Pebas than at Iquitos; but the main layer lies nearly parallel with the level of the river, which falls about 40 feet between the two places. They occur on both sides of the lignite, which is traceable from Tabatinga to the Huallága. The shell-bed must extend far west of Iquitos; and in my last expedition I procured a mass of yellow clay, containing the "Pebas shells," from a point several hundred miles up the Ucayali: the precise locality I cannot give, as I did not visit it. Evidently this Tertiary basin is not so contracted as the glacialists have tried to made it. Dr. Galt brought from the Pachitea (near the junction of the Pichis and Palcazu) a beautiful *Ostrea*, which Conrad calls *O. callacta*, and says it is a Tertiary form, and was filled with a light-coloured clay strikingly similar to that of the Pebas beds*. Mastodon remains have been found near Moyobamba; and silicified wood is occasionally seen in the hands of the Marañon Indians.

It is evident that such an even sheet of fine earth could not have been spread over such a vast area by streams from the rising Andes; it must be the deposit of a quiet inland lake. It is evident that the Amazons estuary extended further west than now, the result of a gentle oscillation: a subsidence of one hundred feet at Tabatinga would make the tides felt on the Marañon. It is evident that the condition of things in the Brazilian Amazons, both during and after the deposition of the formation, was different from that in the Marañon region. If there is any difference in age, I should give the priority to the latter. It is evident that the Andes did not reach their present altitude until after the deposition of the Amazonian formation,—though it was a slow movement, in mass; for the beds are nowhere unequally tilted or dislocated. The clay-beds ascend with gentle inclination the eastern slope, being visible far up the Napo, Pastássa, and Huallága. Balsa Puerto, 3° 15′ west of Iquitos and 400 feet higher, stands on a thick bed of red, yellow, and white clays, resting on a soft slate, dipping easterly†. By the continued rise of the Andes, the great equatorial lake, already shallowed by sediment, was drained, leaving only a network of rivers, igarapes, and lagunes.

Poughkeepsie, New York,
September 22, 1875.

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* In the ferruginous clay at Villa Bella, Lower Amazons, I found imbedded a little shell, which Conrad refers to *Acicula*.

† At the head of the Napo and Pastássa the Andes begin with a soft slate of great thickness, overlying mica-schist and trachyte.

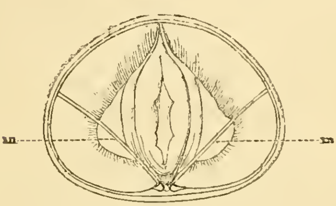
L.—*Note on* Linotrypane apogon. By W. C. M'Intosh.

To the Editors of the Annals and Magazine of Natural History.

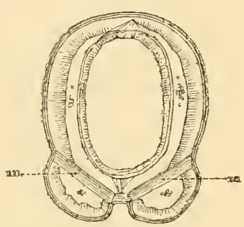
Gentlemen,

In the 'Annals' for this month (October) is mentioned an article, by M. Edmond Perrier, "On a new intermediate Type of the Subkingdom Vermes (*Polygordius*?, Schneider)." So far as can be seen, this form is very closely allied to, if not identical with, that previously described in the 'Proceedings of the Royal Society of Edinburgh' (1873–74, vol. viii. p. 386), from specimens dredged in abundance in the shell-gravel of Bressay Sound, Shetland, in 1871. M. Perrier classifies it with *Polygordius*, as an intermediate type between the Annelids and the Nemerteans. From the structure of the preserved examples formerly alluded to, it was provisionally associated with the Opheliidæ, and named *Linotrypane apogon*. The accompanying outlines (A and B) will explain the general

A



B



structure of the body-wall, and supplement the description in the 'Proc. Royal Soc. Edinb.,' since there was no opportunity for the illustration of that paper otherwise than by the coloured drawings at the reading of it.

If the oblique muscle (*m*) in *Linotrypane* (fig. A), passing upwards on each side, be greatly strengthened, the upper region of the body will be drawn inwards and downwards, whilst a ventral ridge (bounded superiorly by the oblique muscle) will be formed at each side. This is just what happens in a new *Ammotrypane* from Connemara (fig. B), in another from Killibegs Harbour, and a third (noticed in the former paper) from Valentia. The great oblique muscle springs in each case from the raphe at the nerve-cords, and passes upwards and outwards to the body-wall. Moreover, between the extremes of structure (as shown in *Linotrypane* on the one hand, and *Ophelia limacina* with its two prominent ventral ridges, or *Ammotrypane aulogaster* with its single basal and two terminal ventral processes, on the other) there is a series of intermediate forms, which bridge over the apparent gaps.

The bristles are very feebly developed in the Irish forms; and from these it is but a brief step to their total vanishing in *Linotrypane*. A similar tendency to the disappearance of the bristles occurs in a new and remarkably elongated *Ammotrypane* recently brought by Dr. Gwyn Jeffreys from a depth of 1750 fathoms, while dredging in H.M.S. 'Valorous.' The segmentation in this annelid is only indicated by the very minute bristle-tufts, which are invisible to the naked eye, so that, from the dorsum, it resembles a large *Linotrypane*.

I am, Gentlemen,
Your obedient Servant,
W. C. M'INTOSH.

Murthly,
October 8, 1875.

LI.—*On a new Species of the Genus* Eupetomena. By JOHN GOULD, F.R.S.

I AM indebted to Mr. Henry Whitely for the opportunity of describing, through the 'Annals,' a fine species of humming-bird which has just arrived in this country. This new bird (*E. hirundo*) is very similar to the *Eupetomena macroura*, and is the western representative of that bird on the great continent of South America.

The new bird differs from the old by having a shorter tail, the feathers of which are broader and less rigid; the wing, on the other hand, is larger and longer. In colour, while the *E. macroura* is always blue on the head and breast, the new species is distinguished by these parts being washed with green.

The following is a correct description of *E. hirundo*:— Head and throat deep blue, with a wash of green on the crown; body both above and beneath green; wings, tail, and under-coverts steel-bluish black; bill jet-black. Female similarly coloured to the male; but the outer shaft of the wing is not enlarged as in the male, where the stem of this feather is dilated as in *E. campyloptera*. Total length $6\frac{1}{2}$ inches, bill $\frac{3}{4}$, wing $3\frac{1}{8}$, tail $3\frac{1}{2}$.

Mr. Whitely found numbers of this bird flying over the open plains in pursuit of insects. He says, "they rarely approach a flower, but appear to take their food hawking about in the air in the manner of swallows—in fact, at first sight might be easily mistaken for those birds."

Habitat. Huiro, in the Valley of Santa Ana, Peru (elevation 4800 feet).

BIBLIOGRAPHICAL NOTICE.

Figures of Characteristic British Fossils; with Descriptive Remarks. By W. H. Baily, F.L.S., F.G.S., &c. &c. Part IV. 8vo, with 12 plates. London: Van Voorst, 1875.

We welcome with pleasure the fourth Part of Mr. W. H. Baily's work, completing the first volume, which is devoted to the Palæozoic Fossils, and has 48 lithographic plates, drawn by the author himself, and comprising more than 700 figures of fossils; and of these over 300 are original. The descriptive remarks on the natural history of the groups of fossils are illustrated with 18 woodcuts, engraved by Mr. W. Oldham, and including 58 figures. The figures are of natural size, except where otherwise mentioned; and the subjects are arranged zoologically and stratigraphically.

In this lately published Part IV. we have (pp. li–lxiv) an account of the Old Red Sandstone and Devonian Rocks and their fossils, both those (Plants, Crustaceans, and Fishes) of the possibly fresh-water sandstones and those of the marine beds of Devonshire; there must, however, be a slip of the pen at page lx, where the *Amorphozoa* are included in the *Foraminifera*. The Carboniferous rocks and their fossils succeed (pp. lxiv–lxxv). The Permian rocks and their fossils are treated of in pp. lxxv–lxxviii; but their Crustacea, numerous though small, are only noticed by the remark that there are no Permian Trilobites! A short summary of the Palæozoic fossils follows (pp. lxxix, lxxx); but the notice of the Cambrian fossils ignores what has been worked out of late years in that old Trilobitic fauna (*Plutonia*, &c.) by Mr. Hicks and others; and the occurrence of the first land-plant in the Uppermost Silurian and of the first fish in the Lower Ludlow (not "the very uppermost") beds would be of interest to the student.

The subjects of the plates are carefully chosen and truthfully drawn by the author, as in the earlier Parts; and some are clearer in outline, apparently *engraved* on stone. The "Explanations" are well planned and concise, as usual. Fig. 16 of plate 41, though not in the Explanation, is noticed at p. lxxv. "End view" at p. 119, third line, should be "edge view." "Scowleri" for "Scouleri," and other slight mistakes, show the want of literary editing, which is still more evident throughout the Descriptive Remarks. A long list of *Errata* and *Addenda* (pp. 125, 126) in some measure meets this deficiency; and the reader, correcting for himself as he proceeds, will find no hindrance to his becoming acquainted with upwards of 700 characteristic fossil forms, carefully selected out of the 4000 British Palæozoic species, well illustrated, and elucidated by descriptive remarks on their natural history and their places in the geological series.

There is no doubt of Mr. Baily's well-arranged Book of British Fossils being of the greatest use to the geological professor, student, and amateur. Mr. Baily is an ardent palæontologist, skilled artist, and experienced teacher; and he has evidently devoted his scant leisure most untiringly to this labour of love. Within the narrow limits of this book the author has indeed amassed great stores of information, and has referred the reader to most of the original sources, should he desire to follow up the study of Palæontology.

This first volume is to be followed by others on the Secondary and Tertiary Fossils.

MISCELLANEOUS.

On some Lepidoptera with Terebrant Trunks, destructive of Oranges. By M. J. Künckel.

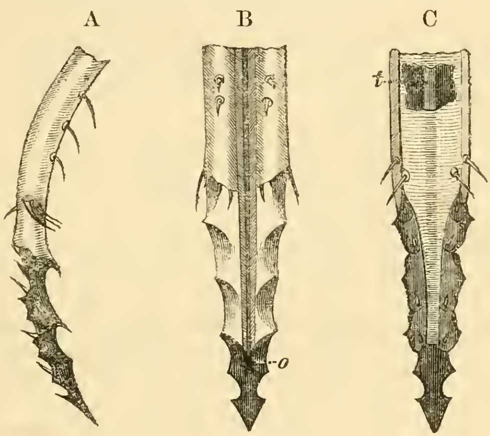
A French botanist, M. Thozet, residing at Rockhampton, in Australia, called my attention some years ago (in 1871) to a Lepidopteron of the genus *Ophideres* (*O. fullonica*, Linn.), which he charged with piercing oranges in order to feed upon their juice. Being convinced, like all other naturalists, that the Lepidoptera have without exception flexible trunks, with no rigidity, I doubted the observation of M. Thozet, and shut up in a box the asserted depredators, proposing to examine them at my leisure. This examination I put off from day to day, until I lately read in an Australian journal* an article in which an anonymous author noticed the depredations committed by *O. fullonica*†, and affirmed, with all the guarantees of careful observation, that these moths perforate the skin of the oranges in order to pump out their juice. During the summer nights they may, without great precautions, be detected at work; absorbed in the operation they are performing, they allow themselves to be captured by hand even upon the oranges. Being curious to obtain evidence of the correctness of these observations, I now carefully examined the trunk of these insects. What was my surprise at discovering a singular and most unexpected fact of adaptation.

It is well-known that the Lepidoptera are distinguished from all other insects by a character of organization of absolute fixity: the buccal organs are modified to form a trunk; or, more explicitly, as was demonstrated by Savigny, the excessively elongated maxillæ constitute an organ of suction. These long, slender, flexible maxillæ, terminated by a thin point of great flexibility, are applied to each other, but leave between them a fine canal. The Lepidoptera are therefore constructed to suck up the nectar of open flowers, to imbibe various fluid aliments. By a strange exception, the moths of the genus *Ophideres*, Boisd., possess a rigid trunk, a true borer of ideal perfection, capable of piercing the skin of fruits, of boring through even the thickest and most resistent envelopes. This trunk is a perfect instrument, which would be an excellent model for the

* 'The Capricornian,' vol. i. no. 9, May 8, 1875, published at Rockhampton. Kindly communicated to me by M. Carrière, head gardener of the nurseries of the Museum.

† In the article in question the moth is by mistake called *O. zullonia*.

making of new tools to be employed in boring holes in various materials. Partaking at once of the barbed lance, the gimlet, and the rasp, it can pierce, bore, and tear, at the same time allowing liquids to pass without impediment by the internal canal. The two applied maxillæ terminate in a sharp triangular point, furnished with two barbs; they then become enlarged, and present on the lower surface three portions of the thread of a screw; while their sides and their upper surface are covered with short strong spines, projecting from the centre of a depression with hard and abrupt margins. The purpose of these spines is to tear the cells of the orange-pulp, as the rasp serves to open the cells of the beetroot, in order to extract the sugar from them. The upper region of the trunk is covered below and on the sides with fine close-set striæ, arranged in half-screws, which give it the properties of a file; the striæ are interrupted here and there by small spines of soft consistence, which serve for the perception of tactile sensations. The orifice of the canal through which the liquids ascend is situated on the lower surface below the first screw-thread. The annexed figures will serve to render this short description sufficiently intelligible.



Trunk of *Ophideres fullonica.* A, in profile; B, from below; C, from above; *t*, interior canal; *o*, orifice of the canal.

Not content with examining *Ophideres fullonica*, Linn., I investigated all the representatives of the genus, and found that *O. materna*, Linn., *O. salaminia*, Cram., *O. imperator*, Boisd., as well as the other species, have a powerful trunk in the form of a borer. The structure of the maxillæ therefore furnishes a generic character of great value; moreover it establishes a closer relationship between the Lepidoptera, the Hemiptera, and certain Diptera in which the maxillæ are destined to pierce tissues.

The Australian colonists dread *O. fullonica* on account of the mischief caused by it in the orange-plantations; for the fruits which it pierces with holes quickly spoil, and soon fall to the ground and rot. All the Lepidoptera of the genus *Ophideres* being, as I have just shown, furnished with a terebrant trunk, it is incontestable that they have similar habits, and that they will bore into oranges and other fruits. As they are very widely diffused in tropical regions, they must justly be ranged among injurious insects. Unfortunately their early stages are unknown, so that no really practical method of destruction suggests itself to the mind; but their large size and striking colours allowing them to be recognized at the first glance, they may be killed without any fear of reproach for committing a judicial error.—*Comptes Rendus*, August 30, 1875, pp. 397–400.

Corals at the Galapagos Islands. By L. F. Pourtalès.

The Galapagos Islands are, as is well known, an important point in the geographical distribution of corals, being almost exactly on the boundary of the coral-producing part of the Pacific Ocean and that portion which is destitute of them on account of the low temperature of the water. All the writers on the subject have placed this group of islands in this latter portion. During the visit of the United-States Coast-Survey steamer 'Hassler,' a number of specimens of corals, of which the following is the list, were picked up on the beaches of several of the islands:—

Ulangia Bradleyi, Verrill. Indefatigable Island.
Pavonia gigantea, Verrill. James Island.
—— *clivosa*, Verrill. Indefatigable Island.
——, sp. James Island.
Astropsammia Pedersenii, Verrill.
Pocillipora capitata, Verrill. Jervis and Charles Islands.
Porites, sp.

The undetermined *Pavonia* is a massive species with larger calicles than those of the two other ones, and more porous and lighter. The specimen is too much rolled for nearer determination. The *Porites* is massive also and in the same condition.

The species are all, or nearly all, identical with those found at Panama. They are mostly reef-builders, but here live probably isolated and at a certain depth, having never been observed *in situ*. In individual growth they are fully equal to those from more favoured localities, the rolled pieces of *Pavonia* measuring six or seven inches in diameter, thus indicating masses of considerable size originally. They are not confined to the northernmost islands of the group, where we should more naturally look for them, from the greater proximity to the warm current, but, as the list shows, a *Pocillipora* was found at Charles Island, one of the southernmost. The probability of fragments drifting from one island to the other is very small, owing to the considerable depth of water between them.—*Silliman's American Journal*, October 1875.

On the Development of the Pulmonate Gasteropoda. By M. H. Fol.

Although this group of Mollusca has already been the subject of numerous works, the following lines will show how incomplete and erroneous are still the notions that we possess as to their development.

Segmentation takes place in a manner conformable to what is observed in the Heteropoda. In all there is total segmentation, leading to the formation of a blastosphere, the nutritive half of which, consisting of elements of larger size and richer in protolecith, becomes invaginated in the other half. The aperture of invagination is nothing but the primitive mouth, and certainly does not become the anus as Mr. E. Ray Lankester asserts. It occupies at first the nutritive pole—that is to say, the pole opposite to the polar corpuscles (*corpuscules de rebut*); but these two poles soon become displaced, in consequence of the more rapid development of the ventral half of the embryo, in which the foot and the preconchylian invagination originate. The dorsal side of the primitive mouth is surmounted by a projection, which is particularly developed in *Helix*, a projection which enters by degrees into the œsophagus, to form there a winged longitudinal crest which afterwards disappears. This crest, which M. Lhering compares to the velum of other Gasteropoda, has really nothing in common with that organ, and may be related to the analogous projection that I have described in the embryos of the Pteropoda.

The cells of the formative pole secrete between them a liquid which finally detaches all this region of the ectoderm and separates it from the entoderm. The vesicle thus produced occupies, in the aquatic Pulmonata, only the bottom of the dorsal region in the neighbourhood of the shell-depression; in the terrestrial Pulmonata this vesicle occupies the whole of the dorsal region as far as the mouth, and attains considerable dimensions, only diminishing at the moment when the pedal sinuses begin to dilate.

The formation of the digestive tube is the same as in the Heteropoda. The embryonic digestive cavity is filled only with albumen, and not with a compact cellular tissue, as stated by M. Rahl. It never ceases to communicate with the exterior by the ciliated canal of the primitive invagination; only this canal buries itself more deeply at the same time with the neighbouring ectodermic tissues which form the œsophagus and the sac of the radula. The salivary glands are evaginations of the wall of the œsophagus on the sides of the sac of the radula. The deutolecith accumulates in great abundance in a portion of the cells of the embryonic digestive cavity, and forms one nutritive lobe or sac in the terrestrial Pulmonata, two lobes in the aquatic forms. These lobes are directly converted into the liver after the absorption of the deutolecith that they contain; the hepatic cells are the entodermic cells of the nutritive sac, and not mesodermic cells as Mr. Lankester supposes. The intestine and the anus are formed as in the Heteropoda

The velum occurs in all the aquatic Pulmonata, in which, however, it is but slightly developed, and occurs only in the form of a zone of cilia, interrupted on the back, and extending from the mouth to the dorsal vesicle. In *Helix* the velum affects the same form, and forms two ciliated crescentiform ridges, which extend from the mouth to the neighbourhood of the shell-depression.

The primitive kidney, which had previously been observed only in the terrestrial Pulmonata, occurs also in all the aquatic Pulmonata. In its origin it is a depression of the ectoderm, which is formed immediately below the velar ridge on each side at its posterior third, and becomes elongated forwards. The anterior part is not glandular in the aquatic Pulmonata; it presents the form of a ciliated tube, which opens like a funnel in the interior of the body a little above the mouth. It consequently affects the same form as the segmental organs of certain Vermes. It is this organ that has been taken in *Limnæus*, by M. Rahl, for the œsophageal ganglia. It is undoubtedly also this organ that M. Ganine saw, but describes as a pair of large cells furnished with long efferent ducts.

A little above the vibratile funnels of the primitive kidney, a mass of cells is seen to become detached from the ectoderm. These cells, which Mr. E. Ray Lankester has erroneously taken for the origin of the cerebroid ganglia in *Limnæus*, in reality only give origin to conjunctive tissue. The cerebroid ganglia are subsequently formed, at the moment when the tentacles begin to push forth; they detach themselves from the ectoderm at the base of the anterior side of the tentacles within the zone of the velum; the process by which they are detached is a simple folding in *Ancylus* and *Planorbis*, but a well-marked invagination in the terrestrial Pulmonata. The eyes appear at the upper part of the tentacles, and the otocysts at the sides of the base of the foot, by the same processes of formation as the cerebroid ganglia. The pedal ganglia are always separated from the ectoderm of the sides of the foot by simple folding.

The foot of the aquatic Pulmonata contracts alternately with the neck, thus producing a larval circulation. In the terrestrial Pulmonata the extremity of the foot becomes converted into a great contractile vesicle, which contracts alternately with the dorsal vesicle. This pedal sinus in *Arion* has the form of a very long gut; in *Limax* and *Helix* it is broad and flattened; and in *Helix pomatia* it attains such dimensions that it lines the whole inner surface of the egg-shell. We also find, in *Helix*, on the right side a true larval heart like that of the Prosobranchiata. This larval heart afterwards passes into the pallial cavity, and does not cease beating until long after the definitive heart is formed. The definitive kidney is formed as in the Pteropoda, and communicates with the cavity of the pericardium by a ciliated duct. The heart appears as a simple contractile cavity in the midst of the mesoderm, and afterwards surrounds itself with a pericardium.

Thus the type of development of the Pulmonate Gasteropoda differs but little from that of the freshwater Prosobranchiata, which I have also studied.—*Comptes Rendus*, September 27, 1875, p. 523.

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LII.—*On a Young Specimen of* Pelagonemertes Rollestoni. By H. N. Moseley, Naturalist on board H.M.S. 'Challenger.'

[Plate XI.]

On June 5, 1875, in lat. 34° 58′ N., long. 139° 30′ E., about halfway between Vries Island, Oosima, and Cape Sagami, the trawl was used by H.M.S. 'Challenger' in from 755 to 420 fathoms. A young specimen of a peculiar pelagic Nemertean, which has been described by me (Ann. & Mag. Nat. Hist. ser. 4, vol. xv. p. 165, March 1875) under the name of *Pelagonemertes Rollestoni*, in honour of my friend and instructor Prof. Rolleston, was found by Dr. von Willemoes-Suhm adhering to the net, and by him handed over to me for examination. The adult specimen before procured and described was in a similar manner found adhering to the trawl-net after a deep-sea dredging by Dr. von Willemoes-Suhm.

The animal was very much smaller than the one obtained before, measuring only 13 millims. in extreme length and 11 millims. in extreme breadth, and about 1 millim. in extreme thickness. It was in good preservation when found, and living; and being extremely transparent, much more of its structure could be observed than in the case of the more full-grown specimen. Unfortunately, an attempt to preserve the specimen by treatment with perosmic acid and subsequent action of glycerine failed, and the specimen perished. The trawl came up late in the evening, when only an hour of daylight remained; the examination made was thus a hasty one.

The animal showed the same feeble pulsating movements which had been shown by the adult.

The external gelatinous investment of the body was perfectly transparent; and none of the peculiar corrugations of a thin superficial epidermic layer were visible as in the adult specimen. The contours of the body were well preserved, including those of the hinder portion, which was broken in the specimen before obtained.

The fore part of the body is wide, with rounded margins; the posterior narrowed, with a series of indentations on its margin corresponding to the successive pairs of diverticula of the digestive tract. At the extreme hinder termination of the body is a shallow notch, at the bottom of which is the anus.

The mouth, which is a simple opening at the apex of a small, short, conical protuberance, was situate just in front of the nerve-ganglia on the ventral surface of the body (it is not shown in the figure, which represents the animal from the dorsal aspect). The central canal of the digestive tract terminated in front in a wide rounded blind end, and tapered gradually to the anus at the posterior end of the body.

The lateral diverticula in this young specimen were evidently in an immature condition; and the successive pairs showed successive stages of development, the most anterior being the most fully formed. This most anterior pair is the only one which shows a commencement of ramification at the peripheral extremities. The ramifications, so ample and well marked in the adult worm, are seen here to be developed as cæcal buds from the outer ends of the long diverticula. The diverticula themselves, of which five pairs were present in the young specimen here figured, arise, as can be seen from the figure (Pl. XI. fig. 1), as simple lateral buds from the central digestive tube. These buds gradually increase in length, their peripheral cæcal ends being always larger than the tubes connecting these with the central digestive tract; and eventually these cæcal ends give off buds and form ramifications. A slight enlargement in the rectum situate just anteriorly to the anus, and shown in the figure, probably represents the spot where a sixth pair of diverticula were about to bud off from the digestive tube. The diverticula, with the exception of the first pair, were not placed exactly opposite one another, the right diverticulum in each pair being situate anteriorly to the corresponding left one.

The digestive tract was filled with a dark reddish brown matter, consisting of large granules and oil-globules. The contents of the diverticula were darker and more opaque, and contained numerous clear oily globules of a bright yellow and bright red colour, mingled with similar opaque globules (fig. 4, *a*). The brightly coloured globules exactly resembled those of the main tract. Similar coloured globules occur in larval Nemertines; and I have observed them also in a marine Planarian larva, possibly that of a *Thysanozoon*, or the Planarian larva described by Johannes Müller from the Mediterranean, supposed to be that of *Eurylepta* (Claus, 'Grundzüge der Zoologie,' p. 286).

The sac of the proboscis corresponded exactly with that described in the adult. It was here found to terminate posteriorly in a blunt point at a short distance from the hinder end of the body. The fluid contained in it appeared transparent and without corpuscles. The proboscis itself could be carefully examined in the present transparent specimen. It was without stylets and quite simple, invaginated in the usual manner; it was not seen fully protruded, but, when so protruded, must be slightly longer than the animal's body; it has an outer pellucid gelatinous investment and an inner muscular layer (fig. 5). No retractor muscle was observed to be connected with it.

The nervous system consists of two pairs of ganglia, of which the upper are by far the larger and give off the stout nerve-cords. The cords, stretching backwards on either side, unite with one another above the rectum at the hinder end of the body. The nerve-ganglia are shown enlarged in fig. 3. No sense-organs of any kind were detected. On the outer margin of the large superior ganglion (fig. 3) a series of elongate pellucid cells were arranged side by side perpendicularly to the curved surface which they form. Abundant fine nerves were given off from the entire length of the nerve-cords to the surface of the body, the muscles &c. arising both from the inner and outer margins of the cords. At the origins of these nerves from the cords there are very slight swellings on the margin of the cord; but these do not contain any nerve-cells. The nerves are very fine, hyaline, with a nearly rectilinear course, and they generally divide into two near their points of distribution; they are never tortuous or much ramified. Terminal organs on the surface of the body in connexion with the nerves were carefully sought for, but could not be found.

A pair of vascular trunks follow the course of the nerve-cords through the body, lying internally to them and beneath them. The vessels unite with one another posteriorly, as do the nerve-cords; their course is undulating. Just behind the nerve-ganglia the vascular trunks are enlarged into wide reservoirs. No branches of these vessels were seen; and though the animal was living when examined, no pulsation in them was observed. The vessels had a pellucid wall, in which were imbedded elongate oval nuclei (fig. 4, *b*), but which otherwise appeared structureless. No motion of any fluid within the vessels was seen.

Although the specimen under description was evidently so immature, well developed ovaries were present, the specimen being a female, as was the adult one before obtained. The ovaries follow in their disposition the vascular trunks so closely as to appear as if connected with them. The ovaries are simple ovoid sacs with a distinct wall (fig. 2), filled with ova (in various stages of development) and granular matter. A dark irregular fissure appeared on the centre of each ovary as viewed from the dorsal surface, which I believe to be an opening by which the cavity of the organ communicates with the exterior, thus dorsally. The ovaries were not quite regular in disposition, an extra anterior one being developed on the right side of the body. In the interspace between the most anterior and larger pair of intestinal diverticula and the next posterior pair were four pairs of ovaries, whereas in the succeeding corresponding interspaces were only single pairs of these organs. In the adult specimen described in the 'Annals' (March 1875), a single ovarian sac only was present in each interspace between the diverticula of the digestive tract. It would therefore seem probable that on further development three pairs of diverticula would have budded out between the first and second pairs in the present specimen.

The muscular system consists of a series of excessively fine transversely or circularly disposed fibres, which are external in position to a series of broad band-like longitudinal muscles. The longitudinal muscular bands are in close relation with the proboscis-sac. Their exact disposition was not made out, and their arrangement as shown in the figure will possibly need correction.

On the whole, *Pelagonemertes* is a form of considerable zoological importance.

In the flattened form of its body and in its dendrocœlous digestive tract the animal resembles Planarians. Amongst the Rhabdocœles the Prostomeæ possess an exsertile proboscis like that of Nemertines; but such an organ is present in no Dendrocœle. In all particulars—in being unisexual, in the simplicity of the generative organs, in the form of the nervous and vascular systems and of the proboscis, in the position of the mouth and presence of an anus—in all essential structures *Pelagonemertes* is most distinctively a Nemertine. Only in its remarkable dendrocœle intestine does it differ from all other Nemertines, and (but this is of far less importance) in the modification of its tissue into the peculiar hyaline gelatinous condition which is characteristic of so many otherwise most widely differing pelagic animals.

The development of the dendrocœle intestine is very remarkable, in that the lateral ramifications are apparently to be regarded as a series of buds occurring successively from before backwards from a previously straight digestive tract such as exists in other Nemertines. In this the digestive tract differs entirely from that of dendrocœlous Planarians, such as *Leptoplana tremellaris*, in which, as we know from the observations of Keferstein (" Beiträge zur Anatomie und Entwickelungsgeschichte einiger Seeplanarien von St. Malo," Abhandl. der k. Gesellschaft der Wiss. zu Göttingen, 4ter Band, Göttingen, 1868, Taf. iii. figs. 19, 20, 21, text p. 34), " the great yelkballs arrange themselves in the embryo with regularity and map out the form of the future digestive tract," the peripheral ramified part of the tract being formed at the same time as the central portion.

The peculiar form of the front of the body of *Pelagonemertes* may be regarded as an instance of the excessive formation of the head-lappets of many Nemertines. In having no ciliated sacs and an unarmed proboscis, *Pelagonemertes* resembles *Cephalothrix*; but the animal must evidently be placed in a new family of Nemertines, for which I propose the term Pelagonemertidæ, thus characterized :—

Pelagonemertidæ, fam. nov. H. N. M.

Animal pelagic in habit. Body gelatinous, hyaline, broad and flattened. Proboscis unarmed. Ciliated sacs absent. Special sense-organs absent. Digestive tract dendrocœlous.

The occurrence of a second specimen of *Pelagonemertes* off Japan shows that the animal has a wide distribution. It was found on both occasions adhering to the trawl-net, and is, from its very slight consistency, easily overlooked. Hence it may have been often missed by us, and probably is as widely distributed as other oceanic forms. Since it has never been taken, by former observers of pelagic animals nor by us, in the tow-net, it is very probable that it occurs only in deep water, and does not come to the surface ; it is, however, most evidently not an inhabitant of the sea-bottom.

Postscript. Since the above was written, my attention has been directed by Dr. von Willemoes-Suhm to Lesson's original figure of *Pterosoma* in the 'Zoology of the Voyage of the Coquille' (which work we have been able to consult, with a splendid series of similar publications, in the Hawaian Government Library at Honolulu), and to the many points of resemblance between *Pterosoma* and *Pelagonemertes*.

Pterosoma plana is described by M. Lesson, 'Voyage de la Coquille, Zoologie,' Paris 1830, p. 254, and figured, pl. iii. figs. 3 and 3 *bis*.

Pterosoma was obtained in great abundance by Lesson between the Moluccas and New Guinea, August 31st, 1828.

The animals measured 3 inches and some lines in length, 18 lines in breadth, and 3 to 4 lines in thickness. In general form and gelatinous structure *Pterosoma* resembles closely *Pelagonemertes*, further in that a series of polygonal areas are marked out on its surface. The spirally-wound organ described as a tube, which is indicated in the figure of *Pterosoma*, can scarcely be any thing else than the proboscis of a Nemertine—the mouth, at the extreme end of the body, being probably the aperture of the proboscis-sac, and the fusiform nucleus the sac itself. On the other hand, it is difficult to conceive that Lesson, with a number of specimens available for examination, could have missed seeing the very conspicuously burnt-sienna-coloured ramified intestine of *Pelagonemertes*, had such been present in his *Pterosoma*. Further, in *Pterosoma* a pair of elongate, closely opposed eyes are described and figured, having transparent coloured corneæ.

On the whole, now that a pelagic Nemertine is known to exist, there seems little doubt that the animal seen and figured by Lesson was a Nemertine and not a mollusk; but it seems to have been a distinct form, with a pair of eyes and an unbranched digestive tract.

EXPLANATION OF PLATE XI.

Representing various structures occurring in a young specimen of *Pelagonemertes Rollestoni*.

Fig. 1. *Pelagonemertes Rollestoni*, enlarged, viewed from the dorsal surface; the proboscis is partly extruded. P, proboscis; Pr.S, sac of proboscis; I. P, invaginated portion of proboscis within the proboscis-sac; G, superior nerve-ganglion; N.C, nerve-cords; V, vascular trunk (the upper V points to an enlargement of the vessel lying just posteriorly to the superior nerve-ganglion); I, intestine; D, diverticula of intestine; O, O, ovaries; C.M, circular muscles; L.M, longitudinal muscles.

Fig. 2. One of the ovaries, enlarged. The dark irregular line on the centre represents what is probably an aperture for the discharge of ova.

Fig. 3. The nervous ganglia and ring, much enlarged. A, superior ganglion; B, inferior ganglion.

Fig. 4. *a*, groups of brightly coloured fatty globules forming the contents of the diverticula of the intestine; *b*, portion of the vascular trunk, much enlarged.

Fig. 5. Portion of the invaginated proboscis, much enlarged. *a*, external gelatinous layer; *b*, internal muscular layer; *c*, cavity continuous with that of the proboscis-sac; within these the invaginated portion of the proboscis with the layers reversed; *b*, internal muscular layer; *a*, external gelatinous layer; *d*, central tube filled with dark amorphous matter (from the proboscis-sac?).

LIII.—*On three new and curious Forms of Arachnida.* By the Rev. O. P. Cambridge, M.A., C.M.Z.S., Hon. Memb. N.Z. Inst.

[Plate XIII.]

The three singular Arachnids described in the following pages belong to widely separated localities. The *first* (*Calyptostoma Hardii*, upon which I have based a new genus of the family Trombidides in the order Acaridea) is a British form, discovered by Mr. James Hardy (of Old Cambus, Berwickshire) on Cheviot Hill, Northumberland, and sent to me among numerous examples of spiders. The *second* (*Westwoodia obtecta*) is of the order Phalangidea, and appears to me incapable of inclusion in any family or genus hitherto characterized; it is altogether one of the most remarkable Arachnids that have lately come under my notice: owing, however, to the minuteness of the creature itself (less than 1 line in length), and the necessarily still more minute and curiously concealed mouth-parts, the special structure of these important features is uncertain; and their minuteness also almost precludes the possibility of satisfactory dissection. Probably, when in use, the parts of the mouth (the palpi and falces at least) could be extruded; so that we must await the examination of living specimens for further knowledge of their structure. This minute Arachnid was received from Otago (New Zealand), where it was found by Capt. F. W. Hutton, and kindly sent to me among other examples of this class. The *third* is also of the order Phalangidea, family Cyphophthalmides (Joseph), genus *Cyphophthalmus* (ejusd.), of which it is a very distinct new species; it was sent to me, among numerous other new and rare Arachnids, from Ceylon, by Mr. G. H. K. Thwaites. For this, which in its general appearance bears a strong resemblance to some forms of Hemiptera heteroptera, I propose the name of *Cyphophthalmus cimiciformis*.

Order Acaridea.

Family **Trombidides.**

Gen. nov. Calyptostoma.

Characters of the Genus.

Body oblong oval, rather broader before than behind (the fore part somewhat obtusely subangular), upper surface very convex; epidermis continuous, without any contractions or foldings to indicate the limits of the cephalothorax, caput, or abdomen.

Mouth-parts apparently very minute, concealed in a deepish circular cavity at the extremity of the fore part.

Eyes six in number, in three pairs, forming a triangle on the upperside of the fore part of the body; the apex of the triangle (being the most obtuse of its angles) directed forwards: the eyes of each pair are contiguous to each other, and seated on very slight tubercles.

Legs short, slender, 7-jointed; the legs of the first and second pairs and third and fourth pairs, respectively, on either side, have their basal joints in contact with each other, describing nearly a square on the under surface of the body, towards the fore part; their relative length appears to be 4, 1, 2, 3, though those of the fourth and first pairs are very nearly of the same length, and those of the third pair but little, if any thing, shorter than those of the second. Each tarsus terminates with two curved claws, which spring from a cleft at the extremity of its upperside.

The *genital aperture* (♀) is placed just behind the basal joints of the third and fourth pairs of legs.

Calyptostoma Hardii, sp. n. Pl. XIII. fig. 1.

Adult female, length 2 lines.

The colour of this interesting Acarid is a uniform reddish yellow (which, however, may possibly, in life, have been a bright red), the legs and genital and anal apertures being light yellow-brown; the whole epidermis, which is of a somewhat coriaceous nature, is thickly covered with minute round punctures, connected, in somewhat regular series, with slight groovings or wrinkles of the skin; and from each puncture there issues a short, strongish, curved, pale amber-coloured diaphanous bristle. Ten small dark red-brown points, or spots, in so many very slight depressions of the surface, and forming two longitudinal lines, occupy the median line of the upper surface; from behind each of the last two of these points runs a short oblique line or very slight indentation. The underside has two small dusky red-brown spots, one a little way behind each of the basal joints of the second pair of legs. The genital aperture has a somewhat corneous appearance; it is of an oval form, convexly prominent, and divided longitudinally by a gaping incision; not far behind it is the anal orifice, which is of the same form and character externally as the genital aperture, though not a fourth of its size.

The *eyes* (seated as above described) are very distinctly visible: those of the foremost pair (forming the apex of the triangle in which the three pairs are placed) are of a triangular shape, closely contiguous to each other, and smallest of the six; those of each lateral pair are also contiguous, on a distinct tubercle, the posterior eye of each being the largest of the six; they are of a pale dull amber-colour, and margined with red-brown.

The *legs* are furnished with short hairs; the basal joints are the strongest; the next are very short, and turned on the outer side: the tarsi, metatarsi, and femora of each pair are of very nearly equal length; the tarsi of the first pair are rather dilated towards their fore extremities, and are (like those of the other three pairs) cleft at the fore extremities on the upperside, two apparently simple terminal curved claws springing from the cleft.

The *palpi* are very minute, and, with the other parts of the mouth, placed at the bottom of a deep circular pit or cavity at the extreme fore end of the body; being thus minute, and sunken below the surface, as well as covered with the hairs fringing the cavity, their form and structure could not be ascertained with the magnifying-powers at my disposal.

Two examples (both females) of this remarkable Acarid were received, among numerous spiders, from Mr. James Hardy, of Old Cambus, Berwickshire, by whom they were found (probably among moss) on Cheviot Hill. It is unlike any thing I have ever seen before; and Dr. L. Koch agrees with me in the opinion that it is new to science. The curious position of the parts of the mouth, with the eyes and other characters, necessitates the formation of a new genus for its reception. It is with much pleasure that I connect the name of Mr. Hardy with this interesting addition to the known species of our indigenous Acaridea.

Order PHALANGIDEA.

Fam. nov. **Crotonoides.**

General appearance somewhat Acarideous, the caput, thorax, and abdomen being so united as to make their junctions imperceptible. Legs nearly equal in length; thorax and abdomen surmounted by a large, somewhat irregular elongated hump or eminence, sloping upwards from the fore to the hinder part.

Habit of life and habitat unknown.

Gen. nov. Westwoodia.

Characters of Genus.

Cephalothorax and *abdomen* with no apparent divisional marks, but elevated gradually to a considerable height at the posterior extremity of the latter.

Eyes two, one on either side, just above the basal joints of first pair of legs.

Mouth-parts very minute, closely compacted, and almost entirely concealed within an oval corneous cavity beneath the caput, just in front of the first pair of legs. Genital aperture of considerable size, close behind the basal joints of the fourth pair of legs. Anal orifice (?) of still larger dimensions, a little way behind the genital parts, at the lower extremity of the hinder part of the abdomen.

Legs 6-jointed, articulated beneath the cephalothorax, but with no distinct sternum; relative length 1, 4, 2, 3, but not greatly differing in actual length; tarsi rather long, undivided, and terminating with three claws of equal size, and, apparently, side by side, *i. e.* not divided into a superior pair and a single inferior claw.

Westwoodia obtecta, sp. n. Pl. XIII. fig. 2.

Adult female, length rather less than 1 line.

Looked at from above, this curious Arachnid is of an elongated oval shape, but in profile it is of a triangular form, and nearly black colour mixed with dark red-brown; the fore extremity of the caput projects forwards, and is of a flattened oblong form; the upperside of the abdomen, which is not distinguishable from the cephalothorax, is much elevated, rising gradually from the thoracic region to its highest part at the hinder extremity; the surface is uneven and rough, and the upperside of the abdomen has a laterally crushed appearance, which, however, may be from accidental pressure; it was so covered with débris of an earthy nature, that its texture and clothing were not distinguishable, except a few curved, pale, bristly hairs on the highest (posterior) part of the abdomen: the underside shows a subtriangular space, on either side of which the legs are articulated; behind the legs are two large, oval, rather convex, corneous, red-brown prominences;

the foremost of these is immediately behind the basal joints of the fourth pair of legs, and is divided longitudinally by a gaping incision; the posterior one is much the largest, and has several longitudinal incisions, of which the central one appears to be the true orifice. This latter I take to be the anus, the former the genital aperture.

The parts of the mouth (falces, maxillæ, palpi, and labium) are exceedingly minute, and packed away within a large oval cavity beneath the caput and close in front of the basal joints of the first pair of legs. The details of the form and structure of these parts are incapable of satisfactory observation by even a lens of high magnifying-power; there appears, however, to be a labium of considerable size, with two pointed oval parts in front of it, which I take to be the forcipate extremities of the falces. No palpi could be discerned.

The *eyes* are two in number, small, and widely separated from each other, in a transverse line near the hinder part of the caput, just above the basal joints of the first pair of legs.

The *legs* are short and strong, and do not differ much in their length; those of the first pair appear to be rather the longest, then those of the fourth pair, and the third pair rather the shortest. The separate joints were (some of them at least) scarcely discernible, owing to the spines and bristles with which they are furnished being almost completely matted with earthy particles; but there appear to be six joints, of which the terminal one is long, nearly cylindrical in form, and undivided, but probably representing the ordinary tarsal and metatarsal joints, and ending with three rather long and somewhat S-curved diaphanous claws, placed side by side in close contiguity to each other, besides numerous bristles and hairs of a similar nature; the uppersides of some of the other joints are furnished with blunt spinous tubercles surmounted by a curved bristle.

A single example of this remarkable Arachnid was received in 1874 from Otago, New Zealand, where it was found by Capt. Hutton, who kindly sent it to me among some spiders from the same locality. Although, for the reasons mentioned above, I am unable to give a satisfactory description of some important portions of structure, yet the mere position of the mouth-parts, as well as other points in the external structure, is amply sufficient for the characterization of a new and very distinct genus of a new family of Phalangidea.

It is with great pleasure that I confer upon this genus the name of Professor Westwood, to whom the entomological world is indebted for the knowledge of so many strange and singular forms of the Articulata.

Family **Cyphophthalmides.**

Genus Cyphophthalmus (Joseph).

Cyphophthalmus cimiciformis, sp. n. Pl. XIII. fig. 3.

Length $1\frac{3}{4}$ line, breadth nearly 1 line.

Nearly the whole of this Arachnid is of a dull amber-colour, the legs and falces being rather paler than the body, the fore part of which (the cephalothorax) is the darkest, the colour of the palpi being palish yellow; the entire surface (including the legs and falces) is completely covered with shallow punctures, giving it a somewhat rugose appearance, with a shining look in different lights; the under surface, as well as the legs and palpi, is furnished with fine hairs; but the upper surface has few or none (perhaps rubbed off).

The form of the cephalothorax and abdomen is oval, the former, however, being of a somewhat subtriangular shape; they are only distinguishable from each other by a transverse suture; the abdomen consists, on the upperside (which with the cephalothorax is considerably convex), of eight segments, of which the last is divided into two roundish caudal prolongations. The segmental plates of the underside, which is much more flattened than the upper, are similar in number; the posterior one contains the anal orifice, which is of a transverse oval form and a little prominent; the inferior segmental plates are quite separate from the superior (see fig. 3, *c*), the latter forming a strong projecting lateral marginal ridge: in front of and adjoining the foremost inferior segment is a small, subtriangular, dark reddish-brown corneous plate, the fore side of which is free; this plate is no doubt the covering of the genital aperture, which, as far as concerns the external appearance, is probably similar in both sexes. Immediately in front of this is a small sternal point, at which the basal joints of the legs meet; directly in front of this, between the basal joints of the first pair of legs, are two pairs of very small, but prominent, white maxillary organs; the foremost pair of these is the largest; the hinder extremities of the basal joints of the second pair of legs are a little prominent, and appear to subserve the part of a labium, and to form the hinder boundary of the mouth. These maxillary organs seemed to be independent of the ordinary maxillæ, *i. e.* the basal joints of the palpi; but the mouth-parts are so crowded together behind the basal joints of the first pair of legs, that, without very careful and skilful anatomy, their structure and position can scarcely be ascertained. The spiracles (two in number) are very indistinct, one on either side of the first segment, underneath the fore extremity of the abdomen.

The *cephalothorax*, united to the abdomen as above mentioned, slopes forward by an even curve slightly steeper than that of the abdomen.

The *eyes* are two in number, and seated on two blunt, conical, tubercular eminences, one on either side of the upper fore part of the caput; they are rather small and indistinct, being coloured like the surrounding surface.

The *legs*, consisting of seven joints, are moderately long and tolerably strong, their relative length being 4, 1, 3, 2, the difference between 3 and 2 being exceedingly small, if any; the basal joints are strong, those of the fourth pair inordinately so, showing in this feature an affinity to *Gonyleptes*: the tarsi end with a single, strong, curved, simple claw, and are much longer than the metatarsi; they are undivided, those of the fourth pair having a conical protuberance at their base on the upperside, and those of the first pair being strongly protuberant or tumid on their undersides near the middle.

The *palpi* are moderately long, slender, and destitute of any terminal claw; the radial is longer than the cubital, which last is of the same length as the digital joint.

The *falces* are long, three-jointed; the basal joint short, with a small eminence on the upperside: the second joint strong and rather long, but not so long as the third; it is of a somewhat subconical form, with a small protuberance at its base on the upperside, in contact with that on the first joint: the terminal joint is long (longer than the two others together); it tapers slightly towards the fore extremity, which terminates with a small denticulate forciple.

A single example of this curious and distinct species was received from Mr. G. H. K. Thwaites, by whom it was sent to me from Ceylon.

Three species only (including the present) are yet known of this genus:—one, *C. duricorius*, Joseph (from the Luëger Cave in Carniola), upon which it was founded by Herr Gustav Joseph; another, *C. corsicus*, Sim., from Corsica; and the present, from Ceylon. It appears to me questionable how far the genus *Stylocellus* (Westwood) is distinct from *Cyphophthalmus*. I have not yet had an opportunity of examining *S. sumatranus*, Westw., the type of *Stylocellus*; but, from the description and figures of it ('Thesaurus Entomologicus Oxoniensis,' 1874, p. 200, pl. xxxvii. fig. 7), there would seem to be no sufficiently distinctive characters for the foundation of a separate genus.

EXPLANATION OF PLATE XIII.

Fig. 1. *Calyptostoma Hardii*: *a*, magnified view, from above; *b*, ditto, underside; *c*, ditto, in profile; *d*, fore part more enlarged, showing the eyes; *e*, tarsus of leg of first pair; *f*, natural length.

Fig. 2. *Westwoodia obtecta*: *a*, magnified view, from above; *b*, ditto, in profile; *c*, underside, with legs truncated; *d*, oval cavity containing the mouth-parts, highly magnified; *e*, leg of first pair; *f*, terminal claws of ditto; *g*, natural length.

Fig. 3. *Cyphophthalmus cimiciformis*: *a*, magnified view, from above and behind; *b*, ditto, in profile, with legs and palpi partly removed; *c*, ditto, underside; *d*, leg of fourth pair; *e*, tarsus of leg of first pair; *f*, natural length.

LIV.—*North-Sea Dredging.* By John Leckenby, F.G.S., and J. T. Marshall.

The Dogger bank and its slopes have always been considered (and deservedly) the El Dorado of conchologists; and having made three dredging-cruises there, twice in 1868 and again in August of this year, with results satisfactory to ourselves, and, we hope, of interest to conchologists generally, we are induced to publish a list of those species which have occurred to us, premising that only those are enumerated which have been met with out at sea, between 20 and 90 miles from land, in depths ranging from 7 to 50 fathoms.

The Dogger bank occupies the centre of the North Sea, is 200 miles in length and from 30 to 50 broad, commencing about 60 miles from the Yorkshire coast, and intermediate between the shores of England and Denmark. Its average depth is 15 fathoms, though in a few places it is only 7, with pits of deep water here and there, the most notable of which are the Great and Little Silver Pits and the Well Pit. The Bank gradually slopes into deeper water ranging from 40 to 50 fathoms; and it is here that the rarer species of *Fusi* &c. are found, the fauna on the Bank itself corresponding to that found in shallow water near the shore.

Our dredgings were carried on in a cutter of 45 tons, chartered at Scarborough, with a crew of five Naval-Reserve men.

We have adopted the nomenclature of Jeffreys's 'British Conchology,' and have marked with an asterisk those which have not been before recorded.

Scarborough, October 1875.

CONCHIFERA.

Anomia ephippium, *L.*
—— ——, var. squamula.
—— ——, var. aculeata.
Ostrea edulis, *L.*
Pecten pusio, *L.*
—— varius, *L.*
—— opercularis, *L.*
—— ——, var. lineata, *Da Costa.*
—— tigrinus, *Müll.*
—— ——, var. costata.
Lima Loscombii, *G. Sow.*
Mytilus edulis, *L.*
—— modiolus, *L.* This species attains a monstrous size in 40 to 50 fathoms on hard ground, and makes sad work with the dredges; one specimen has been found 9 inches long. It grows equally large in the Hardanger Fjord, Norway, in 200–300 fathoms.
Modiolaria marmorata, *Forbes.* Very large.
—— nigra, *Gray.* This also attains a very large size, our largest being 2¼ inches long. It is found with *Mytilus modiolus.*
Nucula nucleus, *L.*
—— ——, var. radiata, *F. & H.*
—— nitida, *G. Sow.* Very fine.
*—— ——, var. turgida, *Marshall.* Shell more triangular and beaks more swollen. Corresponding with the deep-water varieties of *N. nucleus* and *N. tenuis.*
Leda minuta, *Müll.* Very fine.
Pectunculus glycimeris, *L.*
*Arca imbricata (?), *Poli.* [Associated with ordinary Doggerbank shells, such as *Fusus norvegicus, F. Turtoni,* &c. Fishermen often bring us masses of *Filograna complexa,* from one of which I extracted the specimens which Dr. Jeffreys has referred to *A. imbricata.* I do not, however, detect the notched inside margin; and believe they may with more propriety be referred to *A. nodulosa.*—Note by J. L.]
Montacuta substriata, *Mont.*
—— bidentata, *Mont.*
—— ferruginosa, *Mont.* We may here mention that this species is sometimes quasi-parasitic or "commensal." In one part of the Channel Islands, between tide-marks, it is parasitic on *Spatangus purpureus,* in company with *M. substriata,* but *always* occupying the opposite end of the Echinid, *M. substriata* occupying the ventral end. It occurs in all stages of growth, from the fry to the adult.
Kellia suborbicularis, *Mont.*
—— ——, var. lactea, *Brown.*
Lucina borealis, *L.*
Axinus flexuosus, *Mont.* Small form in mud, 45 fathoms.
Cardium echinatum, *L.*
—— ——, var. expansa.
—— fasciatum, *Mont.*
—— edule, *L.*
—— norvegicum, *Spengl.*
Cyprina islandica, *L.*
—— ——, var. crassior.
Astarte sulcata, *Da Costa.*
*—— ——, var. paucicostata.
*—— ——, var. minor.
*—— ——, var. incrassata, *Brocc.*
*—— ——, var. multicostata.
(These last four varieties have been hitherto recorded from the Shetland seas only.)
—— compressa, *Mont.,* and var. striata. The latter abundantly diffused over the entire area.
Venus exoleta, *L.*
—— lincta, *Pult.*
—— fasciata, *Da Costa.*
—— casina, *L.*
—— ovata, *Penn.*
—— gallina, *L.*
—— ——, var. laminosa, *Mont.*
Tapes virgineus, *L.*
Lucinopsis undata, *Penn.*
Tellina fabula, *Gron.*
—— pusilla, *Phil.*
Psammobia tellinella, *Lam.*
—— ferröensis, *Chem.*
Donax vittatus, *Da Costa.*
—— ——, var. nitida. This variety was obtained on the Dogger bank, in 15 fathoms; and fully half of them were infested with a pea-crab.

Mactra solida, *L.*
—— ——, var. elliptica, *Brown.*
—— subtruncata, *Da Costa.*
—— stultorum, *L.*
—— ——, var. cinerea, *Mont.* (All the *Mactræ* are of a much thinner consistency than usual.)
Scrobicularia prismatica, *Mont.* Very large.
—— nitida, *Müll.*
—— alba, *Wood.*
Solen pellucidus, *Penn.*
—— siliqua, *L.*
Lyonsia norvegica, *Chemn.*
Thracia prætenuis, *Pult.*
*—— papyracea, var. gracilis.
*Neæra cuspidata, *Olivi.* Mud, in 45 fathoms, 75 miles from land.
Corbula gibba, *Olivi.* A dwarf form, in 36 fathoms.
Mya truncata, *L.*
—— ——, var. abbreviata.
Saxicava norvegica, *Spengl.* Sparingly distributed, and rarely brought up in the dredge.
—— rugosa, *L.*
—— ——, var. arctica, *L.*
—— ——, var. pholadis, *L.*
Pholas crispata, *L.* Valves, probably drifted.

SOLENOCONCHIA.

Dentalium entalis, *L.*
*Dentalium entalis, *L.*, var. infundibulum.

GASTROPODA.

Chiton cinereus, *L.*
*Tectura testudinalis, *Müll.* The most southern limit hitherto recorded for this species is Hartlepool; it would therefore appear to be migrating southwards.
Puncturella Noachina, *L.*
Emarginula fissura, *L.*
Capulus hungaricus, *L.*
Trochus tumidus, *Mont.* Off Scarborough; very large.
—— cinerarius, var. electissima, *Bean.*
—— Montacuti, *W. Wood.*
—— zizyphinus, *L.*
—— ——, var. Lyonsii, *Leach.*
*—— occidentalis, *Mighels.* Three fine living examples, in gravelly sand, 40 fathoms, about 85 miles N.E. by E. off Scarborough. Its nearest recorded locality, according to Dr. Gwyn Jeffreys, is Aberdeenshire.
Lacuna crassior, *Mont.*
Littorina rudis, *Maton.* Drifted.
—— litorea, *L.* Drifted.
Rissoa punctura, *Mont.*
—— striata, *Adams.*
Turritella terebra, *L.*
*—— ——, var. nivea.
—— ——, var. gracilis.
Scalaria Turtonæ, *Turt.* Living in shallow water.
—— communis, *Lam.*
—— Trevelyana, *Leach.* Not uncommon in 40 fathoms, 30 miles off Whitby.
Odostomia rissoïdes, *Hanley*, var. dubia.
—— conoïdea, *Brocchi.*
—— unidentata, *Mont.*
—— insculpta, *Mont.*
—— interstincta, *Mont.*
—— spiralis, *Mont.*
—— rufa, *Philippi*, var. fulvocincta.
—— acicula, *Phil.*
(The paucity of *Rissoa* and *Odostomia* from our dredgings is somewhat remarkable. More than a hundredweight of fine material has been examined, the result being only one or two specimens of the foregoing. *Rissoa* is scarcely represented at all, not even by the ubiquitous *Rissoa parva.*)
Eulima polita, *L.*
—— distorta, *Desh.*
—— bilineata, *Alder.*
Natica islandica, *Gmelin.* Exceedingly rare, on hard ground,

40 miles N.E. by E. from Scarborough.

Natica grœnlandica, *Beck*. Not uncommon, living with *Scalaria Trevelyana*. As the animal has not hitherto been described, we subjoin the following note, taken on board:—"Body canary-colour; snout depressed in front, not quite so wide as the shell, slightly narrowing; tentacles one eighth of an inch long, pointed at the extremities and flattened at the base, turned back on the shell; eyes none; foot, when fully expanded (which is rarely), twice as long as the shell, posterior portion rounded, partly enveloping the shell; ovary reddish brown; liver deep olive." It is a very sluggish animal; and our first living example tantalized us for three hours before fully exposing itself, although kept in a saucer with a little water; while others never showed themselves at all, though kept for two or three days.

Natica catena, *Da Costa*. Exceedingly large.

*—— ——, var. Leckenbyi, *Marshall*. Shell brown, without any coloured markings. It has much the appearance of *N. sordida*, but is thinner and more globose. Searles Wood's *N. catena*, from the Coralline Crag, is similar to this. We obtained them on the Dogger bank, in 10 fathoms.

—— Alderi, *Forbes*.

—— ——, var. lactea. (There occurred also a small pellucid form, one third the usual size.)

—— Montacuti, *Forbes*. Abundant and fine, with *N. grœnlandica*.

*—— ——, var. albula.

Lamellaria perspicua, var. lata.

Velutina lævigata, *Penn*.

Trichotropis borealis, *Brod. & Sow.*

Aporrhaïs pes-pelecani, *L.*

Buccinum undatum, *L.*

—— ——, var. littoralis, *King*.

—— ——, var. striata, *Penn*.

—— ——, var. pelagica, *King*.

Buccinopsis Dalei, *J. Sow.*

Trophon barvicensis, *Johnst.* Very fine examples.

—— truncatus, *Ström*.

Fusus antiquus, *L.*

*—— ——, var. alba.

—— ——, var. ventricosa.

*—— ——, monst. cinctum. One small specimen.

—— norvegicus, *Chemn.*

—— Turtoni, *Bean*. In muddy ground, exceedingly rare; more often procured by deep-sea fishermen than by the dredge.

—— gracilis, *Da Costa*.

—— propinquus, *Alder*.

—— berniciensis, *King*.

Nassa reticulata, *L.*

—— incrassata, *Ström*.

—— ——, var. minor. Also found at low-water mark at Filey (*Jeffreys*).

Defrancia linearis, *Mont.*

Pleurotoma nebula, *Mont.*

*—— ——, var. elongata.

—— rufa, *Mont.*

—— turricula, *Mont.* Very fine.

*—— ——, var. rosea, *Lovén*.

—— Trevelyana, *Turt.* With the last, generally diffused throughout the North Sea.

Cypræa europæa, *Mont.* Dead, drifted.

Cylichna nitidula, *Lovén*.

—— umbilicata, *Mont.*

—— cylindracea, *Penn.*

Utriculus hyalinus, *Turt.*

Actæon tornatilis, *L.*

*—— ——, var. subulata, *S. Wood*.

*—— ——, var. tenella, *Lovén*.

Bulla utriculus, *Brocc.*

Philine scabra, *Müll.*

—— catena, *Mont.*

—— quadrata, *S. Wood*. Living in mud, 45 fathoms.

The Starfish and Crustacea were everywhere most abundant, but nothing calling for special remark. On one occasion, mixed with the typical form, two specimens of *Goniaster equestris* occurred, one having four rays, the other six, besides the variety *abbensis*.

By the kindness of Dr. Gwyn Jeffreys, we are enabled to add the following species and varieties, which he dredged last May during a short cruise in H.M.S. 'Porcupine' off Scarborough :—

1. Leda minuta, var. brevirostris.
2. Tellina balthica, *L.* A valve, in apparently a semifossil state.
3. —— calcarea, *Chemn.* An imperfect valve, in the same state of preservation.
4. —— tenuis, *Da Costa.*
5. Thracia convexa, *W. Wood.* Young. Distinguishable with difficulty from the young of *T. truncata* or *T. myopsis.*
6. Panopæa plicata, *Mont.* An imperfect valve.
7. Cerithium reticulatum, *Da Costa.*
8. Defrancia teres, *Forbes.*

LV.—*On a Collection of Lepidoptera from Southern Africa, with Descriptions of new Genera and Species.* By Arthur Gardiner Butler, F.L.S., F.Z.S., &c.

The collection of the British Museum has lately been enriched, through the liberality of C. R. N. Burrows, Esq., with a series of Lepidopterous insects collected or bred by himself, chiefly at Natal. The following is a list of the species.

Rhopalocera.

Family 1. **Nymphalidæ.**

Subfamily *Danainæ.*

Genus 1. Amauris, Doubleday.

1. *Amauris echeria*, Stoll, var. *albimaculata.*

Natal.

Primaries spotted with white, as usual in Natal examples.

Subfamily *Satyrinæ.*

Genus 2. Melanitis, Fabricius.

2. *Melanitis bankia*, Fabricius, var.

Natal.

Genus 3. Mycalesis, Hübner.

3. *Mycalesis evenus* ♀, Hopffer.

Natal.

Subfamily *Nymphalinæ.*

Genus 4. Philognoma, Westwood.

4. *Philognoma varanes* ♂, Fabricius.

D'Urban (March 1875).

Genus 5. Junonia, Hübner.

5. *Junonia clelia* ♂ ♀, Cramer.

Natal.

6. *Junonia elgiva* ♂, Hewitson.

Natal.

7. *Junonia ceryne*, Boisduval.

Natal.

8. *Junonia natalica*, Felder.

Natal.

Genus 6. Salamis, Boisduval.

9. *Salamis Anacardii*, Linnæus.

D'Urban (Christmas time).

Genus 7. Euralia, Doubleday.

10. *Euralia anthedon*, Doubleday, var. *marginalis*.

D'Urban (March 1875).

The South-African representative has the black area of the secondaries confined to the outer margin, instead of running over the internal areas nearly to the median nervure.

Genus 8. Atella, Doubleday.

11. *Atella columbina*, Fabricius.

Natal.

Subfamily *Acræinæ.*

Genus 9. Telchinia, Doubleday.

12. *Telchinia cepheus* ♂ ♀, Linnæus.

Natal (bred from the larvæ, February 1875).

13. *Telchinia Buxtoni*, n. sp.

Acræa serena (part.), Trimen, Rhop. Afr. Austr. i. p. 107. n. 67 (1862).

This species differs from *T. eponina* of Cramer (*serena*, part., Fabricius), an insect confined to the west coast of Africa, in the abbreviated oblique postmedian band of primaries in the male, and in the continuation of the white band in the female in the form of a curved decreasing series of about eight elongate diffused white spots. Expanse of wings 1 inch 10 lines; ♀ 2 inches 1 line.

Cape of Good Hope (May 1872).

Several years ago Mr. E. C. Buxton kindly presented a series of both sexes of this species to the British-Museum collection, at the same time expressing his conviction that it was distinct from the West-African insect; I quite agreed with him and kept them separate, but until now have had no good opportunity of describing the species.

14. *Telchinia cabira*, Hopffer.

Natal.

Genus 10. ACRÆA, Fabricius.

15. *Acræa rahira*, Boisduval.

Natal.

16. *Acræa horta* ♂ ♀, Linnæus.

Cape-Town.

Genus 11. PLANEMA, Doubleday.

17. *Planema protea* ♂ ♀, Trimen.

Natal.

The female is interesting, being coloured like the male, with the exception of the postmedian band of primaries, which is white as usual.

Family 2. **Lycænidæ.**

Subfamily *LYCÆNINÆ.*

Genus 12. PENTILA, Westwood.

18. *Pentila tropicalis*, Boisduval.

Natal.

Genus 13. LYCÆNA, Fabricius.

19. *Lycæna gaika* ♀, Trimen.

Natal.

This female is so different from that of *L. lysimon*, that I prefer to consider the African species distinct.

20. *Lycæna knysna* ♀, Trimen.

Natal.

The single example sent has the purple at the base of the wings well marked.

Genus 14. LYCÆNESTHES, Moore.

21. *Lycænesthes messapus*, Godart.

Natal.

This and the next species do not quite agree with *Lycænesthes* proper, since they do not possess the hair-like scales on the outer margin of secondaries; I am, however, unwilling to grieve my entomological friends by characterizing a new genus for their reception.

22. *Lycænesthes asopus*, Hopffer.

Natal.

Genus 15. LAMPIDES, Hübner.

23. *Lampides osiris*, Hopffer.

Natal.

This is the African representative of *L. cnejus*.

24. *Lampides pulchra*, Murray.

Natal.

I suspect that this is the *L. telicanus* of Trimen's 'Rhop. Afr. Austr.'

25. *Lampides palemon*, Cramer.

Natal.

Genus 16. THESTOR, Hübner.

26. *Thestor bibulus* ♀, Fabricius.

Natal.

Subfamily *THECLINÆ*.

Genus 17. IOLAUS, Hübner.

27. *Iolaus hirundo*, var.?, Trimen.

Natal.

The two examples sent are smaller, and darker on the upper surface, than in Trimen's figure.

Genus 18. HYPOLYCÆNA, Felder.

28. *Hypolycæna philippus*, Fabricius (var. *certhis*, Doubleday).

Natal.

This insect seems to come very close to *Iolaus orejus* ♂ of Hopffer.

Family 3. **Papilionidæ**.

Subfamily *PIERINÆ*.

Genus 19. MYLOTHRIS, Hübner.

29. *Mylothris agathina* ♀, Cramer.

Natal.

Genus 20. Colias, Fabricius.

30. *Colias electra* ♂ ♀, Linnæus.

Natal.

Genus 21. Terias, Swainson.

31. *Terias Desjardinsii*, Boisduval.

Natal.

Genus 22. Teracolus, Swainson.

32. *Teracolus ione*, Godart.

Natal.

33. *Teracolus keiskamma*, Trimen.

Natal.

34. *Teracolus achine* ♀, Cramer.

Natal.

Genus 23. Synchloë, Hübner.

35. *Synchloë hellica*, Linnæus.

Algoa Bay (May 1872).

Subfamily *Papilioninæ.*

Genus 24. Papilio, Linnæus.

36. *Papilio demoleus*, Linnæus.

Natal.

37. *Papilio anthemenes*, Wallengren.

Natal.

Family 4. **Hesperiidæ.**

Genus 25. Hesperia, Fabricius.

38. *Hesperia forestan*, Cramer.

Natal.

Genus 26. Pamphila, Fabricius.

39. *Pamphila hottentotta*, Latreille.

Natal.

Genus 27. Pyrgus, Hübner.

40. *Pyrgus elma*, Trimen.

Natal.

Heterocera.

Family 5. **Sphingidæ.**

Subfamily *Macroglossinæ.*

Genus 28. Lophura, Walker.

41. *Lophura plagiata*, Walker.

Natal.

Subfamily *Chœrocampinæ.*

Genus 29. Chœrocampa, Duponchel.

42. *Chœrocampa eson*, Cramer.

Natal.

43. *Chœrocampa celerio*, Linnæus.

Natal.

Subfamily *Sphinginæ.*

Genus 30. Protoparce, Burmeister.

44. *Protoparce convolvuli*, Linnæus.

Natal.

Genus 31. Hyloicus, Hübner.

45. *Hyloicus juniperi*, Walker.

Natal.

Family 6. **Agaristidæ.**

Genus 32. Pais, Hübner.

46. *Pais decora*, Linnæus.

Algoa Bay (May 1872).

Family 7. **Zygænidæ.**

Genus 33. Anace, Walker.

47. *Anace rubra*, Walker.

Natal.

Genus 34. Zygæna, Fabricius.

48. *Zygæna contraria*, Walker.

Natal.

Genus 35. Euchromia, Hübner.

49. *Euchromia lethe*, Fabricius.

Natal.

Family 8. **Lithosiidæ.**

Genus 36. Deiopeia, Stephens.

50. *Deiopeia ocellina*, Walker.

Natal.

Family 9. **Nyctemeridæ.**

Genus 37. Nyctemera, Hübner.

51. *Nyctemera leuconoë*, Hopffer.

Natal.

This species is well figured by Hopffer: it differs from *N. apicalis*, Walker, in the width of the white band of primaries.

Family 10. **Liparidæ.**

Genus 38. Egybolia, Boisduval.

52. *Egybolia Vaillantina*, Stoll.

Natal.

I think this genus has a much greater affinity to the Liparidæ than to the Arctiidæ.

Genus 39. Aroa, Walker.

53. *Aroa terminalis*, Walker.

Natal.

An unusually large example.

54. *Aroa crocata* ♂ ♀, Herrich-Schäffer.

Natal.

Genus 40. Leucoma, Stephens.

55. *Leucoma dealbata*, Herrich-Schäffer.

Natal.

Genus 41. Lopera, Walker.

56. *Lopera punctulata*, n. sp.

♂. Bright ochreous: primaries with an abbreviated transverse macular dusky streak just beyond the end of the discoidal cell; a bisinuated transverse discal series of six black dots, and a black dot at centre of interno-median interspace; body ochreous, pectinations of antennæ blackish; wings and body below uniformly ochreous. Expanse of wings 1 inch 3 lines.

Natal.

The genus *Lopera*, to which this species appears to belong, is nearly allied to *Orgyia*, much more so than to *Poloma*.

Genus 42. Poloma, Walker.

57. *Poloma angulata*, Walker.

Natal.

Genus 43. Dreata, Walker.

58. *Dreata edulis*, Boisduval.

D'Urban (March 1875).

Family 11. **Psychidæ.**

Genus 44. Cryptothelea, Templeton.

59. *Cryptothelea Tuckeri*, n. sp.

♂. Sepia-brown: primaries with a black bilobed spot upon the middle of the inner margin; secondaries with the apical area tinted with cupreous; costal margin greyish; anal tuft of abdomen greyish in the centre; central stem of antennæ sordid whitish; wings and body below dull sepia-brown. Expanse of wings 10 lines.

Natal.

Mr. Burrows has requested me to name this after a gentleman who lent him a box to secure the specimen, which must otherwise have been lost.

Family 12. **Notodontidæ.**

Genus 45. Derrioides, gen. nov.

Genus gracile: antennis elongatis, late pectinatis; capite modice parvo, oculis exstantibus; palpis brevibus crassis; thorace robusto; abdomine tenui, gradatim attenuato; pedibus modice crassis, tarsis tenuibus; tibiis posterioribus spinosis; alis amplis, marginibus externis leviter undatis, margine costali anticarum paululum excavato; venis discocellularibus transversis arcuatis. Generis typus *D. hypenissa*, n. sp.

60. *Derrioides hypenissa*, n. sp.

Rosy madder-brown: primaries with a broad oblique band of darker colour beginning at basal two fifths of inner margin, its outer edge running to apex, its inner edge to median nervure, whence it turns inwards at an abrupt angle to costa, the edge is blackish, bordered externally by a whitish line; a blackish dot on upper discocellular; outer margin dusky: secondaries with a central transverse, waved, whitish-edged blackish line: head dull brown, with a whitish transverse frontal line; collar and palpi dull red; antennæ white, with testaceous pectinations: thorax red-brown; tegulæ large, hairy, dark brown: abdomen rosy madder-brown, with cupreous reflections. Wings below pale rosy brown; a dusky spot on discocellulars; a common, waved, pale-edged, dusky central line; secondaries with abdominal margin greyish: body below pale rosy brown, front of pectus deep dull red; tibiæ and tarsi sordid whitish. Expanse of wings 1 inch 2 lines.

Natal.

This is a remarkable genus, allied to *Paravetta* of Moore.

Family 13. **Bombycidæ.**

Genus 46. Lasiocampa, Schrank.

61. *Lasiocampa rudis* ♂, Walker.

Natal.

Family 14. **Cossidæ.**

Genus 47. Cossus, Fabricius.

62. *Cossus incanescens*, n. sp.

Primaries silvery whitish, transversely speckled with black hatchings, crossed near base by a broad inarched band, and on disk by an irregular, slightly narrower oblique band, the two connected by a slender oblique streak, thus forming a pale brown H; secondaries silky pale grey: head and thorax whitish; collar transversely spotted with brown; thorax behind collar and in front of metathoracic portion transversely banded with blackish: abdomen densely clothed with long brown hairs, base and anus whitish: antennæ white, with pale brown pectinations: wings below shining whity brown; pectus clothed with sordid whitish woolly hairs. Expanse of wings 1 inch 1 line.

Natal.

Allied to *C. impeditus* of Walker.

Family 15. **Hepialidæ.**

Genus 48. Gorgopis, Hübner.

63. *Gorgopis libania?*, Cramer.

Natal (six examples).

I am very doubtful of the correct identification of this species. It is the *G. libania* of Walker; but it is totally unlike Cramer's figure in coloration and pattern, although like it in form. We previously only had one specimen in the collection, so that Walker may have looked upon it as a possible variety of Cramer's insect; so far as I can see, the only chance of its being the same rests in the possibility that the figure is taken from a rubbed and greasy example.

Family 16. **Glottulidæ.**

Subfamily *Xylophasiinæ.*

Genus 49. Prodenia, Guénée.

64. *Prodenia retina*, Guénée.

Natal.

Previously in the Museum from the Congo.

Subfamily *Apameinæ.*

Genus 50. Apamea, Ochsenheimer.

65. *Apamea natalensis*, n. sp.

Primaries above sandy whitish, sparsely speckled with black and clouded for a short distance round the discocellulars with rusty brownish; margins spotted with black; a blackish interno-median basal spot, surmounted by a black dot; a V-shaped whitish marking at end of cell, bounded externally by a semicircular black spot; two submarginal semicircular blackish spots, and between them a small black denticle; fringe whity brown, spotted with blackish: secondaries dark grey, dusky externally; fringe whity brown: body sandy whitish; collar with a black dot on each side, behind which is a transverse bisinuate black line, followed by a thicker brown line; tegulæ longitudinally speckled with black. Wings below whity brown, costal areas speckled with blackish grey; discocellular area of primaries and apical area of secondaries rosy brownish; a dusky transverse discal streak, abbreviated in secondaries; a blackish lunule on discocellulars of the latter wings: body below whity brown. Expanse of wings 1 inch $2\frac{1}{2}$ lines.

Natal.

Not unlike pale examples of *A. gemina.*

Genus 51. Caradrina, Ochsenheimer.

66. *Caradrina partita*, Walker.

Natal.

Previously known from the Congo.

Genus 52. Amyna, Guénée.

67. *Amyna undulifera*, n. sp.

♂. Nearly allied to *A. selenampha*, but smaller, redder in tint, with the undulated transverse lines of primaries less irregular, sharply defined, edged with grey; secondaries shorter, with no trace of a transverse line on upper surface. Expanse of wings 1 inch 2 lines.

Natal.

Family 17. **Hadenidæ.**

Genus 53. Euplexia, Stephens.

68. *Euplexia amaranta*, Felder.

Natal.

Family 18. **Acontiidæ.**

Genus 54. Acontia, Ochsenheimer.

69. *Acontia formosa*, n. sp.

Primaries creamy white, sericeous; a subbasal mustard-yellow arched band, whitish within the discoidal cell, and interrupted by a large dusky spot upon the inner margin at base; a minute rounded pale grey spot, edged with dark grey towards the end of the cell, and immediately beyond the cell a larger similar spot, between them an oblong olive-green spot; a broad discal band widening from the costa to the inner margin, olive-green internally, olive-brown and mustard-yellow externally, traversed by two transverse, irregular, interrupted plumbaginous lines, and interrupted at base of second median interspace by a hastate creamy whitish spot, uniting at its apex with the ground-colour: secondaries pale greyish white with brassy reflections, especially round the margins; fringe creamy white: head and thorax white, frons and palpi sordid yellow, antennæ dull brown; abdomen silky testaceous. Primaries below pale grey, with the costa and outer margin pale testaceous; a broad dark grey discal band, widest on costa; a triangular dark grey spot, edged with whitish, placed across the discocellulars; inner margin broadly white; secondaries as above: body below white. Expanse of wings 11 lines.

Natal.

Family 19. **Erastriidæ.**

Genus 55. Erastria, Ochsenheimer.

70. *Erastria africana*, Felder.

Natal (three examples).
Can this be the *Microphysa decissima* of Walker?

Family 20. **Anthophilidæ.**

Genus 56. Microphysa, Boisduval.

71. *Microphysa abscissa*, Walker.

Natal.

Family 21. **Plusiidæ.**

Genus 57. Plusia, Ochsenheimer.

72. *Plusia aurifera*, Hübner.

Natal.

Family 22. **Gonopteridæ.**

Genus 58. Cosmophila, Boisduval.

73. *Cosmophila indica*, Guénée.

Natal.

If it be thought necessary to reject this name as inappropriate, Walker's name of *C. edentata* may be used.

Genus 59. Gonitis, Guénée.

74. *Gonitis pusilla*, n. sp.

Primaries greyish brown, clouded with dull yellowish, crossed at nearly equal distances by five irregular dusky lines—the first, third, and fifth bounded internally by dusky brownish nebulous diffusions, almost uniting the lines into three bands, the fifth line with a whitish and the others with a pale external edging; a submarginal series of minute dark brown lunulate dots: secondaries pale grey-brown, fringe darker; two parallel ill-defined, white-edged, angulated discal dusky lines, the inner one abbreviated, the outer one originating at anal angle; outer margin with a slender, interrupted, yellowish-bordered, black terminal line: body brown, abdominal segments margined with whity brown. Primaries below grey-brown; costal area pale testaceous, crossed beyond the cell by a dusky line; several testaceous subapical dots: secondaries testaceous; apex, a spot at end of cell, and two discal lines dusky; fringe grey: body sordid testaceous. Expanse of wings 11 lines.

Natal.

The smallest species in the genus.

Family 23. **Polydesmidæ.**

Genus 60. Polydesma, Boisduval.

75. *Polydesma laudula*, Guénée.

Natal.

Family 24. **Homopteridæ.**

Genus 61. Homoptera, Boisduval.

76. *Homoptera delineosa*, Walker.

Natal.

Family 25. **Hypogrammidæ.**

Genus 62. Callyna, Guénée.

77. *Callyna decora*, Walker.

Natal.

Family 26. **Catephiidæ.**

Genus 63. Audea, Walker.

78. *Audea bipunctata*, Walker.

Natal.

Family 27. **Ommatophoridæ.**

Genus 64. Patula, Guénée.

79. *Patula Walkeri*, n. sp.

Patula macrops, Walker (nec Linnæus).

The African form differs from the Indian in its deeper colour and less pointed primaries; all the black bands much more irregular, strongly dentated; the central band much broader at costa of primaries, placed much closer to the subcentral bar of secondaries so as to give the impression of a distinct broad fascia across the wing; the discal black spots more distinctly lunate; the ocellus of primaries darker and considerably narrower; wings below darker, all the white spots smaller. Expanse of wings 5 inches 3 lines.

D'Urban (March 1875).

At first sight this would appear to be merely a dark form of *P. macrops*; but I believe it to be quite distinct.

Family 28. **Hypopyridæ.**

Genus 65. Entomogramma, Guénée.

80. *Entomogramma pardus*, Guénée.

Natal.

This species is identical with Walker's *Hypopyra anteponens* and *Remigia venusta*.

Family 29. **Ophiusidæ.**

Genus 66. Sphingomorpha, Guénée.

81. *Sphingomorpha Monteironis*, n. sp.

The example in this collection being in poor condition, I shall take my description from an example collected by Mr. Monteiro at Ambriz.

Very like *S. chlorea* (*S. sipyla*, Guén.), but differing as follows:—Primaries much narrower, more pointed; basal half confused, not interrupted by a white line so as to separate the external area as a darker spot; pale subapical transverse streak widened into a broad diffused spot; black spots bounded by the dentated yellowish discal line much larger; secondaries with brown band broader, pale discal band more distinctly interrupted; wings below not so much speckled with dark brown; front legs clothed with longer masses of hair. Expanse of wings 3 inches.

Ambriz (*Monteiro*); Natal (*Burrows*).

This species is clearly distinct from *S. chlorea*; the form and pattern of the primaries is strikingly different. Mr. Monteiro took a long series at Angola; he says that it is very common. It always flew into the house when he was at dinner; so that he gave it the name of "the dinner-moth."

M. Guénée has described a species from Senegal, which he considers a variety of his *S. sipyla*, of which he says:—"Je n'ose en faire une espèce séparée, car elle diffère à peine du type." It may perhaps be my *S. Monteironis*; but the description scarcely suits it.

Genus 67. Ophisma, Guénée.

82. *Ophisma croceipennis*, Walker.

Natal.

The West-African representative of this species, noted by Walker as "var. γ," is totally distinct, the transverse lines on primaries being all undulated, and the black spots of secondaries united into a subcuneiform black patch. It may take the name of *Ophisma rivularis*.

Genus 68. Ophiusa, Guénée.

83. *Ophiusa properans*, Walker.

Natal.

Genus 69. Grammodes, Guénée.

84. *Grammodes geometrica*, Fabricius.

Natal.

It is difficult to distinguish this species from *G. ammonia*.

Genus 70. Triganusa, Walker.

85. *Triganusa euproctisoides*, Walker.

Natal.

This genus would, I think, be better placed next to *Ophisma*; but even there it does not look well; it certainly ought not to come between *Grammodes* and *Trigonodes* (which is where Mr. Walker has put it in the Collection). The example taken by Mr. Burrows has a second black spot on primaries, at basal third of interno-median interspace.

Family 30. **Euclididæ.**

Genus 71. Trigonodes, Guénée.

86. *Trigonodes acutata*, Guénée.

Natal.

Family 31. **Remigiidæ.**

Genus 72. Remigia, Guénée.

87. *Remigia congregata*, Walker.

Natal.

88. *Remigia nigrifrontalis*, Walker. (See *Herminia.*)

Wings pale grey, shading into testaceous upon the disk; a deeper-coloured central oblique band, margined by black lines, beginning at middle of abdominal margin of secondaries, running obliquely to third branch of median nervure in primaries, whence it recurves with a double angle to just beyond the middle of costal margin; several minute black lituræ on basal area; outer margin tinted with tawny, edge stramineous; fringe dark greyish brown; a discal series of pale-bordered black dots, becoming larger towards apex of primaries; apex with a white spot, becoming grey, and bounded by an oblique brown litura internally: head and collar black, front margin of collar white; thorax and abdomen grey; antennæ brown, ferruginous below; palpi black, grey internally. Wings below greyish brown, with three parallel, continuous, nearly equidistant, arched dusky bands; secondaries with a dusky dot on discocellulars: body whitish. Expanse of wings 1 inch 7 lines.

Natal.

Family 32. **Thermesiidæ.**

Genus 73. Tatorinia, n. gen.

Nearly allied to *Thermesia*; but at once distinguished by its smaller eyes and considerably longer palpi with shorter terminal joint. Type *T. Burrowsii*, n. sp.

89. *Tatorinia Burrowsii*, n. sp.

General coloration of the darker examples of *Azazia rubricans*; pattern almost as in *Thermesia creberrima.*

Wings dark greyish brown, basal and external areas tinted with olivaceous; basal area crossed by two irregular and much interrupted dusky lines; primaries with two central badly defined parallel dusky lines; a whitish-centred spot in the middle of the discoidal cell, and a second (larger and sinuate) on discocellulars; a discal distinct yellowish white line crossing the two wings from near apex to near anal angle, interrupted at costal areas, and margined with piceous, on secondaries terminating in a diffused spot on discoidal interspace; internervular folds terminating in black dots, united by a fine, black, waved marginal line; fringe reddish: body olivaceous brown, abdomen paler. Wings below testaceous, speckled with grey, veins ochraceous; three nearly equidistant lunulated black lines, and between them series of ill-defined dusky lunules; a white-centred black spot within the cells, and another on the discocellulars; outer margin as above: body below sandy whitish. Expanse of wings 1 inch 9 lines.

Natal.

Genus 74. Renodes, Guénée.

90. *Renodes nigriceps*, Walker.

Natal.

The type is a faded and rubbed specimen from Sierra Leone.

91. *Renodes pallidula*, n. sp.

Sandy whitish, speckled with black atoms: primaries with an oblique, abbreviated, pale brown streak from inner margin, beyond it a zigzag discal line and a broad external border (tapering to apex) of the same colour; three or four black discal dots towards apex; a black marginal line: secondaries with three nearly equidistant parallel, pale brown, discal bands, and between them two series of black dots; outer margin with a black edge: head, collar, palpi, and anterior femora and tibiæ black; thorax and abdomen sandy whitish, the latter black-speckled, with whitish margins to the segments. Wings below pale testaceous, densely sprinkled with brown scales; disk crossed by three brown lines, the two inner ones dentate-hastate, irregular, and approximating on primaries, between the two outer ones a series of black spots; external area of primaries dusky in the centre; a black dot on discocellulars; body below whitish; legs (excepting anterior femora and tibiæ) testaceous. Expanse of wings 1 inch 3 lines.

Natal.

Genus 75. Selenis, Guénée.

92. *Selenis costalis*, n. sp.

Basicostal area creamy white; two oblique lituræ and a brown subapical line, crossed by three white dots, on costa of primaries; a broad central mahogany-brown band tapering from abdominal margin to discoidal interspace towards apex of primaries, and bordered externally by a silvery line; a discal tapering pale testaceous streak bounding the central band, and bordered externally by a red-brown line margined with silvery grey; outer margin pale brown, with a submarginal series of black dots; fringe dark grey; primaries with an oblique apical brown litura; head, collar, and abdomen brown, the latter with white margins to the segments; thorax creamy white. Wings below grey, crossed by two darker grey discal lines; discocellular and submarginal black dots; apical half of costa of primaries spotted with white: body below pale testaceous Expanse of wings 10 lines.

Natal.

Genus 76. Gracilodes, Guénée.

93. *Gracilodes caffra*, Guénée.

Natal.

Genus 77. Scambina, Walker.

94. *Scambina larvata*, Walker.

Natal.

Family 33. **Platydidæ.**

Genus 78. Hypena, Schrank.

95. *Hypena obacerralis*, Walker.

Natal.

A very variable species.

96. *Hypena senialis*, Guénée.

Natal.

M. Guénée says that his description is taken from a specimen in poor condition; when fresh it more nearly resembles *H. obesalis* in colouring than *H. obsitalis*; it is, however, the size of the latter.

97. *Hypena varialis*, Walker.

Natal.

Allied to the preceding species.

98. *Hypena velatipennis*, n. sp.

Allied to *H. indicatalis*. Very variable in tint; darker or lighter grey: primaries with the basal half blackish, sharply defined externally by a transverse, slightly trisinuate, white-edged black line; irrorated with green-shot scales, and crossed by two irregular black lines, between which (within the cell) is a black dot; apical half irrorated with black atoms, which (in dark examples) form two transverse sinuated lines, the sinuations together forming incomplete circles; a heart-shaped subapical black spot, edged externally with white, and bounded below by a white longitudinal litura, the whole enclosed by an angulated black line from apex; apical costa dotted with white; a submarginal series of black dots: segments of abdomen with pale hind margins. Wings below grey, secondaries and costal area of primaries irrorated with brown; a submarginal black line and a marginal whitish line; fringe pale grey, intersected by two black parallel lines; primaries with apical costa white-spotted; secondaries with a black dot on discocellulars. Expanse of wings 1 inch 2 lines.

Natal.

Family 34. **Herminiidæ.**

Genus 79. Heterogramma, Guénée.

99. *Heterogramma*, sp.?

Natal.

I feel very uncertain of the determination of this species, and therefore do not describe it. It somewhat resembles a figure in the fourth part of the Lepidoptera of the 'Novara' Expedition; unfortunately we have no species of *Heterogramma* with which to compare it.

Genus 80. Bocana, Walker.

100. *Bocana æsopusalis*, Walker.

Natal.

Family 35. **Pyralidæ.**

Genus 81. Pyralis, Linnæus.

101. *Pyralis smaragdina*, n. sp.

General appearance of *P. costalis*. Wings above red-brown, clouded with slaty grey; a lunate golden-yellow spot near base of cell, from which an arched dusky line runs to inner margin; a second similarly coloured spot at basal two fifths of costal margin, below which is a quadrate pearly spot within the cell; a golden irregular costal streak from end of cell to apex, cut by a black line, which also bounds a quadrate pearly spot at end of cell; a third, black-edged, pearly spot at base of first median interspace; outer margin and fringe irregularly golden yellow, interrupted in the middle by a brown spot; secondaries crossed by two irregular dusky lines; anal half of outer margin and entire fringe golden yellow; head testaceous; anal segments golden yellow. Wings below pale grey; all the markings as above, but paler; secondaries with an additional grey spot at centre of cell; body below white. Expanse of wings 9 lines.

Natal.

Differs from *P. costalis* in its narrower wings, more pointed primaries, the three pearly spots in primaries, less regular and interrupted golden-yellow borders, and yellow anal segments of abdomen.

Genus 82. Aglossa, Latreille.

102. *Aglossa noctuina*, n. sp.

Primaries dark rosy brown, base blackish; two transverse irregular black lines and a black discocellular dot, exactly as in *A. laminalis*; a marginal row of black dots; fringe red-brown, shining: secondaries whity brown, with the veins slightly reddish; a dusky spot at base of discocellular cleft, and an irregular dusky discal line parallel to the outer margin: palpi, antennæ, head, and thorax deep rosy brown; abdomen dull black, with pale margins to the segments; anus testaceous. Wings below pale grey; costal areas rosy tinted, costal margins black, dotted with whitish; a continuous dusky discal line; dusky lunate spots on discocellulars; cell of primaries spotted with dusky: body below shining rosy brownish; front of pectus deep chocolate-brown; legs testaceous, tibiæ and tarsi of two front pairs black above, dotted with whitish. Expanse of wings 1 inch.

Natal.

Allied to *A. laminalis*, but easily distinguished by its much deeper coloration and the markings on secondaries.

103. *Aglossa ocularis*, n. sp.

Primaries above grey; a cuneiform patch of stramineous crossed by the discocellulars, the position of which is marked by an oblique reniform stigma; a very oblique black line beginning, distinct, at base of inner margin, but fading away as it reaches the back of the stramineous patch; a second, dentate-sinuate oblique line from near the centre of inner margin, bounding the stramineous patch externally, and running almost to costa; an irregular zigzag discal stramineous band; a submarginal series of eight black lunular lituræ: secondaries sordid pale testaceous, with a broad external grey border, interrupted by a submarginal pale stramineous streak; two dotted grey discal lines, and a dusky spot at end of cell: body grey, head and collar slightly reddish, fringe at back of thorax whitish. Primaries below grey, internal area pale; a patch over the end of cell whitish, crossed by an oblique dusky spot; costa white-dotted: secondaries creamy white; a black spot at end of cell and another at anal angle, two discal dotted grey lines; a broad grey border as above; a submarginal dull red streak, leaving one spot of whitish near apex, its anal termination being also whitish: body below sordid greyish testaceous; tarsi of anterior legs blackish above and spotted with testaceous. Expanse of wings 1 inch 3 lines.

Natal.

104. *Aglossa fragilis*, n. sp.

Primaries stramineous, discocellular area and apex clouded with burnt sienna; outer margin with a red-brown border, tapering to apex, partially varied with dark grey; a marking, like the figure 8, enclosing two black dots at the end of the cell; two irregular oblique red-brown lines, the one towards the base ill-defined and broken up into dots, the other beyond the cell crossing the wing, and well-marked; a marginal row of black dots: secondaries greyish brown: head and collar dark grey, thorax stramineous, abdomen testaceous. Primaries below grey, reddish along the costa; a whitish subcostal discoidal litura, and a whitish spot at end of cell: secondaries testaceous, tinted with rosy: body greyish testaceous. Expanse of wings 1 inch.

Natal.

105. *Aglossa inconspicua*, n. sp.

Primaries above dove-colour, crossed by two slightly waved and divergent, oblique red-brown lines, the inner one bordered within and the outer without with ochreous, the outer one also bounding a transverse diffused brown streak; a black dot at end of cell; a waved discal series of dusky dots; outer margin slightly dusky: secondaries whity brown, the basal area and a diffused streak at anal angle irrorated with slightly darker brown: head and thorax grey, abdomen pale testaceous. Primaries below grey, sprinkled with whitish; an ill-defined, scarcely visible, waved dusky discal line: secondaries creamy whitish, sparsely speckled with brown; a brown dot at end of cell: body below whitish; legs and palpi stramineous. Expanse of wings 1 inch 1 line.

Natal.

106. *Aglossa formosa*, n. sp.

Allied to the *Pyralis ratoalis* of Walker. Wings above cream-colour; primaries with an orange streak from base along median nervure, and joining a red subquadrate spot at middle of inner margin; a white spot with a black dot on each side of it within the cell, and another below it and touching the red internal spot; an angular black-edged white spot at end of cell; outer margin broadly plumbaginous, the inner margin of the border being distinctly conical, the apex of the cone touching the white spot at end of cell; a subapical red-edged sagittate yellow spot: secondaries with a slender marginal black line; fringe white: head black, collar reddish; thorax creamy white; abdomen red-brown, with white segmental bands and anus. Primaries below shining grey; secondaries white, with grey costal area: body sordid testaceous, with sides of pectus white. Expanse of wings 10 lines.

Natal.

107. *Aglossa magnifica*, n. sp.

Primaries above deep reddish castaneous, clouded with shining grey or plumbaginous, crossed by two diverging undulated black lines, partially bordered with white, outer margin plumbaginous; fringe pale grey, varied with castaneous: secondaries grey, with faint lilacine reflections; outer border dusky, with a white marginal line; fringe grey: body reddish castaneous, centre of abdomen greyish, margins of the segments paler. Wings below shining grey, with cupreous reflections; body creamy white. Expanse of wings 10 lines.

Natal.

Family 36. **Ennychiidæ.**

Genus 83. Pyrausta, Schrank.

108. *Pyrausta aurea*, n. sp.

Ochreous: primaries above with a dusky transverse angulated line crossing the end of cell, and running to inner margin; an abbreviated arched line from subcostal nervure to second median branch: secondaries with an irregular dusky discal line parallel to the outer margin, and a dot at end of cell: primaries below tinted with grey. Expanse of wings 7½ lines.

Natal.

Unlike any other species of *Pyrausta* known to me in coloration.

Family 37. **Asopiidæ.**

Genus 84. Syngamia, Guénée.

109. *Syngamia merionealis*, Walker.

Natal.

Genus 85. Agathodes, Guénée.

110. *Agathodes modicalis*, Guénée.

Natal.

111. *Agathodes ostentalis*, Hübner.

Natal.

One small example. I believe this species has not hitherto been recorded as African.

Genus 86. Hymenia, Hübner.

112. *Hymenia recurvalis*, Fabricius.

Natal.

113. *Hymenia perspectalis*, Hübner.

Natal.

114. *Hymenia griseata*, n. sp.

Primaries dull greyish brown; a minute basicostal testaceous spot, and another, edged with black, near base of cell; a small whitish spot at base of interno-median interspace, and a black-edged, straight, transverse whitish litura just beyond it; two small angular black markings just beyond the middle of the cell; a testaceous costal streak, crossed by a black spot, from the end of cell, a very irregular black-edged whitish line from end of cell to inner margin; apical half of cell sordid whitish; a marginal macular black line; fringe white, spotted with grey: secondaries grey, costal area whitish; a broad external brown border, bounded within by an irregular brown-edged white line: body dark brown, head and base of abdomen greyish. Wings below very pale brown; a black-edged brown spot on discocellulars; a broad discal grey band, obsolete towards the inner margins, bounded within by a very irregular dusky-edged whitish line: body very pale brown. Expanse of wings 10 lines.

Natal.

Most like *H. meridionalis* in general appearance.

Family 38. **Hydrocampidæ.**

Genus 87. Cataclysta, Hübner.

115. *Cataclysta fraterna*, n. sp.

Closely allied to *C. elutalis* from Ceylon; but with the wings comparatively longer, the body more slender; the basal area of the wings paler, with dark brown markings and better-defined silvery spots; the central series of silvery spots bounded within by a distinct irregular black line; external area dark brown, outer margin grey; marginal spots of secondaries well defined. Expanse of wings $8\frac{1}{2}$ lines.

Natal.

Family 39. **Spilomelidæ.**

Genus 88. Zebronia, Hübner.

116. *Zebronia cassusalis*, Walker.

Natal.

This species is scarcely distinguishable from the Ceylonese *Zebronia aurolinealis* of Walker.

Family 40. **Margarodidæ.**

Genus 89. PHAKELLURA, Guilding.

117. *Phakellura indica*, Saunders.

Natal.

I think Guénée's name of *P. gazorialis* would be better than *P. indica*.

Genus 90. MARGARONIA, Hübner.

118. *Margaronia transvisalis*, Guénée.

Natal.

Family 41. **Botydæ.**

Genus 91. BOTYS, Latreille.

119. *Botys straminea*, n. sp.

Allied to *B. pholausalis*, but much more like the Australian *B. piasusalis* in marking.

Stramineous, with pink reflections; an irregular brown line crossing the wings at basal third; a second, very irregular discal line, widely interrupted on primaries, where it runs from the subcostal nervure to the middle of the second median branch, and recommences near the base of the same branch; a black dot just beyond the middle, and a black litura at the end of discoidal cell of primaries; a continuous marginal series of brown dots; fringe silvery white: wings below paler, otherwise as above; body white. Expanse of wings 1 inch.

Natal.

Genus 92. PIONEA, Guénée.

120. *Pionea africalis*, Guénée.

Natal.

P. africalis is identical with Walker's *Scopula? concisalis*.

Genus 93. SCOPULA, Schrank.

121. *Scopula martialis*, Guénéc.

Natal.

122. *Scopula ferriscriptalis*, Walker.

Natal.

Family 42. **Scopariidæ.**

Genus 94. STENOPTERYX, Guénée.

123. *Stenopteryx hybridalis*, Hübner.

Natal.

Family 43. **Ennomidæ.**

Genus 95. HYPERYTHRA, Guénée.

124. *Hyperythra leucicolor*, n. sp.

Hyperythra limbolaria (part.), Walker.

♂. Bright saffron-yellow, more or less speckled with brown, crossed by two diffused pale reddish grey bands or lines, the external one internally bisinuate on both wings, bounded externally near outer angle of primaries by one dusky spot, and near apex of secondaries by two. Wings below paler, the inner band only represented by a reddish spot on interno-median interspace, the outer one by a continuous chain-like discal series of rosy spots with carmine margins; a black dot on discocellulars. Expanse of wings 1 inch 1 to 3 lines.

♀. Not unlike Guénée's figure of *H. limbolaria*, but with only three (almost equidistant) lines across the primaries and two across the secondaries, the inner band below much interrupted. Expanse of wings 1 inch 7 to 9 lines.

Natal (one male).

We received both sexes of this species in a collection sent to England last year by Mr. J. V. Gooch. It was at the time supposed to be the Javan *H. lutea* of Cramer (*H. limbolaria*, Guénée); but it is clearly quite distinct.

Genus 96. CABERODES, Guénée.

125. *Caberodes interpellans*, n. sp.

♂. Wings greyish brown, slightly shot with a rosy tint; markings precisely like *Ellopia flagitiaria*—that is, a curved subbasal and a waved discal dark brown line, with a black spot on discocellulars in primaries, and a subangulated discal line and black dot in secondaries; antennæ rather unusually wide towards the base, and thorax very robust. Expanse of wings 1 inch 7 lines.

Natal.

Family 44. **Boarmiidæ.**

Genus 97. GNOPHOS, Treitschke.

126. *Gnophos umbratilis*, n. sp.

♂. Wings greyish brown in appearance, but really yellowish testaceous, densely mottled with blackish brown, crossed in the middle by two ill-defined dusky lines; black discocellular dots; a small elongate black dot at centre of second median interspace of secondaries: wings below much less mottled with paler brown, the transverse lines widened into diffused bands, very distinct on secondaries; costa of primaries, area between the bands of secondaries, and the body very slightly mottled, and consequently much yellower in appearance than the rest of the underside. Expanse of wings 1 inch 5 lines.

Natal.

Family 45. **Acidaliidæ.**

Genus 98. ACIDALIA, Treitschke.

127. *Acidalia natalica*, n. sp.

Whity brown; wings crossed by two brown lines, the inner line diffused, oblique in primaries, and crossing discocellulars to near the middle of inner margin, arched in secondaries and crossing the apical fourth of discoidal cell; the outer line dark brown, irregularly sinuated, crossing the disk of both wings, and succeeded by a narrow diffused brown streak, which gives it the appearance of being double; a black dot at the end of the cells, and a marginal series of black dots; fringe whity brown: wings below slightly paler than above, mottled with darker brown; the two lines better defined. Expanse of wings 1 inch 2 lines.

Natal.

The frons is not black, as in several of M. Guénée's African species. *A. natalica* is most nearly allied to *A. strigulifera*.

128. *Acidalia lactaria*, Walker.

Natal.

This species is identical with *A. derasata* of Walker (part xxvi. p. 1604).

129. *Acidalia instructata*, Walker.

Natal.

This species varies much in tint.

130. *Acidalia cinerascens*, n. sp.

Pale grey, mottled with brown; black discocellular dots; a marginal series of black dots; primaries with a transverse zigzag discal brown line; secondaries with two central, slightly irregular, subangulated brown lines: wings below testaceous, mottled with brown, less densely on costa of primaries; a transverse subapical costal brown litura. Expanse of wings 1 inch 2 lines.

Natal.

Genus 99. ARGYRIS, Guénée.

131. *Argyris latonaria*, Guénée.

Natal.

132. *Argyris vestalis*, n. sp.

Somewhat like *A. ocellata*, but much smaller. White; both wings with a central brown band from end of cell to inner margin, varied with black, indistinctly streaked with plumbaginous, enclosing a black-edged discocellular white spot, the upper end broad, the lower end pointed; a bisinuate brown litura connecting central band with costal margin; a waved undulated discal transverse line; two submarginal series of grey spots, an interrupted marginal series of black dots; fringe varied with grey. Wings below white, primaries sordid: secondaries with a blackish discocellular litura, an ill-defined postmedian dusky line, a continuous dentate-sinuate discal black line, and a sinuated marginal black line: primaries with two submarginal series of grey spots; fringe white, varied with grey and dotted with black: body white; antennæ, tibiæ, and tarsi testaceous. Expanse of wings 11 lines.

Natal.

Family 46. **Fidoniidæ.**

Genus 100. TEPHRINA, Guénée.

133. *Tephrina deerraria*, Walker.

Natal.

Genus 101. STERRHA, Hübner.

134. *Sterrha sacraria*, Linnæus.

Natal (six examples).

Genus 102. ASPILATES, Treitschke.

135. *Aspilates mæviaria*, Guénée.

Natal (four examples).

136. *Aspilates arenosa*, n. sp.

♂. General aspect and coloration of the preceding; it differs as follows:—Discal band of primaries less oblique and consequently nearer to outer margin; of secondaries paler, widening from near anal angle to second subcostal branch, where it becomes obsolete, broadly bordered on both sides with whitish. Primaries below greyish, band as above: secondaries much paler; interno-median area dusky; discal band much more abbreviated, but darker than above; a black discocellular spot. Expanse of wings 1 inch 4 lines.

Natal.

Family 47. **Gelechiidæ.**

Genus 103. EXODOMORPHA, Walker.

137. *Exodomorpha divisella*, Walker.

Natal (eight examples).

Family 48. **Pterophoridæ.**

Genus 104. AGDISTES, Hübner.

138. *Agdistes pustulalis*, Walker.

Natal.

There are also in the Collection two species of Tortricites and two Tineites which I have been unable to determine; and as at present I do not possess sufficient knowledge of the groups to refer them to their proper positions, I cannot attempt to name them. I have to thank Mr. F. Moore, of the Indian Museum, for very kindly assisting me in determining some of the more obscure genera of Pyralites and Geometrites.

LVI.—*Relation of the Canal-System to the Tubulation in the Foraminifera, with reference to Dr. Dawson's 'Dawn of Life.'* By H. J. CARTER, F.R.S. &c.

As an illustration of the relation of the canal-system to the tubulation in Foraminifera in the so-called "*Eozoon canadense*," Dr. Dawson repeats, in his book just published (the 'Dawn of Life'), p. 43, a fac-simile of the woodcut which illustrates his letter in 'Nature' (vol. x. p. 103, June 1874), which illustration had been previously published in the 'Annals & Mag. Nat. Hist.' (vol. xiii. pl. xix. fig. 1, June 1874), and also appeared about the same time in the 'Monthly Microscopical Journal.'

By this I infer that the woodcut (which, in the 'Dawn of Life,' is stated to be "after Carpenter") is the most convincing representation that Dr. Dawson can adduce of the identity of Foraminiferal structure with that of the so-called "*Eozoon canadense*" in the Laurentian limestone; for we find in the 'Dawn of Life,' p. 204, the following paragraph:—

"In the 'Annals of Natural History' for June 1874, Dr. Carpenter has given a crushing reply to some objections raised in that Journal by Mr. Carter. He first shows, contrary to the statement of Mr. Carter, that the fine nummuline tubulation corresponds precisely in its direction with reference to the chambers with that observed in *Nummulites* and *Orbitoides*. In the second place, he shows by clear descriptions and figures that the relation of the canal-system to the fine tubulation is precisely that which he had demonstrated in more recent nummuline and rotaline Foraminifera. In the third place, he adduces additional facts to show that in some specimens of *Eozoon* the calcareous skeleton has been filled with calcite before the introduction of any foreign mineral matter. He concludes the argument in the following words :—' I have thus shown,'" &c. (See the rest in Dr. Dawson's book, and in the 'Annals,' *l. c.* vol. xiii. p. 463.)

Now I do not hesitate to state that the woodcut to which I have alluded, and which is one of the "clear figures" to which Dr. Dawson alludes, does *not* show "that the relation of the canal-system to the fine tubulation is precisely that which he [Dr. Carpenter] had demonstrated in more recent nummuline and rotaline Foraminifera,"—inasmuch as it is impossible to demonstrate that which is utterly at variance with the principle on which a Foraminiferous test is constructed.

This is a decided expression; but having published nearly as much of the anatomy of the Foraminifera in 1852 ('Annals,' vol. x. p. 161, pl. iv.) and, subsequently, in a more general form, in 1861 (*ibid.* vol. viii. p. 309 *et seq.* pls. xv., xvi., xvii.) as I have of the Spongida during the present year, and having now before me perhaps one of the finest collections of Operculine, Nummuline, and Acervuline Foraminifera that exist, both fossil and recent, simple and infiltrated (that is, with the original cavities of the canal-system, tubulation, and chambers filled with red oxide of iron to the minutest degree), together with a knowledge of the active living animal in a recent state gained here on the sea-side, and the typical piece of the so-called "*Eozoon canadense*" submitted by Dr. Carpenter to Professors King and Rowney for conviction, I claim to have a voice in the matter, and to be allowed to state instructively what the *real* relation of the canal-system is to the so-called "nummuline tubulation" in the Foraminiferal test.

For this, then, I must premise (what, I fear, judging from that which others have published on the subject, is so little understood generally) :—First, that in the ammonite-like form of *Operculina*, where the chambers are only one deep and therefore all the chambers on the same plane, the tubuli of the chambers (that is, the "nummuline tubulation") go straight from the roof of the chamber to the surface of the *Operculina*, thereby affording not only the shortest but the most direct communication with the exterior that the sarcode and its contents, with which the chamber is exclusively filled, can obtain;

while the canal-system is entirely outside the tubuli and the chamber with which they are connected. Thus the flat surface of the vertically compressed chamber on either side of the *Operculina*, as its ammonite-like form lies horizontally on the table, is vertically pierced by the tubuli; while the narrow part or vertical sides of the compressed chamber, which is concealed within the test, is pierced *alone* by the ramuli coming off from the large branches of the canal-system which border upon the chamber all round.

Secondly, that as the single plane of chambers of *Operculina* is multiplied vertically in the Nummulite, the same structure, *mutatis mutandis*, is here repeated, while the tubuli go from chamber to chamber; and nothing interferes with this arrangement in the whole pile of chambers until the tubuli thus, at last, open on the surface.

The reason of this is obvious; for the tubuli transmit the sarcode from the chamber, which appears to be successively engaged in forming the layers of the test, while there are no tubuli in the contracted sides of the chamber, which, being covered by the surface-layer of the test, do not need them, but instead are pierced by the ramuli of the canal-system, which thus communicate with the interior of the chamber.

The function of the canal-system has not yet been discovered; but the main canals, which border the contracted sides of the chamber (viz. that part of it within the test) all round, send off three sets of branches, viz.:—1st, those which penetrate the "contracted sides" of the chamber; 2nd, those which open on the surface of the *smooth* areæ of the test surrounding the chamber; and, 3rd, those which open on the convex surface of the marginal cord. The latter I have been able to show distinctly in a preparation lately made of a portion of the marginal cord of *Nummulites lævigatus*, where, as in *Operculina*, their apertures appear like *puncta* scattered over the convex surface of the cord along the lines of the amorphous matter which fills up the interstices between the hard crystalline, fusiform, spicule-like bodies that not only form the surface of the cord here, as in *Operculina*, but, in some specimens of *Operculina*, are continued inwards *over* the intercameral spaces to the preceding turn of the spire, showing that Dr. Carpenter is quite wrong when he states that this structure " is due to the peculiar manner in which the homogeneous substance of which it [the marginal cord] is composed is traversed by the 'marginal plexus' " ('Introduction to Study of Foraminifera,' p. 257, 1862)—since there is no "plexus" here, any more than in the marginal cord in direct contact with the spicular structure, simply because the latter is on the *surface* of the test, where *alone* the "puncta" (which are the openings of the ramuli of the large canals forming the plexus) are present and visible.

With reference to the function of the sarcode of the chamber, all that can be stated at present is that, being for the most part filled with bodies like ova, it is analogous to an ovisac, and thus apparently designed chiefly for the purpose of reproduction.

Thirdly, as regards the Acervuline forms of Foraminifera, in which the chambers are heaped up upon one another as the bulk of the mass increases, although this does not take place with such regularity as in Nummulites, it will be seen that the principle of structure *must* be the same from the simplest to the most complicated form of Foraminiferal tests: viz. the tubuli must be more or less perpendicular to the walls of the chamber; and therefore, as the lines of the chambers are necessarily continuous from the centre to the circumference, the canal-system *cannot interrupt, but must be wholly outside them.*

Thus it follows that the canal-system can *never* be *opposite the ends of the tubuli*; for *no* portion of it can ever be *within* the chambers, where *alone* the ends of the tubuli present themselves, till the latter reach the surface. Yet, on the other hand, the canals may run directly parallel to or across the long diameter of the tubuli at any angle; but it *must* be *outside* them. *No* section could ever bring them *opposite the ends* of the tubuli, if they are not *in* the chamber.

Now let us look at the woodcut to which I have referred, and there we shall find the fragments of the so-called "canal-system" (*b b*) cut across *opposite* the ends of the tubuli, showing that they are on the same plane, whereby they must have been *in* the chamber, which, as I have shown, is an impossibility in Foraminiferal structure.

I therefore most unhesitatingly state that there is no identity between this *selected* representation of the so-called "*Eozoon canadense*" and Foraminiferal structure. Such a relation of "canal-system" to "nummuline tubulation" could not exist in a Foraminiferal test either in theory or fact!

Since, then, Dr. Dawson could not see this, I am not surprised that he should have stated that Dr. Carpenter had "given a crushing reply" to my objections; while the amount of knowledge of Foraminiferal structure, both recent and fossil, that is displayed in other parts of his book may suit popular taste, but can hardly call for scientific reply.

This, however, is the age of wild speculation, and that which is most sensational (alas for Science!) is also most attractive. It puts one in mind of the Hindoo, who considers the simple truths of Christianity not worth his notice; but tell him there is a ladder between the highest summit of the Himalaya and the Heavens, on which there are Munis and Rishis going up and down all the day long, and he will say "that's *worth* believing!" Belonging to that school which can see nothing satisfactory in a theory so elastic that no human argument can cover it, and nothing so contemptible, in a scientific point of view, as the habit of hastily theorizing, I have not much sympathy with those who are always ready with a cause and explanation for every thing. When facts are discovered, they can be told in a few words; and the most palpable only should be credited with a deduction like that of the "dawn of life."

LVII.—*Contributions to the Study of the chief Generic Types of the Palæozoic Corals.* By James Thomson, F.G.S., and H. Alleyne Nicholson, M.D., D.Sc., F.R.S.E., Professor of Natural History in the University of St. Andrews.

[Continued from p. 309.]

[Plate XII.]

Genus Amplexus.

Amplexus, Sowerby, Mineral Conchology, vol. i. p. 165.

Gen. char. Corallum simple, subcylindrical or cylindro-conical, tapering towards the base, frequently tall, and more or less twisted. The epitheca is thin, with encircling lines of growth; and accretion-ridges are usually more or less conspicuously developed. Septa delicate and very short, never reaching to near the centre of the calice. Tabulæ exceedingly well developed, extending completely across the visceral chamber, and invariably exposed over a wide central area, into which the septa do not penetrate. A septal fossula is present, which is usually formed by a slight lateral depression of the tabulæ. Calice circular, moderately deep, with a thin margin.

The nearest ally of *Amplexus* has generally been assumed to be *Zaphrentis*; and there is doubtless a close alliance between the two. Typical examples of the former, however, are very readily and completely separated from characteristic species of the latter genus by the much more rudimentary condition of the septa and the nature of the septal fossula.

Upon the whole, therefore these two genera are marked off from one another by characters of a more fundamental and recognizable nature than those which separate *Zaphrentis* from *Cyathophyllum*.

The external form of the corallum in *Amplexus* is characteristically cylindrical, though this, of course, cannot be said to be distinctive of this genus. In addition, the corallum is very commonly tortuous, often of very unequal thickness in different parts, and frequently of great length as compared with its diameter. The accretion-ridges are sometimes very marked, at other times not so much so; and the epitheca is thin, and occasionally (as in *A. nodulosus*, Phill., Pl. XII. fig. 2) marked with hollow spinulose or nodular outgrowths.

The septa afford one of the most striking of the generic characters, being invariably very short and, comparatively speaking, rudimentary. This is well seen in transverse sections of *Amplexus coralloides*, Sow., and *A. nodulosus*, Phill. (Pl. XII. figs. 1 & 2). They differ in their length; but in no species of the genus do they ever extend further inwards towards the centre of the visceral chamber than, perhaps, about a third of the total diameter of the corallum, whilst in most species they are much shorter than this. In typical species, as in *A. coralloides* (Pl. XII. fig. 1), no secondary septa are developed; and there may or may not be interseptal dissepiments, whilst these, when present, are always comparatively simple and few in number.

The tabulæ are very well developed, and are usually bent in a more or less marked manner at their outer extremities (see the longitudinal section of *A. coralloides*, Pl. XII. fig. 1B). Owing to the rudimentary condition of the septa, there is invariably a space in the centre of the corallum which is occupied exclusively by the tabulæ. This central space, in which the tabulæ alone are exposed to view, varies from about a third to three fifths or more of the total area included within the wall of the corallum; and in no case which has come under our observation are the septa continued over the bare and smooth upper surfaces of the tabulæ. The distance of the tabulæ from one another is variable; but they usually extend completely across the visceral chamber, unless they be much crowded, in which case they may sometimes coalesce (see longitudinal sections of *A. coralloides*, fig. 1B, and *A. nodulosus*, fig. 3A). The tabulæ are approximately flat in the central area of the corallum; and the fossula, when recognizable at all, seems to be formed by a depression in the tabulæ, which is occupied by a septum of smaller length than the others. This is the case, at any rate, with *Amplexus coralloides*, though we are not prepared to assert positively that this character is distinctive of the genus.

The calice is approximately circular in form, with a thin upper margin, and of moderate depth. Owing to the shortness of the septa, the bottom of the calice is nearly flat, and is formed by the upper surface of the first tabula.

Upon the whole the genus *Amplexus* must be regarded as a very distinct one, the type of which is found in *A. coralloides*, Sow., of the Carboniferous. The earliest examples of the genus with which we are acquainted appear in the Upper Silurian; and the group undergoes a considerable development in the Devonian, where it is represented by such typical forms as *A. Yandelli*, Edw. & H., and *A. tortuosus*, Phill. It is, however, in the Lower Carboniferous that the headquarters of the genus is found, and where it obtains its greatest development both as regards the number of species and the size of individual examples.

Genus Zaphrentis.

Zaphrentis, Rafinesque and Clifford, Ann. des Sci. Phys. de Bruxelles, vol. v. p. 234.

Gen. char. Corallum simple, turbinate, conical or cylindro-conical, usually more or less curved. Calice deep, with a large and conspicuous fossula, the position of which is variable, but which is seen on transverse section to be formed by the coalescence of a portion of the septa, which fold round and form its walls. Septa well developed, extending nearly or quite to the centre of the visceral chamber. No columella is developed. The tabulæ, though varying in their development, are always a conspicuous feature; and the septa are prolonged over their upper surfaces. The interseptal loculi are usually filled up towards the circumference of the corallum by convex dissepiments; but these are generally more or less remote and irregular, and the tabulæ are continued through them to the wall.

The general form of the corals belonging to *Zaphrentis* is turbinate or trochoid; but they sometimes assume a more or less cylindrical form, and may attain a very great size. Other species, again, are singularly small in point of size. The epitheca is thin, and is usually marked with fine encircling striæ, whilst accretion-ridges are not uncommonly present. The calice is deep, with attenuated margins; and there is always a large and deep fossula. The position of the fossula varies, being sometimes on the convex or dorsal side of the corallum, sometimes lateral, and commonly on the concave or ventral side. Generally speaking, there is only a single fossula; but sometimes there are subordinate depressions, which appear to be of the same nature, though these have not been as yet sufficiently investigated. The most characteristic feature about the fossula, however, is the fact that it is formed by the coalescence of a greater or less number of the septa, which unite with one another towards the centre of the visceral chamber and form the walls of the fossette (Pl. XII. figs. 5 & 6).

The mode of formation of the fossula is thus entirely different in *Zaphrentis* from what obtains in *Amplexus*. We are not aware that this peculiarity has been noticed before; but all transverse sections exhibit it, and we believe it to be a character of primary importance in the definition of the genus.

The septa in *Zaphrentis* are differently developed in different species—but are usually remarkably thick towards the margins of the corallum, and become attenuated as they approach the centre of the visceral chamber. Indeed in some forms the septa are so much thickened towards the periphery, that they coalesce at their outer margins, and form a thick false wall. They also differ as to their extension inwards. Sometimes they reach quite to the centre of the visceral chamber; but at other times they fall short of this, and leave a small central area occupied solely by the tabulæ. In silicified specimens, however, the septa can often be traced on the upper surfaces of the tabulæ as far as the centre of the corallum (see Pl. XII. fig. 6, *Zaph. patula*). Small secondary septa are usually developed, one between each pair of primary septa; but they do not appear to be universally present. According to Milne-Edwards and Haime, the free edges of the septa are denticulate, as they project into the calice. This peculiarity, however, so characteristic of the genus *Heliophyllum*, we have not been able to recognize in any of the species of *Zaphrentis* which have come under our notice. The development of the interseptal dissepiments also seems to vary in different species of the genus. In some of the Devonian species these structures do not appear to exist at all; and in others they are but sparsely produced. Delicate curved dissepiments, however, with the convexity upwards, are commonly developed towards the circumference of the corallum; but in no case, are the dissepiments developed to such an extent as altogether to obliterate the tabulæ or to form a distinct external *vesicular area*. This latter structure is not found in any true *Zaphrentis*; and we shall hereafter show that the so-called *Z. cylindrica* of the Carboniferous, in the structure of which an outer zone of vesicular tissue is a conspicuous feature, is truly referable to the genus *Cyathophyllum*.

The tabulæ of *Zaphrentis* are usually remarkably well developed, and generally extend right across the entire space occupied by the visceral chamber, from side to side. They very commonly also exhibit a very conspicuous downward curvature near the circumference of the corallum. At other times they become more or less completely blended externally with the dissepiments, which then show a similar downward bending.

Upon the whole, the genus *Zaphrentis*, as restricted by us, may be readily recognized by the complete, or comparatively complete, development of the septal system, the great development of the tabulæ, the existence of a fossula, which is formed by the coalescence centrally of a certain number of the septa, and the fact that the dissepiments are in no case sufficiently developed to form an exterior zone of vesicular tissue. Additional characters of more or less importance are to be derived from the characters of the septa, the downward curvature of the tabulæ at the outer margins of the corallum, and the total absence of a columella.

The genus seems to make its first appearance in the Lower Silurian, though much has yet to be done before we can speak positively as to the affinities of some of these ancient forms. It is well represented in the Upper Silurian, and may be considered as attaining its maximum in the succeeding period of the Devonian. It is also largely represented in the Carboniferous period, after which it appears to have died out. *Z. patula*, Mich., and *Z. Enniskilleni*, Edw. & H., may be taken as exhibiting the typical structure of this genus in its greatest perfection.

In the Carboniferous deposits of Scotland, the species of *Zaphrentis* appear to attain their greatest development in the earlier portion of the Mountain-Limestone series. In the upper portions of the same series they appear to be already approaching extinction, and are usually much dwarfed and stunted in growth.

EXPLANATION OF PLATE XII.

Fig. 1. *Amplexus coralloides*, Sow.; 1 A, transverse section of the same; 1 B, longitudinal section of the same.

Fig. 2. *Amplexus nodulosus*, Phill.; 2 A, transverse section of the same.

Fig. 3. Transverse section of another individual of the same; 3 A, longitudinal section of the same.

Fig. 4. *Amplexus*, sp.; 4 A, transverse section of the same, cut somewhat obliquely; 4 B, longitudinal section of the same.

Fig. 5. Transverse section of *Zaphrentis Enniskilleni*, E. & H. The section is cut above the floor of the calice, and consequently shows no interseptal dissepiments.

Figs. 5 A–5 D. Transverse sections of the same specimen, showing the arrangement of the septa at different stages of growth.

Figs. 6–6 C. Transverse section of *Zaphrentis patula*, Mich., at different points, showing the dissepiments, secondary septa, and mode of formation of the fossula.

Fig. 7. Transverse section of *Zaphrentis Guerangeri*, E. & H., showing how the fossula is formed by the folding and coalescence of a certain number of the septa; 7 A, longitudinal section of the same, showing the arrangement of the tabulæ.

[To be continued.]

LVIII.—*On the Bower-birds of Australia, with the Description of a new Species.* By John Gould, F.R.S.

Of all the acts performed by birds, that of building themselves beautiful bowers, variously decorated with shells, bleached bones, glittering stones, and gaudily coloured feathers, must ever be ranked amongst the most interesting traits in connexion with ornithology. At present the only known country in which these playing-places or halls of assembly are constructed is Australia. Whoever may have the good fortune to lift up the curtain which separates New Guinea from other countries, may probably find others.

Chlamydodera occipitalis, n. sp.

In size a trifle larger than *C. maculata*, and in its general aspect and spotted upper surface very similar; and, like that, the present new bird has the usual occipital mark of lilac feathers, except that it is twice as large and more beautiful in colour, especially when seen from beneath. I have for many years had two females in my collection, which differ from the females of *C. nuchalis*, so common on the river-banks of Mokai Guyder and other parts of the interior of New South Wales; but it is only lately that I have received the male. That I ought to be an authority on the different species of the Bower-birds is evidenced by my having lived among them, studied their habits, and given double-sized plates of the bowers of two of the species in my folio edition; but never in all my encounters with the *Chlamydodera maculata* (and they were many) have I seen any thing like the bird under consideration. In giving North Queensland as the habitat of this species, it must be taken in a general sense; for the precise locality is unknown to me; and I await fresh information with interest and anxiety.

BIBLIOGRAPHICAL NOTICES.

The Micrographic Dictionary: a Guide to the Examination and Investigation of the Structure and Nature of Microscopic Objects. By J. W. Griffith, M.D. &c., and Arthur Henfrey, F.R.S., F.L.S., &c. Third Edition. Edited by J. W. Griffith and Professor Martin Duncan. 8vo. London: J. Van Voorst, 1871–1874.

If we are rather late in noticing the completion of this third edition of the 'Micrographic Dictionary,' this must not be taken to indicate any want of appreciation of the value of the work, but rather that we regarded it as already so well known and highly esteemed that any thing in the shape of a review of it was really a work of supererogation. That the authors must have hit upon a widely felt want (must have "struck oil," if we may venture to use that elegant Americanism) when they first conceived the idea of preparing such a dictionary, may be regarded as proved by the reception it has met with; for it is no small evidence of popularity that so bulky a volume, with nothing but its intrinsic merits to recommend it, should have reached a third edition within sixteen years.

The cause of this popularity is not hard to find. Microscopists are pretty thickly scattered over this as well as other countries; and a prime want of every microscopist is a book which shall enable him, without having recourse to what is perhaps beyond his reach, an extensive scientific library, to ascertain in a general way the nature of the objects which come under his observation. Ordinary treatises on the microscope and its uses certainly furnish some information of the kind required; but this is generally restricted to the more striking objects, and it would manifestly be foreign to the purpose of such works to enter into details of genera and species. But it is precisely one of the main objects of the 'Micrographic Dictionary' to furnish such particulars, without neglecting the more general subjects of microscopical research; and thus the volume becomes a sort of condensed summary of minute zoology and botany, which renders it not only almost indispensable to the mere microscopist, but also a work of the highest value for reference to naturalists in general.

The edition of the 'Micrographic Dictionary' now before us was commenced in 1871, but, owing chiefly to ill health, Dr. Griffith, the surviving author, was unable to advance regularly with the task of editing it; and after about half the work was completed he was compelled to call in the assistance of Professor Duncan, whose well-known attainments in various departments of natural history are a sufficient guarantee that his part of the work is executed in a manner worthy of the reputation which the book had already acquired. The principal alterations in this edition are in the articles relating to the members of the animal kingdom; and in his treatment of these Dr. Griffith had already, in the portion edited by him, given up some of that extreme conservatism in the matter of zoological classification which characterized the former editions. Prof. Duncan has gone still further in his portion of the book towards bringing the information contained in the zoological articles into full accordance with the most modern generally accepted views on this department of natural history. One series of these articles strikes us as being of special importance—namely that on the Foraminifera, in which we find an exposition of the views entertained with regard to the classification of the animals of that class by the distinguished English naturalists who have devoted so much attention to them. This section of the Dictionary has been prepared by Prof. T. Rupert Jones. The articles on the lower forms of vegetation, and especially those on the Fungi, have been placed under the care of the Rev. M. J. Berkeley; and we need hardly tell the readers of the 'Annals' that, under these circumstances, they are well done.

It is impossible in noticing a book of this nature to indicate all the alterations and additions that have been made in it, especially as the majority of them are in themselves but small. In the aggregate, however, very considerable additions have certainly been made, seeing that the present edition contains 100 pages more letterpress than its predecessor. That exceedingly useful element, the bibliography appended to the various articles, has been considerably increased in many instances.

The woodcut illustrations scattered through the text are, with very few exceptions, the same as those used in the second edition; but three new plates have been added, and all, or nearly all, the old figures have been freshly engraved on copper.

No doubt there may be here and there in the 'Micrographic Dictionary' things which one would like to see improved, and deficiencies which require to be supplied; but they are generally in small matters, and where the work done is so good it seems invidious to point out little spots. The most important deficiency that we have noticed is that of an article giving a summary of the modern views on embryogeny—a subject which is daily attaining more and more importance in connexion with zoological classification, rendering some account of the principal phenomena observed in different branches of the animal kingdom, and of the theories founded upon them, quite indispensable in a book of reference like that now under consideration.

But whatever defects may be noticed in this volume (and we believe that microscopists think the portions of it devoted to purely microscopic interests are a little behind the time), it seems to us that naturalists are deeply indebted to the Editors for what they have given us. The book is, in fact, so far as it goes, a substitute for, and guide to, a whole library of works on most branches of natural history; and as such we may most heartily recommend it to the notice of our readers.

A Monographic Revision and Synopsis of the Trichoptera of the European Fauna. By Robert M'Lachlan. Parts I.–III. 8vo. London: Van Voorst. Berlin: Friedländer, 1874–1875.

There is so much of the influence of fashion in the study of entomology that one might almost number upon one's fingers the naturalists who devote any attention to insects not belonging to one or other of three orders. The great majority commence by collecting Lepidoptera, and never get much further; a considerable number of the rest give their minds up to Coleoptera; whilst a few choice spirits take up the study of certain families of Hymenopterous insects, such as the bees, wasps, sandwasps, and sawflies. But outside these bounds the entomological field finds few labourers, although it must be admitted that greater interest attaches to some of the other orders, at least from a philosophico-zoological point of view, than to those which are generally studied. This is especially the case with the insects belonging to the orders Orthoptera and Neuroptera, both as including the oldest known forms of the class, and as presenting peculiarities of structure and life-history which give them the highest importance in those discussions as to the classification of insects, and especially as to the possible genetic relations of those animals among themselves and with other groups of Annulosa, which, since the prevalence of theories of evolution, have acquired such prominence.

The Trichoptera, regarded by Kirby, Stephens, and Westwood as constituting a distinct order, are not perhaps in this respect of so much interest as some other divisions of the old order Neuroptera; and although the history of their metamorphoses undoubtedly has its attractive side, the perfect insects themselves are not distinguished for their beauty, or for any striking variety of form and colouring such as might induce the ordinary collector to pay attention to them. The minuteness of the characters by which the genera and species are to be distinguished renders their study rather difficult; and doubtless this also accounts partially for the neglect with which they have generally been treated.

To this neglect, however, there have been some striking exceptions. In this country that universal genius, Dr. Leach, devoted a good deal of attention to the Trichoptera, published descriptions of some genera and species, and even projected a special work upon them, which, however, never made its appearance. Leach was followed in Britain by Stephens and Curtis, both of whom described many new forms and introduced several new generic groups. Abroad the most important early work specially devoted to the Trichoptera was Pictet's treatise on the Phryganides of Switzerland, published some forty years ago; Kolenati in 1848 produced a revision of the genera and species of the group; and since that date many memoirs on these insects, especially by Hagen and Brauer, have appeared in German natural-history periodicals.

In England at the same time we have had one entomologist working in the most painstaking and earnest manner upon this difficult group of insects; and Mr. M'Lachlan's papers relating to it, which have appeared from time to time in the publications of the Linnean and Entomological Societies, and in other periodicals both in this country and abroad, have furnished sufficient evidence of his determination to arrive, if possible, at trustworthy results in the discrimination and classification of the group. His most important contribution to Trichopterology (if we may use such a term) is undoubtedly his monograph of the British species of the group, published in 1865 in the Transactions of the Entomological Society. Of this he says, in the introduction to the work of which the title stands at the head of this notice, that "the experience of nearly ten years appears to show that this work has been of some service to European entomologists generally;" and, indeed, considering the conscientious care with which it had evidently been prepared, we can easily believe that this modest claim to merit is more than justified. Nevertheless the author confesses "to having for a long time been dissatisfied with it. There are many points of detail," he says, "concerning which time has proved my earlier views to have been erroneous, or at any rate badly expounded; and the figures—however gratifying to me they may have been in 1865—were ill-drawn, and their original defects magnified by bad engraving." How far we are bound to accept Mr. M'Lachlan's estimate of the value of his own work may be a question; but there can be no doubt that entomologists have every reason to be thankful that he has formed it, seeing that his doing so has led to his undertaking the labour of preparing the monographic revision of the Trichoptera of the European faunal region, the first three parts of which are now before us. His object in this work is to describe, figure, and classify all the Trichoptera inhabiting Europe, Northern Asia, and the Mediterranean district, the materials for which now existing in collections he estimates will represent from 250 to 300 species, although he anticipates that new forms will probably be brought under his notice during the progress of the work. But the amount of labour involved in the revision of these species cannot well be estimated from the smallness of their number; the minuteness of the characters distinguishing the genera and species (which are in many cases derived more or less exclusively from the peculiarities of the anal appendages) necessitates an enormous amount of careful examination, whilst the neglect or misinterpretation of these characters by the earlier describers adds immensely to the labour of determining the species noticed by them; and the further fact that many of the descriptions of species were written by entomologists who had made no special study of these insects adds greatly to the difficulties of nomenclature. In fact, considering how little the study of the Trichoptera has been in fashion among entomologists, the number of synonyms pertaining to many of the species is really wonderful.

From its nature Mr. M'Lachlan's work is scarcely open to criticism, except upon points of detail, into which no one who has not made the Trichoptera his special study can enter without presumption. The author describes the general structure of the Trichoptera, and characterizes the families, genera, and species constituting the group, tabulating them in each case in order to facilitate the task of discrimination. The synonymy of the species is given in full; and we would suggest that the synonymy of the genera should also be given, as at present many contractions of generic names appear in the specific synonymy, the meaning of which the student cannot ascertain without referring to other works.

With regard to the position of the Trichoptera in the system, Mr. M'Lachlan is not inclined to adopt either of the two plans of dealing with the Linnean Neuroptera advocated by different schools of entomologists. He would neither retain the old order in its integrity, nor, removing the groups with imperfect metamorphosis to the Orthoptera, restrict the term Neuroptera to the Planipennia and Trichoptera, which he thinks "do not show sufficient connexion to warrant their being considered co-ordinate." His own inclination would be to split up the Neuroptera of the older entomologists into several orders, of which, under such treatment, the Trichoptera would undoubtedly be one; and in his present, as in former works, he treats them as constituting an order.

As to the question of the relationship of the Trichoptera to the Lepidoptera, there is, of course, room for considerable difference of opinion. Mr. M'Lachlan strongly maintains that there is such a relationship, and that it "bears the impress of actual homology rather than of casual analogy." In this view, notwithstanding the objections that may be urged against it, we are inclined to think he is in the right; the perfectly phalænoid facies of so many of the smaller Trichoptera, the clothing of the wings, the state of the buccal organs, the form and structure of the larvæ, and even their habits, all seem to point towards a direct alliance with some of the Micro-lepidoptera or with the Psychidæ.

The figures which illustrate this work, and show in outline the venation of the wings and the characters of the anal appendages and other organs upon which Mr. M'Lachlan depends for the discrimination of the genera and species, are all drawn by himself under the microscope, and certainly show a great advance, both in execution and in fulness of detail, upon those accompanying his Monograph of the British Caddis Flies. The details of each species are represented; and, so far as we are acquainted with the objects, the figures leave nothing to be desired.

In concluding this notice we can only express a hope that entomologists will regard it as a duty to subscribe to a work which is in every way one of the most creditable that has appeared in Britain for a long time, and thus, as far as possible, prevent what is undoubtedly a labour of love on the part of the author from being at the same time a heavy loss to him.

MISCELLANEOUS.

On the Development of the Heteropoda. By M. H. Fol.

Although the excellent memoir of Krohn has furnished us with numerous and precise details as to the larval development and the metamorphoses of the Heteropod Mollusca, on the other hand we only possess very scanty and unsatisfactory data as to the commencement of their evolution, notwithstanding that the genus *Firoloides* ought certainly to be regarded as one of the most favourable for the study of embryogeny.

The segmentation takes place in accordance with the same laws as in the Pteropoda, except that the first four spherules of segmentation are perfectly equal among themselves, and enclose the same proportions of nutritive vitellus or protolecith and of formative vitellus or protoplasm. Here also the nuclei disappear before each segmentation, and are replaced by molecular stars. My memoir on the development of the Geryonides furnished in 1873 the first known example, in the animal kingdom, of this mode of segmentation.

The segmentation being completed, the embryonic sketch presents the form of a cellular sphere, furnished with a central cavity, and of which the histological elements are larger and more filled with protolecith on the one side, the nutritive side, than on the opposite or formative side. This latter bears in its centre the two polar corpuscles. The nutritive side of the blastosphere enters afterwards into the other; and the aperture of invagination, which is at first very large, gradually narrows; *it is the primitive mouth.* This opening of invagination occupies at first the pole exactly opposite to that at which the polar corpuscles are; but this arrangement soon begins to change gradually. In fact one of the halves, which we may call the ventral half of the embryo, begins to grow much faster than the opposite half, so that it affects more and more a bilateral symmetrical form. The part of the ectoderm of the ventral surface which abuts on the primitive mouth constitutes a protuberance which will become the foot. Between this protuberance and the polar corpuscles a depression of the external lamella is produced, namely the preconchylian invagination.

The velum appears as a zone of cilia which passes between the preconchylian invagination and the polar corpuscles, and unites at the upper margin of the mouth. The polar corpuscles which adhere to the point of the external lamella which was opposite to the primitive mouth (that is to say, at the formative pole), are found to occupy nearly the centre of the velum at the time when the larva begins to turn. This relative displacement is due to the more rapid growth of the tissues of the ventral surface of the embryo. Now this ectodermic tissue, which occupies the centre of the velum, is precisely that which gives origin to the cerebroid ganglia, the tentacles, and the eyes. The cells from which these nervous organs are derived occupy, therefore, originally the formative pole of the embryo. It would be easy for me to found on this curious observation a theory of the *neuræa* as a sequel to the *gastræa* of M. Häckel. The *neurula* would be a *gastrula* which would possess, at the pole opposite to that occupied by the aperture of invagination, cells destined to become the central nervous system and the eyes; it might be compared to the Ctenophores in the adult state, as well as to the embryos of many of the higher animals; but I have not any predilection, I must confess, for hypotheses of this kind.

The primitive mouth soon penetrates into the interior of the embryo; and the neighbouring parts of the ectoderm afterwards follow it, constituting an infundibulum which becomes the œsophagus with the sac of the radula. At the bottom of this infundibulum there is a fine ciliated canal, by which it communicates with the cavity of the inner lamella. This canal corresponds to the primitive mouth, which does not close up at any moment. This observation, so easy to verify in *Firoloides*, sufficiently refutes the opinion of certain phylogenists who believe that the primitive aperture of invagination in the Gasteropods becomes the anus, and annihilates all the conclusions that they have drawn from this supposition. It is by this ciliated canal that the albumen of the egg penetrates into the digestive cavity, or the primitive cavity of invagination. The cells of the inner lamella absorb this albumen, and deposit it in their interior under the form of strongly refracting masses, which I shall name the deutolecith. It is nevertheless only at the ventral part of the ectoderm that this storing of nutritive substance takes place, the rest of the lamella preserving its character of embryonic cells. At its aboral part it furnishes a hollow prolongation, which unites with the ectoderm below the foot to form the intestine and the anus.

The preconchylian invagination becomes filled with a viscous brownish substance; then it spreads out, and the viscous substance extends into a thin layer, which hardens on contact with the sea-water, and constitutes the apex of the shell.

The otocysts are formed by invagination of the ectoderm on the sides of the base of the foot. The cerebroid ganglia detach themselves from the internal surface of the part of the ectoderm circumscribed by the velum, the same which afterwards gives origin to the tentacles.

The ventral part of the entoderm forms a sac, which occupies the apex of the shell; it is the nutritive sac. The rest of the walls of the embryonic digestive cavity gives origin directly to the intestine and stomach, which remains in communication with the nutritive sac by a large aperture. After hatching, the deutolecith contained in the walls of the nutritive sac becomes disaggregated, and falls into the stomach to serve for the nourishment of the larva. This sac afterwards acquires a lobed form, and gives origin directly to the liver.

The retractor muscle originates in a small number of cells, which detach themselves from the internal surface of the entoderm in the middle of the dorsal region, elongating and attaching themselves to the velum on the one hand, and to the apex of the rudiment of the shell on the other.

The branchial cavity is a depression of the ectoderm, which is produced between the margin of the shell and the neck of the larva on the dorsal side behind the anus, which is situated to the right. The mucus-gland is originally a depression of the ectoderm in the middle of the upper surface of the foot. The larvæ brought up in captivity all die at this degree of development: the sequel of their evolution has not yet been observed in a manner complete enough to be the subject of a communication.—*Comptes Rendus*, September 13, 1875, p. 472.

On the Sexual Reproduction of the Vorticellians. By M. Balbiani.

Since the time of Spallanzani (1776) it has been generally admitted that the Vorticellians are reproduced by gemmiparity or external budding. Professor Stein, of Prague, has the merit of having shown that this belief only rested on an illusion, and that what was taken for a bud separating itself from the parent was in reality the conjugation of two individuals of unequal size fusing into a single animalcule. M. Stein sees in this phenomenon a multiplication of the Vorticellians by sexual reproduction, and, as the description which he gives of it differs considerably from the picture which I have traced of this mode of reproduction in the other Infusoria, he uses it as a weapon for attacking my works on this subject. Let us first see how M. Stein describes the facts which he has observed, and take for example his observations concerning a Vorticellian living in a colony, and one of the most widely spread, namely *Carchesium polypinum*.

By successive and rapid binary divisions a certain number of individuals of the colony break up into groups composed of four or eight individuals, the size of which is, in consequence, four or eight times as small as that of the ordinary individuals. They remain at first united at the extremity of their common peduncle, and then detach themselves from it successively by the agitation of the cilia which form a crown at their posterior extremity.

As soon as it is free, each of these little individuals, or *microgonidia* (the name given to them by M. Stein), whirls rapidly about between the branches of the bush formed by the colony, and at last makes choice of one of the large ordinary individuals, on the side of which it fixes itself by its posterior extremity. The body-walls of the two individuals are absorbed at the point of contact; and they then communicate freely by their central cavities. During this time the elongated and cylindrical nucleus of each is divided into a number of small rounded fragments, which are dispersed irregularly in the internal parenchyma. Soon after, all the contents of the microgonidium, the parenchyma with the nuclear fragments, are seen to pass slowly into the body of the large individual and mix with its substance. The microgonidium is then reduced to its external envelope, empty and folded together; and this latter also at length penetrates to the interior of the other individual, where it disappears without leaving any trace.

After mingling in the body of the individual resulting from the conjugation, the fragments of the two nuclei approach one another, and are fused into a common mass, to which M. Stein gives the name of *placenta*. In the centre of this mass appear nucleated spheres (*Keimkugeln*), which, in their turn, produce in their interior mobile bodies furnished with vibratile cilia, which M. Stein regards as the embryos of the *Carchesium polypinum*. These embryos escape from the mother by a special canal of parturition, while the unemployed portion of the placenta lengthens and reconstitutes the nucleus.

Such is, in few words, the manner in which M. Stein describes the reproduction of *Carchesium* and of several other Vorticellians which presented analogous phenomena. This description, indeed, presents some considerable differences from that which I have given of the sexual reproduction in the other Infusoria. It will be remarked, above all, that there is no mention of the *nucleolus*, to which I ascribe so important a part in this latter mode of multiplication, since, according to me, it represents the male organ or testis of the Infusoria. And, in fact, not only does M. Stein deny the existence of the nucleus in all the Vorticellians, but in them he expressly attributes the formation of the germinative spheres and of the embryos which proceed from them to the copulation of the nuclear fragments of different origin, a copulation which he interprets as a true fecundation.

If things really occurred as M. Stein asserts, it would be necessary to suppose one of two things—either the Vorticellians are reproduced in accordance with other laws than those which govern the other Infusoria, or else my observations are not correct. The absence of a fecundation by filiform spermatozoids originating in the nucleolus, would, above all, establish between them a difference of the first importance. I hasten to say that there is nothing of the kind. It is a long time since I described and figured the nucleolus in several Vorticellians, amongst which is *Carchesium polypinum*; and my observations on that subject have been confirmed by M. Engelmann.

I can only confirm all that M. Stein says of the formation of the small individuals or microgonidia by successive binary divisions of a single animalcule. I have seen, like him, these little products of division abandon, one at a time, their common peduncle, and, after a few moments of brisk agitation in the liquid, enter into conjugation with the sedentary individuals. This conjugation is not effected without a certain resistance on the part of these latter, if we may judge from the quick contractions of their peduncle at each contact of the microgonidium. Moreover, in order to avoid being projected to a distance, and to keep always near the individual with which it wishes to conjugate; the microgonidium fixes itself on the anterior part of the peduncle of the latter by a thin filament which it secretes from its posterior part. It succeeds at length in attaching itself, by this posterior part acting as a sucker, to a point of the surface of the large individual, most frequently at a little distance above its insertion on the peduncle. The microgonidium is furnished with an elongated nucleus, and it possesses besides a nucleolar corpuscle resembling that of the other individual. It is at the moment when the cavities of the bodies of the two conjugated animalcules begin to be put in communication, after the absorption of the parietal surfaces in contact, that the division of their respective nuclei into smaller and smaller and more numerous fragments begins, as M. Stein has described it. At the same time the nucleole in the microgonidium is seen to enlarge and divide into two secondary nucleoli, each of which is transformed into a voluminous ovoid capsule, in which appear numerous filaments of extreme tenuity, arranged parallel to one another. The transformations of the nucleolus and the nature of its contents are identical in all points with what we observe in the other Infusoria during sexual reproduction; we must therefore conclude that in the conjugation of the Vorticellians the nucleolus plays the same part as in these latter (that is to say, that of the male organ), and that the filaments developed in its interior represent the spermatozoids of these animalcules.

In the other individual the nucleolus does not undergo the same modifications, but preserves, during the whole of the conjugation, its initial rudimentary state. After all the substance of the microgonidium has passed into the cavity of the conjoint individual, we find in the interior of the latter, with the mingled fragments of the two nuclei, the seminal capsules of the microgonidium, easily recognizable by their striated appearance, due to the presence of the spermatic filaments. The aspect which the individual presents at this moment entirely recalls that of a *Paramecium* which has just copulated, at the phase in which the nucleus is divided into numerous fragments; and in the same way also as in this latter species, some only of the nuclear fragments (from five to seven) become complete ova, while the rest approach one another to reconstitute the nucleus. I have never seen these fragments fuse together to form a placenta, in the interior of which the living embryos originate, as M. Stein describes. We must therefore believe that, in his present observations, this naturalist has again been the victim of one of those illusions which led him formerly to introduce, into the genetic cycle of the *Paramecia*, *Stylonychia*, and other Infusoria, creatures connected with them by simple relations of parasitism, as has been shown by my old observations, confirmed by those of M. Metschnikoff and the quite recent observations of M. Bütschli.—*Comptes Rendus*, October 18, 1875, p. 676.

The Effect of the Glacial Epoch upon the Distribution of Insects in North America. By Aug. R. Grote, A.M.

From the condition of an hypothesis the Glacial period has been elevated into that of a theory by the explanations it has afforded of a certain class of geological phenomena. The present paper endeavours to show that certain zoological facts are consistent with the presence, during past time, of a vast progressive field of ice, which, in its movement from north to south, gradually extended over large portions of the North-American continent. These facts, in the present instance, are furnished by a study of our Lepidoptera, or certain kinds of butterflies and moths now inhabiting the United States and adjacent territories. Before proceeding with the subject, a brief statement of the phenomena assumed to have attended the advent of the Glacial period is necessary.

At the close of the Tertiary, the temperature of the earth's surface underwent a gradual change by a continuous loss of heat. The winters became longer, the summers shorter. The tops of granitic mountains in the east and west of the North-American continent, now in summer time bare of snow and harbouring a scanty flora and fauna, became, summer and winter, covered with congealed deposits. In time the mountain-snows consolidated into glacial ice, which flowed down the ravines into the valleys. Meanwhile the northern regions of the continent, which may have inaugurated the conditions, submitted extendedly to the same phenomena. Glacial ice, first made on elevations, finally formed at, and poured over, lower levels. Glacial streams finally united to form an icy sea, whose frozen waters slowly ploughed the surface of the rocks, and, in their movement from north to south, absorbed the local glacial streams in their course, and extended over all physical barriers. The Appalachians and Rocky Mountains are supposed to have had local glaciers. The animals must always have retreated before this frozen deluge. The existing insects of the Pliocene, in submitting to the change of climate which accompanied the advance of the glacier, must have quitted their haunts with reluctance, and undergone a severe struggle for existence, no matter how gradually they had been prepared for the encounter. We may expect that multitudes of specific forms ultimately perished, of whose remains no traces have been preserved.

After this brief statement of the outlines of the opening of the Glacial period, we turn to some facts offered by a study of certain of our existing species of butterflies and moths.

The tops of the White Mountains and the ranges of mountain-elevations in Colorado offer us particular kinds of insects, living in an isolated manner at the present day, and confined to their respective localities. In order to find insects like them we have to explore the plains of Labrador and the northern portion of the North-American continent, in regions offering analogous conditions of climate to those existing on the summits of these mountains.

The genera *Œneis* and *Brenthis* among the butterflies, and *Anarta* and *Agrotis* among the moths, are represented by the same or similar species in all of the above-mentioned localities. In the case of the White-Mountain butterfly (*Œneis semidea*) we have a form sustaining itself on a very limited alpine area on the top of Mount Washington*. Although there is some doubt whether precisely the same form of *Œneis* has been discovered in Colorado, the fact remains that *Œneis* butterflies exceedingly like it, though registered by us under different specific names, live in Labrador and Colorado. Whether the White-Mountain butterfly (*Œneis semidea*) be, as suspected by Lederer, a modification of some of the Labradorian forms of the genus, or not, the geographical distribution which its genus enjoys cannot be meaningless. The question comes up, with regard to the White-Mountain butterfly, as to the manner in which this species of *Œneis* attained its present restricted geographical area—How did the White-Mountain butterfly get up the White Mountains? And it is this question that I am disposed to answer by the action attendant on the decline of the Glacial period.

I have before briefly outlined the phenomena attendant on the advance of the ice-sheet; and I now dwell for a moment on the action which must equally be presumed to have accompanied its retirement. Many of the features of its advance were repeated, in reverse order, on the subsidence of the main ice-sheet or glacial sea. The local glaciers appeared again, separate from the main body of ice, and filled the valleys and mountain-ravines, thus running at variance with the main body of the glacier, being determined by local topography. A reversal of the temperature shortened the winters and lengthened the summers. Ice-loving insects, such as our White-Mountain butterfly, hung on the outskirts of the main ice-sheet, where they found their fitting conditions of temperature and food. The main ice-sheet had pushed them insensibly before it, and during the continuance of the Glacial period the geographical distribution of the genus *Œneis* had been changed from a high northern region to one which may well have included portions of the Southern States. And, on its decline, the ice-sheet drew them back again after itself by easy stages; yet not all of them. Some of these butterflies strayed by the way, detained by the physical nature of the country and destined to plant colonies apart from their companions. When the main ice-sheet left the foot of the White Mountains, on its long march back to the pole, where it now seems to rest, some of these wayward flitting *Œneis* butterflies were left behind. These had strayed up behind the local glaciers on Mount Washington, and so became separate from the main body of their

* See Mr. Scudder's article in the 'Geology of New Hampshire,' i. p. 342. Mr. Scudder first pointed out the existence of alpine and subalpine faunal belts on Mount Washington, and makes the interesting remark "that if the summit of Mount Washington were somewhat less than 2000 feet higher, it would reach the limit of perpetual snow."

companions, which latter journeyed northward, following the course of the retirement of the main ice-sheet. They had found in elevation their congenial climate; and they have followed this gradually to the top of the mountain, which they have now attained and from which they cannot now retreat. Far off in Labrador the descendants of their ancestral companions fly over wide stretches of country, while they appear to be in prison on the top of a mountain. I conceive that in this way the mountains may generally have secured their alpine animals. The Glacial period cannot strictly be said to have expired; it exists even now for high levels above the sea, while the Esquimaux finds it yet enduring in the far north. Had other conditions been favourable, we might now find Arctic man living on snow-capped mountains within the temperate zone.

At a height of from 5600 to 6200 feet above the level of the sea, and a mean temperature of about 48 degrees during a short summer, the White-Mountain butterflies (*Œneis semidea*) yet enjoy a climate like that of Labrador within the limits of New Hampshire. And in the case of moths an analogous state of things exists. The species *Anarta melanopa* is found on Mount Washington, the Rocky Mountains, and Labrador. *Agrotis islandica* is found in Iceland, Labrador, the White Mountains, and perhaps in Colorado. As on islands in the air these insects have been left by the retiring ice-flood during the opening of the Quaternary.

On inferior elevations (as on Mount Katahdin, in Maine), where we now find no *Œneis* butterflies, these may formerly have existed, succumbing to a climate gradually increasing in warmth from which they had no escape; while the original colonization, in the several instances, must have always greatly depended upon local topography.

I have briefly endeavoured to show that the present distribution of certain insects may have been brought about by the phenomena attendant on the Glacial period. The discussion of matters connected with this theoretical period of the earth's history thus brings out more and more clearly, as it now appears, the fact of its actuality. I hope that my present statements may draw the attention of our zoologists more to the matter, seeing that we have in our own country fields for its full exploration.—*Silliman's American Journal*, Nov. 1875.

On the Reprodu tion of the Eels. By M. C. Dareste.

Last year M. Syrski considerably advanced the question of the reproduction of the eels, by showing that in certain eels there exist in the place of the female reproductive organs, some organs of quite different form and structure. M. Syrski regards these as male reproductive organs. The description which he gives of their form and structure renders his opinion very probable. It must, however, be added that M. Syrski could not ascertain the existence of spermatozoids in these organs, the proof of which alone could serve to demonstrate certainly their true nature.

The eels in which M. Syrski discovered what he regards as the male organs, differ from the others by several characters, and especially by their small size and the great volume of their eyes.

Having been engaged during last year in a revision of the Anguilliform fishes, I have been able to ascertain the correctness of the facts announced by M. Syrski; and I have convinced myself that in many individuals of the species *Anguilla vulgaris* there exist, in place of the ovaries, organs of very different form and structure, which are very probably the male organs. I have also ascertained that these individuals differed from the others by their small size and their large eyes. They all belong to the variety known in France as the *Anguille pimperneau*, which does not ascend rivers, but remains always at their mouths, and at the expense of which Kaup has formed three distinct species under the names of *Anguilla Cuvieri*, *A. Bibroni*, and *A. Savignyi*. As I have hitherto been unable to investigate these animals elsewhere than in the collection of the museum and in individuals preserved in alcohol, I could not, any more than M. Syrski, detect the presence of spermatozoids; but for many reasons, which I cannot here develop, I share his opinion as to the testicular nature of the organs discovered by him.

There is, however, one point upon which I cannot agree with M. Syrski; and it is that these small eels, of the variety called *pimperneau*, do not exclusively belong to the male sex. I have ascertained the existence of perfectly well-characterized ovaries in several individuals belonging to this variety.

From this observation it follows that the *Anguille pimperneau*, an essentially marine variety which does not ascend rivers, possesses both sexes; while those which ascend rivers and which belong to the varieties called *Latirostres* and *Acutirostres* present only female individuals, in which, however, the ova never arrive at maturity, and consequently they always remain barren.

The eels of North America do not differ specifically from those of Europe; and we find there the same varieties of form. That which represents our *pimperneau*, and which Kaup has described under the name of *Anguilla novæ aurelianensis*, has furnished me with the form of reproductive organs which I regard as belonging to the male sex.

The species *Anguilla vulgaris* would therefore present a sexual form (the *pimperneau*) and several sterile forms. This very remarkable fact, however, is not isolated in fishes, since we meet with analogous facts in the carp.

I have found these male organs in some individuals of another species of eel, *Anguilla marmorata*, which belongs to the Indian Ocean. Here the deficiency of materials has prevented my ascertaining the existence of a completely sexual form and of sterile forms.—*Comptes Rendus*, July 19, 1875, p. 159.

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END OF THE SIXTEENTH VOLUME.

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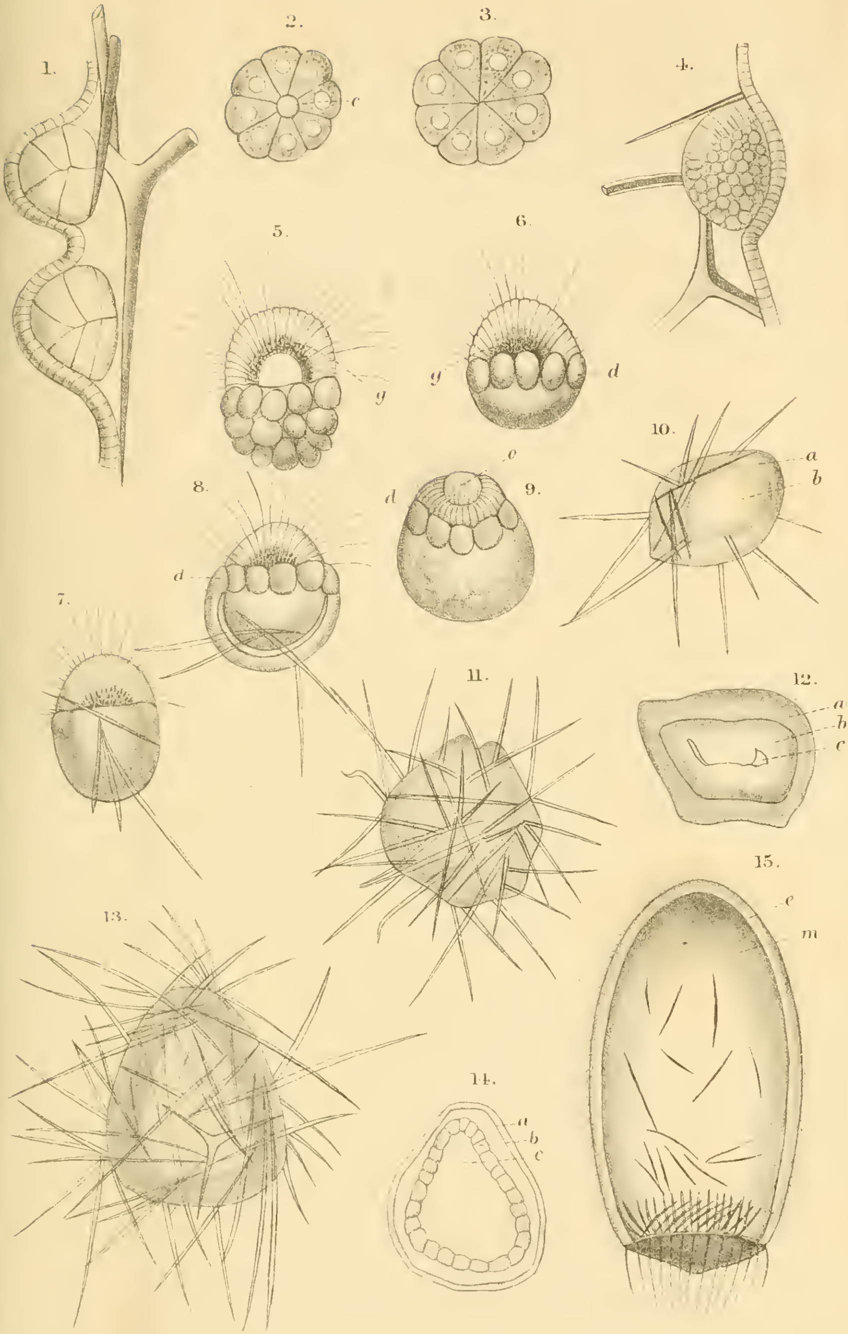
E W Robinson del et Sc 1875



Mintern Bros lith.

Ann. & Mag. Nat. Hist. S. 4. Vol. 16. Pl. III.

TABLE
of
Forms that may be assumed by the
SPONGIDA.

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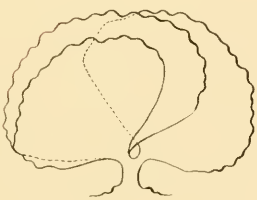

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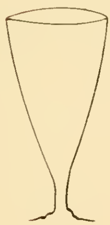

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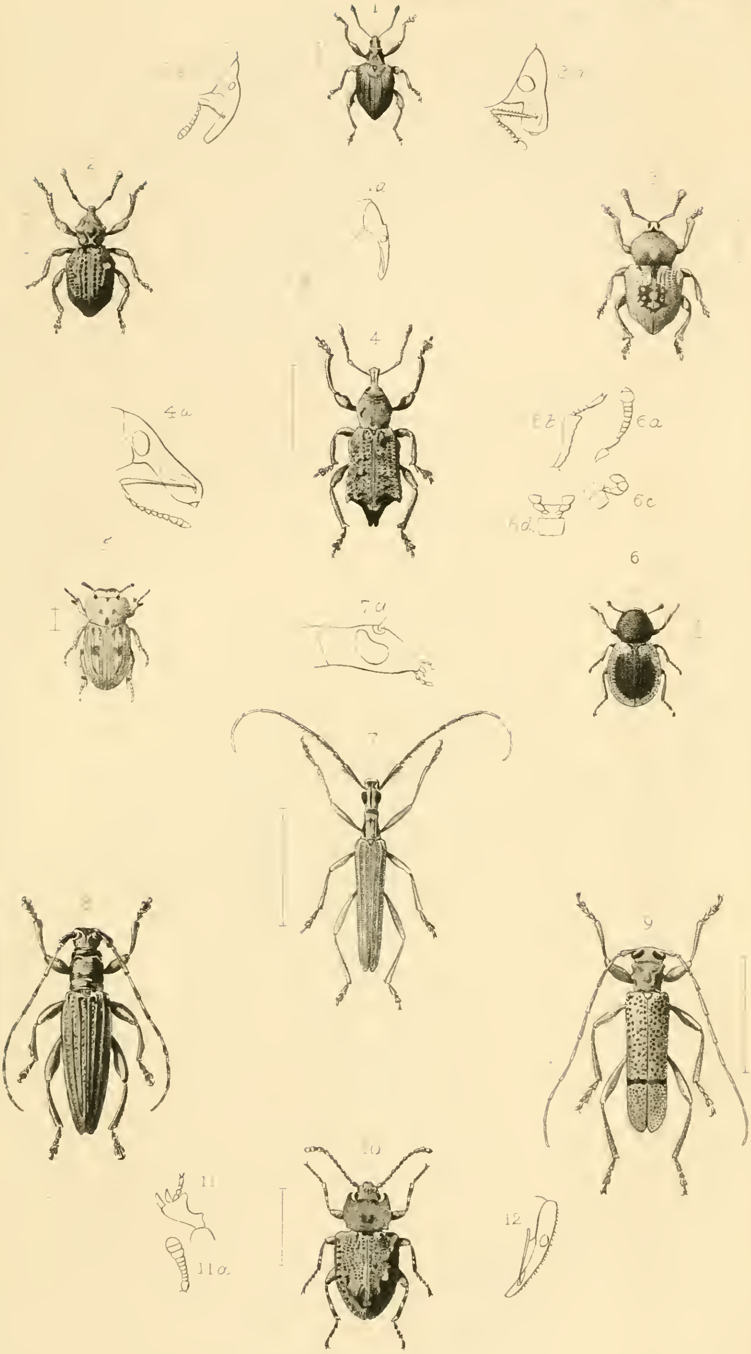

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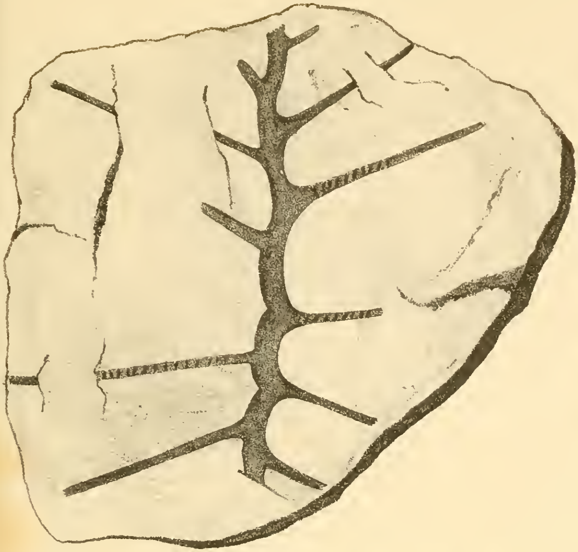
R. Mintern lith

Mintern Bros imp

LUFFARIA ARCHERI



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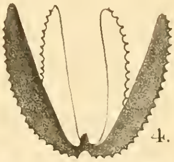

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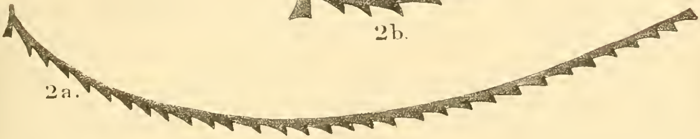

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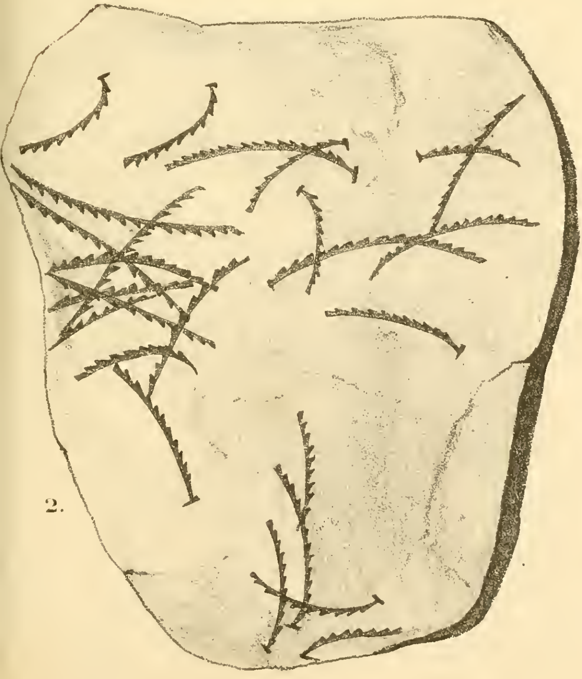

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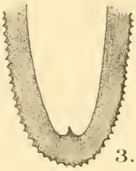

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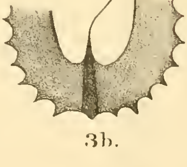

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O.P. Cambridge del.
A.T.H... lith.

W. West & Co. imp.

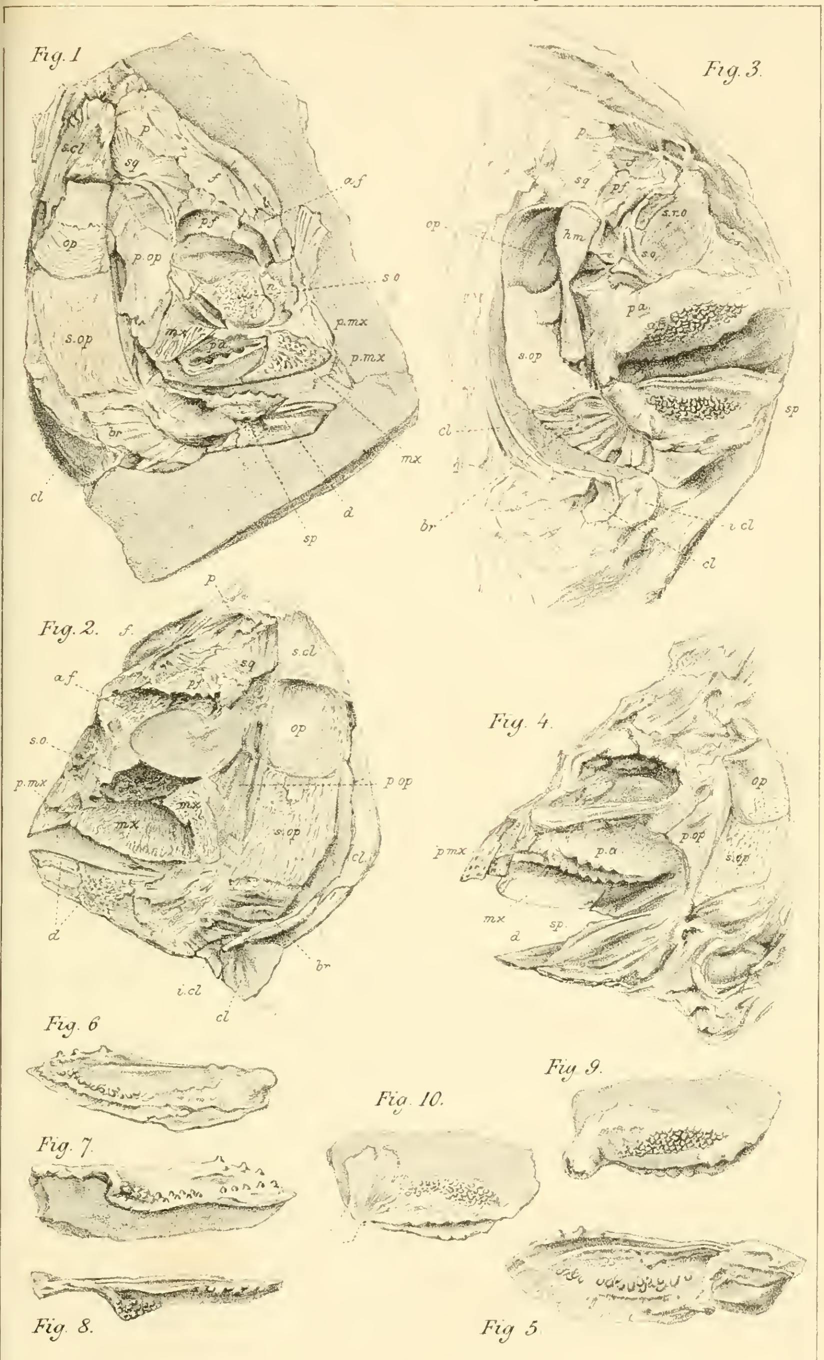

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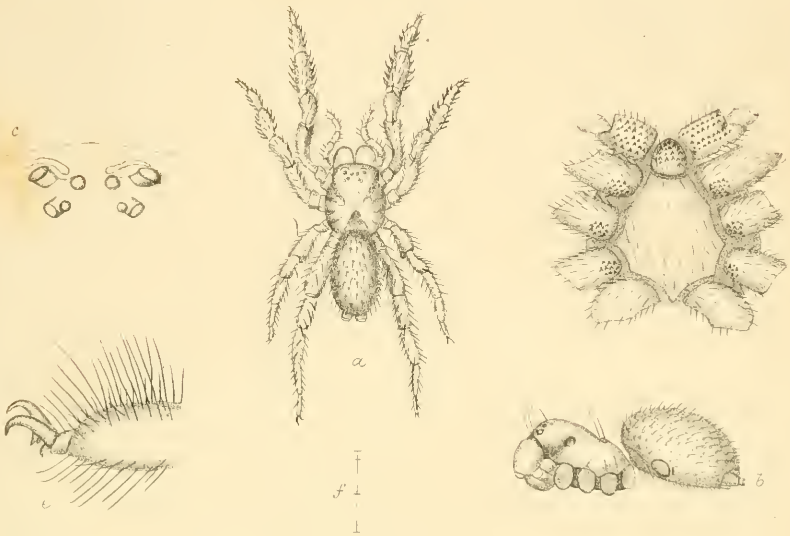
Fig. 1



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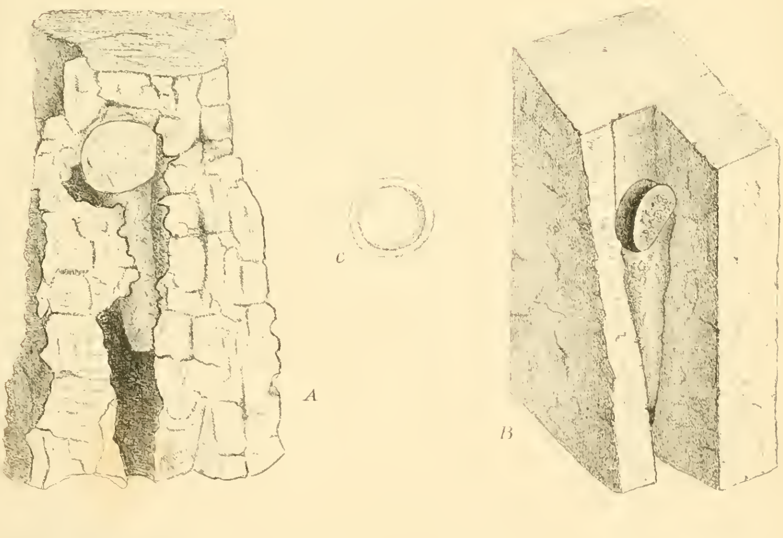

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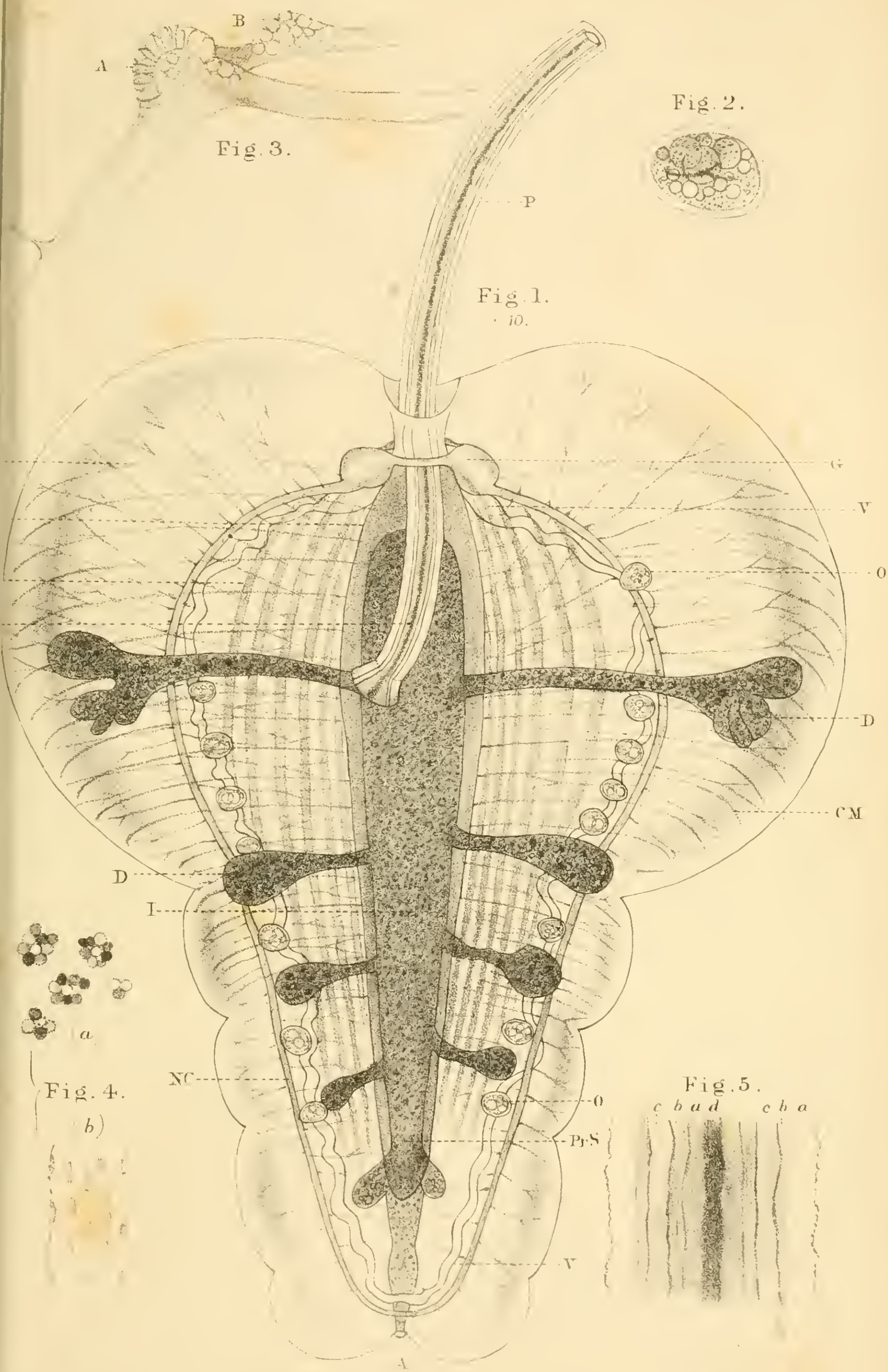

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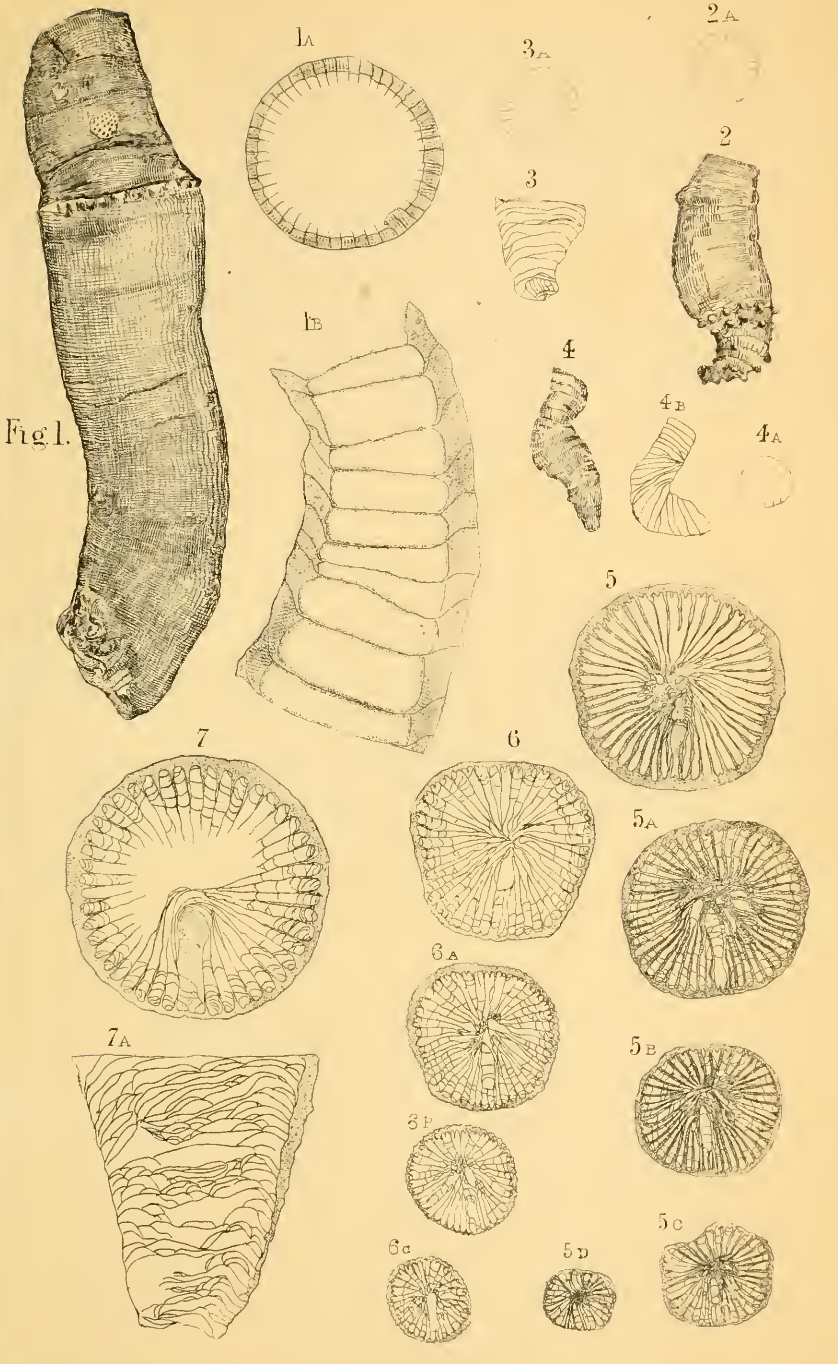

Gardner & Stevenson, Imp. Glasgow

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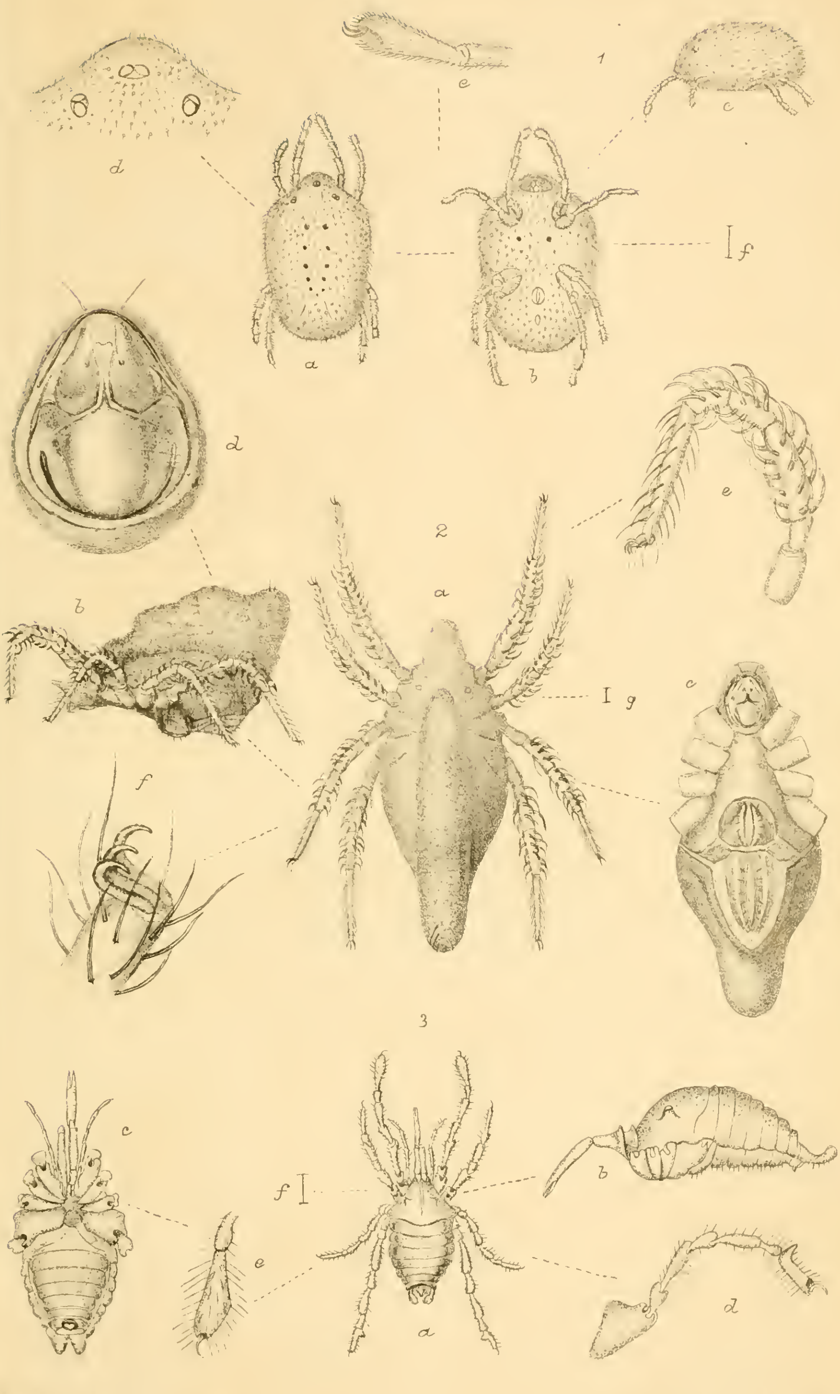
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